

U.S. Strategic Bombing Survey
6

MORALE DIVISION

UNITED STATES STRATEGIC BOMBING SURVEY



MEDICAL BRANCH REPORT



**THE EFFECT OF BOMBING ON
HEALTH AND MEDICAL CARE
IN GERMANY**



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This report was written in compliance with the Presidential Directive of the 9th of September, 1944. The study of the health in Germany was made by a group of selected medical scientists under the auspices of the Secretary of War. The conclusions contained herein are the combined conclusions of this group and do not necessarily reflect those of other sections of the United States Strategic Bombing Survey.

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CHAPTER ONE

INTRODUCTION

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This is a report of the manner in which Allied air attacks on German cities and industries influenced the health of that country. The information presented and the conclusions arrived at are the result of a health survey in Germany by a group of American scientists in medicine and related subjects during the closing days of the European war and for some months thereafter.

There was no precedent for accomplishing the task to which we were assigned, for until this mission was undertaken there had never been an evaluation of the effects of military operations on an enemy civilian population. This was an investigation of an entirely new order. In the careful check they maintained on the reactions of the people during the war, the German government had not studied the effects of the strategic air offensive as distinct from the rigors of war as a whole. Similarly, the British took few steps in determining the effects of bombing of their own cities, although various individuals in Britain did make semi-official studies of what had happened to the people as a result of the raids by the Luftwaffe. We were, therefore, working largely in the dark in an attempt to study the health of an enemy population as it was affected by the most potent weapon in total war, the air attack.

In this investigation of the American, British, and French occupation zones of Germany we encountered no evidence of Allied effort to break the health of the German people. Nevertheless, the bombing razed hospitals to the ground and created conditions which interfered with the maintenance of good health. In effect, the average inhabitant of the German cities was placed in the same position as the soldier on the battle field. The events in the air succeeded in greatly lowering the standard of health throughout Germany by destroying facilities for the maintenance of environmental sanitation, by creating the most acute conditions of overcrowding which have been encountered in the western world, by denying civilians hospital care and adequate drugs, and by changing three meals a

day from an individual habit to an object of individual ingenuity.

This is not a sanitary report. The effects of bombing on the health of a nation cannot be properly assessed within the limited scope of what is generally considered a sanitary report, for sanitation is only one component of the health of a nation. Nor is it a compilation of vital statistics, for all the manifestations of bombing are not reducible to statistical analysis nor are they immediately apparent in the way in which the destruction of some material object makes itself evident. It is, on the other hand, a study of every facet of German health, an analysis of the health aspects of the surroundings in which the German people lived, what they ate, how they were cared for medically, and how they were injured and died in the raids.

All aspects of bombing cannot be reported here because they are not as yet readily discernible in their entirety. We feel that the effects of bombing of civilian populations are in many ways subtle, long-range effects. They are of such a nature as will largely determine the health of the German people for the coming generation. What can, therefore, be accurately reported at this time are the changes in the health of the nation which were visible during the period of the field work.

As the reader proceeds through this report he will soon understand that one of the greatest problems was in determining just where the ordinary rigors of war ceased in their influence on the health of the German people and where bombing began to make itself evident. This was a harassing difficulty which finally compelled us to conclude that any investigation of the medical aspects of the air war must transcend the scope of what happened after each air raid and must, by the very nature of the problem involved, include many other factors affecting the health of the country as a whole. Indeed it might be said that this became a study of the health of Germany during the war years with particular emphasis upon the manner in which it was influenced by the combined aerial offensive.

In order to fortify ourselves with background

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information in the period while waiting for the progress of the American and British armies to make target cities available for the field team, an effort was made to acquaint ourselves with the health problems which had arisen in England. We studied the activities of the medical services by the Ministry of Home Security, made visits to several emergency hospitals used for the evacuation of expectant mothers, and interviewed many British health authorities. For the information and guidance given us in forming our first impression of these problems, we wish to express our appreciation to Professor James Mackintosh of the London School of Hygiene and Tropical Medicine; Dr. Robert D. Gillespie, Psychiatrist at Nuffield House, Guy's Hospital; Dr. Godbar and Dr. Kelly of the British Ministry of Health; and to Dr. Ripley Oddie, Mr. A. C. Henry, Mr. A. N. Edwards, and Mr. K. G. Gold, all prominent in the British pharmaceutical industry.

In March and April of 1945, Lieutenant Colonel Meiling, a medical officer and chief of the Morale Division, was assigned to the Intelligence Task Forces (T-Force) of the Twelfth U. S. Army Group, and Major Enloe to the Intelligence Task Force of the Sixth Army Group. As members of these special units they were able to enter captured German cities with the initial assault forces under the auspices of Allied military intelligence groups. The material and information secured in these operations were later to prove of great value in the rapid exploitation of the German national health targets. This was found to be the most expeditious manner in which to locate civilian and military medical leaders in the days immediately following German capitulation. The location of the authorities with a national picture of German health presented a considerable problem during the period of chaos and extreme apathy following the dissolution of the German government by the Allied powers.

The medical group, consisting of four Army Medical Corps officers, a Coast Guard officer, three civilian physicians, two Sanitary Corps officers, one Quartermaster Corps officer, and two enlisted research analysts, was assembled for the first time in early May in London. The innumerable delays and complications resulting from travel restrictions, priorities, military processing and administration had prevented the earlier arrival of all of this group in the theater of operations.

Since we had neither sufficient time nor the per-

mission of the Russian authorities to cover all of Germany prior to the deadline set for completing the field work, it was decided to confine our city investigations to selected communities in the western zones of occupation. The localities were chosen from the sample of the Social Sciences Branch of the Morale Division on the basis of relation of severity of bombing to the size of the city. The cities chosen were Stuttgart, Ulm, Augsburg, Munich, Nuremberg, Wurzburg, Karlsruhe, Pforzheim, Ludwigshafen, Darmstadt, Frankfurt, Kassel, Dortmund, Cologne, Essen, Hamm, Hamburg, and Kiel. For statistical data alone Bochum, Bremen, Duisberg, Duesseldorf, Muehlheim, and Solingen were also visited.

In surveying the medical and health facilities of any given target area many informal interviews were conducted with members of the professional and administrative staffs of the various hospitals and, as far as they were available, with the former public health officials, police medical inspectors, officials of the local and district medical organizations, and university authorities. Special provisions were made for interviewing civilian and military health authorities and various ministers of the government, both national and state, in whom we were interested. As a rule these personages were found to be in the custody of the Allied occupying forces. Prisons, interrogation centers, bombed-out homes, offices and hospitals are not the most desirable locations for establishing mutual professional relationships. Fortunately the language of science is international so it was not always difficult to establish a spirit or atmosphere of scientific and professional rapport during the interrogations and interviews. The medical group of the Morale Division possessed a distinct advantage in the very intimate personal knowledge of German medicine possessed by seven of its members who had at one time or another actually studied at the medical faculties at German and Austrian universities.

Statistical data were obtained from official documents and reports, with numerous spot checks being accomplished at local, provincial and state levels. Every effort was made in the time allowed to secure classified medical and health reports and directives at all levels of the German government which would throw light upon the correlation between bombing and the health of the people bombed.

Preliminary information indicated that the

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famed winter sports country of Upper Bavaria had become the air raid shelter of Germany. This was the part of the country to which the women and children, the aged and infirm, in other words, the people whom the Nazis considered "non-essential," had fled to escape the air raids. It was also the hospital area of the German Army. It was believed that a study of such an influx into these rural areas which caused Garmisch to be as packed as a tenement district would provide information on the movement of large population groups which is perhaps one of the most pronounced sequelae of bombing. In order to ascertain the results of this mass migration on the health of the migrants and on the people of the villages to which they went, one phase of the survey included Kempten, Garmisch-Partenkirchen, Weilheim, Schongau, Bad Tölz, Rosenheim, Reichenau and Berchtesgaden. The routine followed in studying the rural evacuation areas of alpine Bavaria was the same as that employed in the study of the cities of Germany only on a smaller scale.

Examination at the city level and at the evacuation areas provides the greater part of the foundation for the accounts given in the chapters to follow. The remainder was supplied by review of enemy records which we captured and by interrogation of officials at every level of the German hierarchy. Lieutenant Colonel Meiling accomplished the greatest share of the ground work in obtaining accounts of the experiences of the offices of the Commissar of Health, Professor Brandt, and of the German military authorities. Members of this branch were responsible for originally locating and capturing the files of the Reichs Commissar of Health, for discovering the hide-out of the secret archives of the German chemical industry, and for conducting the first interrogations of the Director of German Public Health, Dr. Leonardo Conti, and of the discoverer of sulfanilamide, Dr. Gerhard Domagk. Upon request of the counter-intelligence corps of the Twelfth Army Group, two members assisted in interrogations which led to a reconstruction of Hitler's medical history and the changes in his personality during the last years of the war.

This report has been organized along the general lines of the Appraisal Form for Local Health Work, 1938 edition, published by the Committee on Administrative Practices of the American Public Health Association. It was felt, however, that a thorough investigation of the subjects mentioned in this Appraisal Form would not result in a com-

plete survey such as was directed by the late President Roosevelt in his letter to the Secretary of War, September 9, 1944. The President stated that, in his opinion, the survey should include an investigation of "the problems created in moving evacuees from a bombed city, the burden in the community to which the evacuees were moved, the complications caused in transportation, food distribution, medical attention. . . ." Therefore, in addition to the ordinary subjects it was decided to include an appraisal of the distribution of medical personnel, the changes in medical education, the fate of industries producing pharmaceuticals, surgical dressings and supplies, and to determine as far as possible the causes of death in air raid casualties.

The second chapter is the result of an effort to determine as accurately as possible under the existing circumstances just how many persons died in Germany in the air raids. The manner in which they died, whether through direct physical injury, from carbon monoxide, or through such interesting effects as inhalation of air of a temperature exceeding 500° F, has been discussed in Chapter Three. Chapter Four is not strictly a statistical analysis of communicable diseases; it is this with the addition of the observations of prominent men throughout Germany on the effect of bombing on communicable diseases and other disorders. The other disorders include venereal diseases and conditions of a psychogenic nature. Many physicians in Germany and in England called this war, in which the civilian population was subject to attack, a "war of the vegetative neuroses." It is unfortunate for our report that more precise statistical information was not available on the incidence of such afflictions as peptic ulcer and coronary disease. It is certain that if a yardstick had been applied to the frequency with which fear, the disruption of normal routine, and the psychologic upheaval accompanying the chaos and sorrow and struggle for existence in a city under heavy bombing contributed to the physical breakdown of the German population, we would have an index to one of the most important effects of bombing on a country's ability to wage war. This is not evident from the discussion of industrial health in Chapter Five, nor is it apparent in the next chapter, number six, which is concerned with vital statistics. The frequency of suicides and the ratio of mortality from heart disease, cerebral hemorrhages, and perhaps old age may give only an indication of the role played by psychogenic disorders.

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The medical care provided for the German civilian population during the war is discussed in Chapters Seven, Eight and Nine. They also contribute to an understanding of the extent to which bombing influenced the health of the people. The detailed information presented on the hospitals of Germany (Chapter Nine) should prove of value in the future planning for the defense of the civilian population of the United States. The striking contrast, evident in this chapter, between those cities with enough foresight to provide air raid hospitals in advance and those that awoke too late to the danger is an excellent example of the value of prior-planning in health protection.

Interviews with top political and medical authorities made it clear that the anticipation of bombing caused Hitler to reorganize completely the top level of German health control and to establish the Office of Reichs Commissar for Health as the final arbiters between the demands of the civilian and the Armed Forces for medical care. This is the substance of Chapter Seven. Chapter Eight recounts the fate of medical education in Germany during the past five years and describes the extent of the destruction of some of the institutions. This dissertation also emphasizes one of the long range effects of bombing. One of the great problems facing the occupying authorities will be to find a sufficient number of German physicians who can keep the health of the country from deteriorating to the point where it becomes a burden and a danger to the Allied nations.

The discussion of environmental sanitation in Chapter Ten points perhaps to the most important lessons of all to be learned from this undertaking. It makes it easier to understand why there were no epidemics in Germany during this war. When we state that there were no epidemics it is not implied that there were no discernible increases in certain contagious diseases or that they did not reach important proportions in some areas. Diphtheria in adults posed a real problem to the health authorities; typhoid also was encountered in one or two places, but there were no outbreaks of disease of such alarming proportions as might be described as major epidemics. Certainly the destruction of the water and other sanitary facilities and the problems of living in these wilds of rubble created an ideal culture medium for the spread of contagious disease. But this did not occur.

Nutrition and food supply are important pillars in the economy of any nation and especially in the

economy of a nation at war. How the Germans organized their food distribution, how they rationed their food, and how this system of production and distribution broke down under the impact of the Allied air attack are described in Chapter Eleven. The question of transportation plays an important role in the discussion of production and distribution of medical supplies as described in Chapter Twelve. It was not possible to visit all of the pharmaceutical plants since some of them lay beyond the area of the jurisdiction of our credentials, nor could each of the surgical supply manufacturing concerns be inspected. Nevertheless, we were fortunate enough to discover and to have for our study the complete files on medical research and drug supply of the Hitler government. From these and from the visits to all the important laboratories in western Germany we were able to reconstruct a picture of the experience of these organizations during the war.

Members of the Medical Branch Team exploited every source of information in the time allowed. We were able to interrogate not only university professors, but also local health authorities and nutrition experts. The opinions of the top men in German public and military life were also sought. As a matter of interest in understanding the sources of information exploited a list of the more important persons, though not all of the individuals interviewed and interrogated, is given in Appendix A. The Appendix also contains Lieutenant Colonel Meiling's report on some aspects of the health services of the German Armed Forces which he was requested to make by the Military Effects Division of the Survey. The data on nutrition comprising Appendix C have been included for the reader who wishes to go further into an analysis of that subject. The files containing hundreds of captured documents used as source material for this report may be examined at the War Department.

Although attributing a subject to one author, as has been done here, is not a customary procedure in government reports, it was agreed that the nature of this document is such that it should conform to the usual practice followed in medical literature. The fact that an investigator's name appears above each chapter implies only that he was responsible for assembling data contained in that chapter. There is perhaps no one subject upon which information was not contributed by other members of the team. In fact, in guiding this group through Germany we endeavored to have every

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analyst, excepting those responsible for nutrition and statistics, exploit at one time or another every type of target. The conclusions presented are not the final impressions of only one man but are to be regarded as the conclusions of the entire Medical Branch.

We have written the report on the effect of bombing on health and medical care in Germany as free from scientific jargon as possible so that it may accomplish its small part in the large mission of the Strategic Bombing Survey. We believe that what has been set down will aid in understanding what happens to the health of a nation when

the face of its cities is macerated by bombing. Although this is a description of the manner in which a thoroughly regimented nation reacted to air raids, we may learn from it how a democratic society can rise to a similar threat in the future. Others may arrive at conclusions which have escaped our attention. It seems difficult, however, to avoid the one outstanding fact which the study of these data defines, namely, that a people well trained in personal hygiene, who, as one German puts it, know where the dangers to ill health lie, are the strongest bulwark against breakdown of public health when their cities have been destroyed by the enemy.



CHAPTER TWO

CIVILIAN DEATHS FROM AIR ATTACKS

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The most direct effect of bombing on health naturally would be the actual number of people killed. Therefore, the value of a complete and accurate recording of all deaths from air raids in German cities was recognized from the beginning of these investigations. The exact number killed by Allied bombs could not be determined and because of loss of records and the utter confusion of defeat it is unlikely it will ever be known. An estimate, therefore is presented which we believe is sufficiently accurate to provide a basis for understanding the relation between the tonnage of bombs delivered on a city and the number of people expected to be killed.

Only one record of air raid mortality covering all of Germany was discovered by the medical section. This was a copy of a report by the German Statistical Office, Weimar Branch, which listed deaths due to aerial attacks by city and month, from October, 1940, through the end of 1944. Figure 1 shows graphically the total number of deaths suffered by German civilians as a result of aerial attacks on Germany, as recorded by the German Statistical Office.

The official German figures could not be accepted without ascertaining their reliability, not only because of the possibility of deliberate falsification of air raid records, but also because of possible errors in the local system of recording deaths following air raids, and in the transmission of those records to the point of central compilation and publication. Even if the report compiled by the German Statistical Office was assumed accurate and prepared in good faith, with no effort to conceal casualties, it was evident that it was a preliminary or initial report, unrevised for later additions as more bodies were found under the rubble.

It was believed that air raid casualty figures obtained from local police and statistical officials would prove reasonably reliable, as any basis for deliberate falsification had ended with the termination of hostilities. Local authorities under Allied

control were, also, for the most part either anti-Nazi or affiliated with the Nazi regime.

In order to test the validity of local reports of aerial attacks it became desirable to compare the local information against the known aerial attacks as recorded by the Allied air forces. The city of Duisburg was chosen for this test. Information received from local authorities in Duisburg was very complete; the city, situated in the industrial Ruhr, was frequently and heavily bombed, and deaths were more numerous than average.

The findings of this comparison are shown in the five panels of Figure 2. The top panel, giving the locally reported number of deaths per month from air raids, corresponded extremely well with the second panel showing the number of planes the Allied air forces reported sending against the city each month. Each peak in the number of planes bombing the city was reflected by a corresponding peak in the number of deaths reported by the local authorities. The third panel, giving the tons of bombs the air forces dropped, reflected faithfully the number of planes carrying those bombs. The local estimates on the number of bombs dropped are shown in the fourth panel. This followed very closely the air force record of tonnage dropped. The great peaks in the local figures of bombs dropped on the city were caused by the local procedure of recording the number, not tonnage, of falling bombs. Therefore, in a raid where a great number of incendiary bombs, weighing only a few pounds each, were used, the number of bombs may have been great, while the bomb tonnage was low.

The bottom panel gives a comparison between the number of attacks as recorded by the local authorities and by the air forces. In the main, these correspond. Such differences as do occur are perhaps largely accounted for by dissimilar ideas as to what constituted an attack. A group of bombers following an earlier group, after an elapsed time of an hour or two, might have been called another

FIGURE 1

**TOTAL DEATHS OF CIVILIANS FROM AIR RAIDS
ON GERMANY**

AS REPORTED TO THE GERMAN STATISTICAL OFFICE
BY MONTHS, OCT 1940-DEC 1944



and separate attack by the local authorities, while the air force could have regarded it as a continuation of the earlier attack, or vice versa. Also, an air raid on an industrial plant or area just outside of a city's corporate limits may have been called an attack on the city by one group and might not have been so regarded by the other.

The two pages comprising Figure 3 illustrate the bombing experience and mortality from air attacks on thirteen German cities, by months, from October, 1942, to December, 1944. The air raid deaths were taken both from the German Statistical Office and local estimates, with those figures judged to be more correct for a particular city being used for that city. The monthly total bomb tonnage reported by all air forces on each city is represented by solid blocks. The deaths, represented by lines, are not shown as actual numbers but as monthly rates, computed on a monthly basis, per 1,000 population.

Figure 3 shows that, in most cases, the death rate rose in proportion to the increase in tons of

bombs dropped and to the number of consecutive months in which comparatively heavy raids were carried out. Seldom did a high death rate accompany a low bomb tonnage. One notable exception was Augsburg, where during the months of October and November, 1944, the death rates were fairly high although the tonnage of bombs was low. This led to the conclusion that in those two months either air raid shelters or bunkers were hit, or that the information received from the air forces as to the tonnage dropped on Augsburg was in error.

Mulheim is shown as having had a considerable number of air raid deaths in April, 1943, and throughout the entire year of 1944, with no record of bombs released upon the city during those periods. Again it appeared that the air raid reports from the air forces were in error, in that they failed to show Mulheim as a target. The region of the Ruhr is so continuously and densely populated that Mulheim might easily have been bombed under the mistaken impression that it was another

FIGURE 2

MONTHLY SUMMARY OF AIR RAID ATTACKS ON DUISBURG

COMBINED INFORMATION FROM AIR FORCE AND LOCAL REPORTS



FIGURE 3

THE BOMBING EXPERIENCE AND MORTALITY FROM AIR ATTACKS ON THIRTEEN GERMAN CITIES

MONTHLY DEATHS PER 1,000 POPULATION, MONTHLY BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

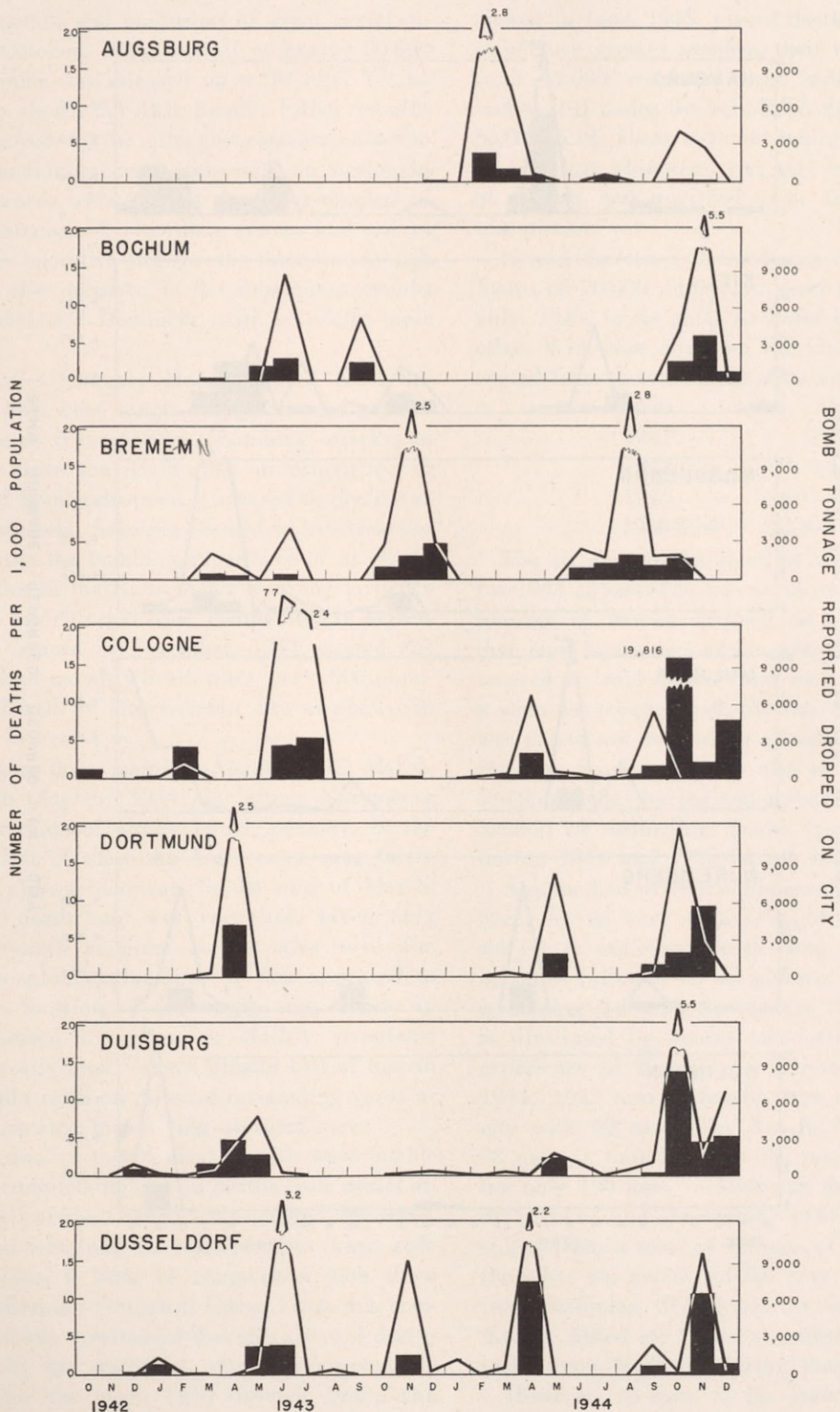
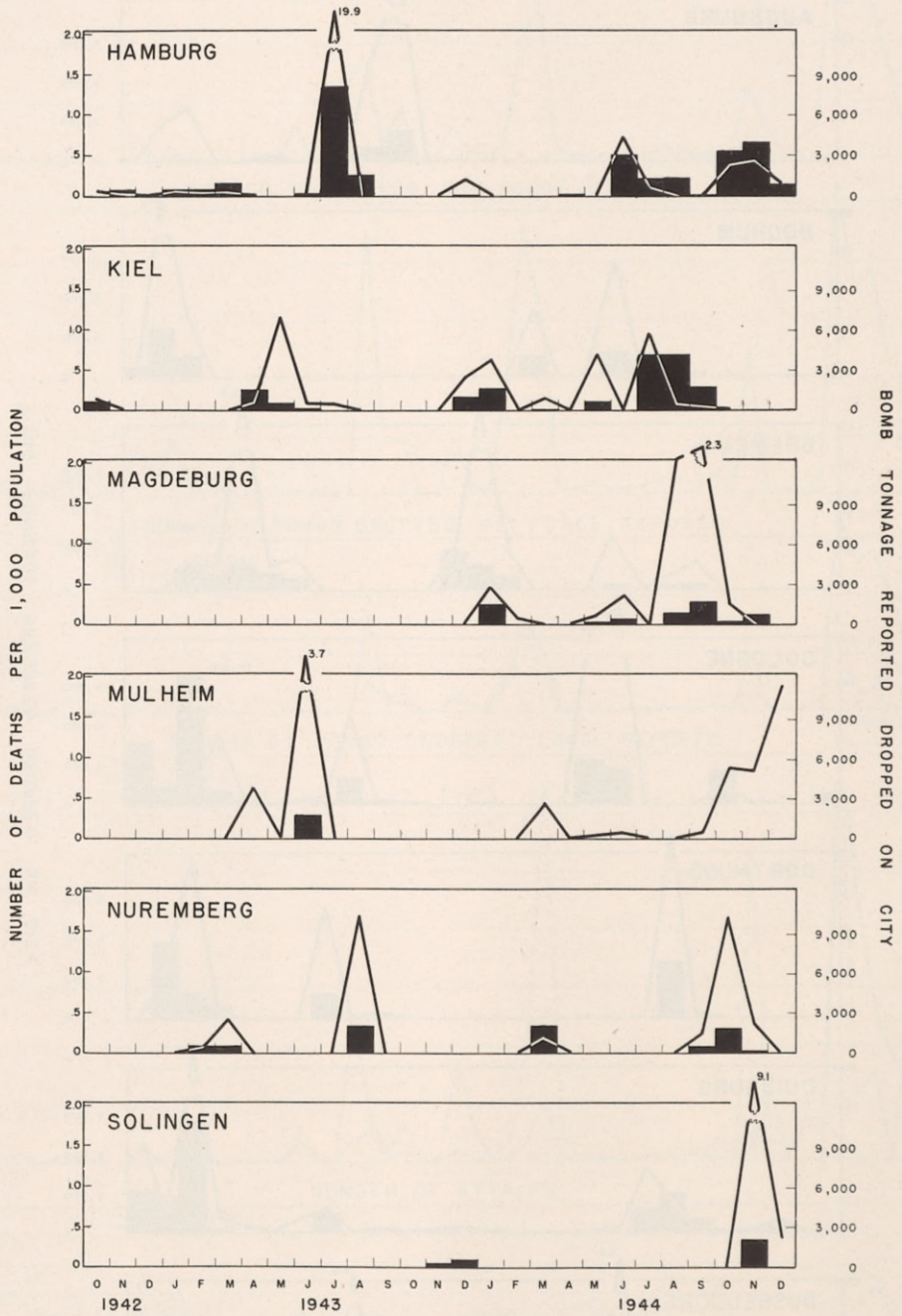


FIGURE 3 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM AIR ATTACKS ON THIRTEEN GERMAN CITIES (CONTINUED)



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city, with the latter city having been reported as the target of the attack.

Cologne was an example of the manner in which the city procedure and governmental system frequently became inoperative under the terrific destruction and confusion of great aerial attacks. In October, 1944, a total of nearly 20,000 tons of bombs was released upon the city. Yet no deaths are shown for that month. Either records were destroyed or the city governmental machinery was unable to cope with such an onslaught and no records were kept of the great number of deaths occurring. A recording system had not as yet become operative two months later for, though bombings also occurred in the subsequent months of November and December, still no deaths were reported.

Some cities, notably Hamburg and Kiel, appeared to have been taught safeguards and preventive measures from previous bombing attacks. In these two cities the death rate, in proportion to the tons of bombs dropped, appeared to decline in 1944. Conversely, Solingen seemed to have learned nothing from the bombing experience of its neighboring cities in the Ruhr. After escaping virtually unscathed prior to that time, comparatively moderate aerial attacks in November, 1944, caused one of the highest monthly death rates, per 1,000 population, suffered by any German city as shown in Figure 3.

There were three months—August, 1943, March, 1944, and October, 1944—in which Nuremberg underwent raids of almost equal intensity. In the first and last of these the death rates were fairly high and almost identical. In the raid of March, 1944, the death rate was very low, being only about one-ninth as great as the other two. The most reasonable explanation of this appeared to lie in the location of the target area. Raids on targets located in urban or thickly populated areas naturally took a much greater toll of human life than did raids on railroad marshaling yards or factories situated in outlying or rural areas.

Field teams of the Medical Branch were unable to secure complete figures on deaths from aerial attacks on all of the German cities visited. However, the figures obtained in certain cities were sufficient to form a basis of comparison with those from the German Statistical Office. From this comparison, it was determined that the air raid deaths as given by the statistical office were reasonably accurate for the years 1940 through 1943, with

one exception. This exception was the city of Hamburg, for which the statistical office listed 34,324 dead from aerial attacks in July, 1943, the month of the great Allied attack on that city. All Hamburg city officials and health authorities, interviewed in June, 1945, placed deaths in July, 1943, at a much greater number, their estimate ranging from 46,000 recovered dead with 10,000-12,000 bodies still under the rubble, to the total figure of 60,000 dead. These were not impromptu guesses by incompetent observers, but the reasoned analysis of officials best qualified to be familiar with the true picture.

It was, therefore, deemed reasonable to add the figure of 20,000 additional dead in Hamburg for July, 1943, to the total as stated by the statistical office. With that addition, the air raid deaths accepted from the statistical office were as follows:

1940	349
1941	2,785
1942	4,327
1943	103,271
1940-1943	110,732

The air raid deaths given by the statistical office for 1944 appeared to be low in respect to the great tonnage of bombs dropped on German cities in that year. Upon comparison with the known locally secured air raid deaths from several cities in 1944 a wide discrepancy with the statistical office listing was noted, not only in the monthly figures following very heavy raids, but also in the deaths given for those cities for the entire year. Therefore, some method of estimating deaths from aerial attacks during 1944 and 1945 had to be devised.

Any method of estimation employed would have been, by its very nature, highly inaccurate and subject to criticism. Death from bombing attacks on cities followed no set pattern. The difficulty of estimating deaths by the tonnage of bombs dropped is illustrated by figures taken from the bombing experience of the city of Nuremberg. In March, 1944, 2,047 tons of bombs were released over the city with 60 casualties. Yet in November, 1944, 98 persons were killed as the result of raids totaling only 190 tons. In Mulheim, during the months of October and November, 1944, 175 deaths resulted from a total of 17 tons of bombs, while in the other ten months of the year the local authorities attributed 271 deaths to aerial attacks, although Allied air forces recorded no bombing attacks upon Mulheim during those ten months.

However, in spite of the known weaknesses in

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this manner of determining deaths, it was decided to base the deaths upon the tonnage of bombs dropped to arrive at the estimated air raid casualties for 1944 and 1945. The cities for which local air raid deaths were available were representative German cities and many of the great differences found in any one city were eliminated by compensating differences found in another. Any other type of estimation seemed to be even more inaccurate with less basis for justification of its use, than did the method determined upon.

As it was believed that deaths from a given tonnage of bombs were not consistent for all cities but varied with the size of the city, the following city population groups were established: 0-99,999, 100,000-249,999, 250,000-399,999, 400,000-499,999, and 500,000 and over.

From the tabulation of air attacks on Europe, by city and date, by the 8th and 15th Army Air Forces and the Royal Air Force, a listing was made of the tons of bombs dropped in 1944 and in 1945 on individual German cities. These city totals were then added by population groups, giving the total tonnage dropped in each year on each group of cities.

There were thirteen cities for which the medical section had secured local records of air raid deaths, and at least two of these thirteen cities fell in each of the five population groups. From these local air raid death figures and from the bomb tonnage on these same cities the ratio between tons of bombs dropped and deaths resulting therefrom were established for each of the years 1944 and 1945, and for each of the population groups.

The total bomb tonnage dropped upon each population group was multiplied by the ratio (i.e., deaths per ton) for that group, giving the deaths in each group for each year. Adding the population groups for each year, the highly speculative results of 201,000 deaths from air attacks in 1944 and 110,000 deaths from January 1, 1945, to the cessation of hostilities were obtained.

To these may be added the figure of 111,000 deaths during the years 1940-1943, to give a preliminary calculated estimate of 422,000 deaths in Germany from aerial attacks during the course of the war. To this other totals must, however, be added.

All air raid death figures taken from the German Statistical Office, and those local figures upon which the estimates for 1944 and 1945 were based, were for the resident civilian German population

only. A true picture of the actual number killed by bombing should have included, in addition to the figure given above, foreigners, Jews, slave laborers, displaced persons, members of the Wehrmacht and security police, and prisoners of war, all of whom were excluded from the figures given. These additions would have increased the estimate of 422,000 deaths to a considerably higher figure.

The only deaths considered, including those upon which the above estimates were based, were recorded deaths. If bodies were recovered and burial made without a certificate of death being signed and recorded those deaths were not included in the figures prepared by the local authorities. This undoubtedly was frequently the case in the latter part of 1944 and in 1945 when the great raids wiped out not only the city records, but temporarily forced to a halt the normal functions of the city government. In addition, no estimate could be made of the great number of persons classed as missing. These figures were not secured from the local authorities, but it was known that in many cities great numbers of bodies were still under the debris. Local authorities in those cities which suffered great raids in the last eight to ten months of the war estimated that unrecovered, and therefore, unrecorded, bodies easily totaled 25 per cent or more of the recovered and recorded deaths. From discussion with local authorities and after viewing the debris and rubble comprising the sole remains of great sections of many German cities, it was the opinion of the Medical Branch investigators and field team members that the figure of 25 per cent was very conservative. If so considered, the estimate of 77,750 missing in the years 1944 and 1945 would have given a *total estimate of 499,750 German civilians killed by Allied air raids*. This large number of missing persons was indicative of the utter chaos that prevailed in most German cities following the great aerial attacks.

It is interesting to note that Professor Brandt, the Reichs Commissar for Health, when interrogated in an Allied prison camp in June, 1945, by a member of our team, stated that the Propaganda Ministry had estimated that 535,000 deaths had occurred from air raids. This estimate is inclusive of foreigners, Jews, slave labor, police and members of the armed forces on leave. Weight is lent to the validity of our figures by these official estimates presented by Brandt, which did not come to our attention until after the completion of our own computations.

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Summary

No complete and accurate figures on German civilian air raid casualties, covering the entire period of the war, were available. Local reports of recorded deaths from aerial attacks were secured from a number of cities and proved to be comparatively accurate. The report of the German Statistical Office, listing deaths by cities, was obtained and found to be generally correct for the years 1940 through 1943. Estimates of air raid deaths for 1944 and 1945 were prepared based upon the

known tonnage of bombs dropped and the known locally recorded deaths per ton for sample cities graded by population size. The result yielded an estimated total of 422,000 deaths. It was further estimated that an additional number, approximating 25 per cent of the known deaths in 1944 and 1945, were still unrecovered and unrecorded. With the addition of this estimate of 1944 and 1945 unrecorded deaths, the final estimation gave in round numbers a half million German civilians killed by Allied aerial attacks from the beginning of heavy bombing to the end of the European war.



CHAPTER THREE

THE NATURE OF AIR RAID CASUALTIES

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Until 1943 the only reports available to German governmental agencies on the causes of death came from police and medical inspectors in the health services of the bombed cities. Very few post-mortem examinations were performed in the early years of the war because all victims were taken to cemeteries where they were identified and buried as fast as feasible. The problem of the cause of death was apparently not considered of sufficient importance or magnitude to warrant special measures. Without well-laid plans and organization careful pathologic examinations of the bodies was extremely difficult. Oftimes water and light failed. Also, the lack of any uniform system no doubt inhibited the personal initiative of the doctors entrusted with the establishment of accurate diagnoses, who as individuals were furthermore affected by the bombings of their home towns. Thus very soon such diagnoses as "anoxia," "carbon dioxide poisoning," "tearing of the lungs," and "asphyxiation" were made and, as fast-spreading rumors, assumed alarming proportions in not only the population at large but also among the medical profession.¹ Despite these rumors it soon became apparent to leading pathologists that the air war was causing death in several different manners new to medicine. As the bombings became more intensive it was realized that only through systematic studies of the victims could more accurate knowledge of the causes of death be gained. Correct diagnoses and some attempt at collecting accurate statistics on the causes of death were not only of the utmost importance to medical science, but also had a practical value in the problem of compensation for victims without external injuries.

In 1943 several important measures were taken to ensure correct diagnosis of persons killed in aerial bombings. First, the Reichs Ministry of the Interior ordered that all persons in whom the causes of death were not clear-cut were to be subjected to autopsy before an interment permit could be issued to the relatives. Second, the *Luftgau* (air district) physicians of the Luftwaffe were to appoint and supervise commissions for the study of

the causes of death in air raids, particularly for the clarification of hitherto unknown or unsuspected causes of death. These commissions—or "examining troops," as they were called—consisted of at least three members: a pathologist, a sanitary or industrial hygienist, and a medico-legal expert. These commissions could be temporarily augmented by all types of specialists, such as ophthalmologists, internists, toxicologists, surgeons, and, in fact, by any type of medical specialist the permanent board might deem necessary for the solution of a particular problem. The advantages of such a mixed commission over one consisting of police and health officers of one given community are obvious. The mixed commission was recruited from several cities in the respective *Luftgau*, and was to bring its work into the affected area from the outside without being personally affected by the catastrophe, according to a talk by Professor Rose, chief consultant in hygiene for the Air Ministry. The duties of the commissions were to clarify the causes of death by postmortem examinations, to study carefully the circumstances under which death or injury was produced, and to study the injured and uninjured survivors by follow-up visits to the hospitals and by eyewitness accounts. Professor Buechner, consultant to the Luftwaffe, estimates that from 20,000 to 30,000 autopsies were performed on air raid victims during the entire war.

The central collection of reports was kept at the Institute of Aviation Medicine in Berlin and was, therefore, not available for inspection by the Medical Branch. The reports of the findings of these commissions were forwarded to the Air Ministry, where they were consolidated and published. The first of these reports² was issued on October 30, 1944, and the second and last³ on January 24, 1945. In March, 1944, the Air Ministry issued several pamphlets describing medical experiences in air raids but these, like the consolidated *Luftgau* reports, were not given to the public or the press. They were sent only to "cleared" medical authorities and to institutions.

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Before the establishment of the commissions a meeting was called by the inspector of sanitary and medical matters of the Luftwaffe to discuss the effects of the great incendiary raids on Hamburg in July and August of 1943. The meeting took place in Jueterbog in December, 1943, and was attended by pathologists, medicolegal experts, pharmacologists, and physiologists, all of whom had had extensive experience with this problem. They concluded that the most prominent causes of death¹ studied at the time were:

(1). Causes of death from external injury:

- (a). Burial under rubble and debris and injury from flying fragments.
- (b). Secondary injuries through explosions (drowning, scalding, chemical burns, poisoning from by-products of exploded bombs).
- (c). Burns.
- (d). Tetanus secondary to burns where no serum was given prophylactically.

(2). Causes of death from internal injury:

- (a). Carbon monoxide poisoning in air raid shelters and occurring during rescue work.
- (b). Effect of heat through conduction and radiation in the presence of very high temperatures.
- (c). Overheating over a prolonged period of time through temperatures which, normally, can be tolerated for short periods only.
- (d). Dust inhalation; blocking of the upper respiratory passages and inhalation with damage to the small bronchi and alveoli.
- (e). Carbon monoxide poisoning from bursting gas mains (see also 1-b).
- (f). Sudden heart death through fright and exhaustion in cardiac patients.
- (g). Blast injuries in which external in-



FIGURE 4. Typical scene in Hamburg after incendiary raid. Notice large amount of rubble and fires one week after the raid. Possibility of escape very slim.

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juries may be absent or which may be masked by external injuries.

Several theories were refuted as being scientifically unsound or unproven. The majority of authorities present at this conference expressed the belief that deaths from anoxia, from carbon dioxide poisoning, from "gas poisoning" (i.e., "phosphorus gas"), or from high-frequency air waves subsequent to explosions, had not been substantiated.

The report of this conference stated that a satisfactory schematization was not always feasible in catastrophies of such magnitude as that which had occurred in Hamburg because several types of damage could occur in one individual at the same time. It also warned against taking reports from various cities too literally. For example, one city reported 20 per cent of all deaths in one air raid as unsolved, whereas a city nearby, hit in the same raid, reported only 1 per cent as unsolved. The reasons for such discrepancies were thought to be a lack of thorough examinations and the placing of too much reliance by the medical examiners on police reports.

Up to September, 1943, 277 autopsies had been performed on air raid victims and had been studied extensively by examining commissions assigned to this project. The cases were chosen at random throughout Germany regardless of the types of bombs dropped. The effects of bomb fragments, of carbon monoxide poisoning, of heat, and of pre-existing organic disease (mainly cardiovascular) combined with the excitement and exertion were listed as etiologic factors in these air raid victims.

The Hamburg raids in July and August, 1943,



FIGURE 5. Occupant of air raid shelter found several days after raid. Death apparently came without struggle.



FIGURE 6. Man who succumbed from effects of high temperature in the street while running to safety. Clothes were incinerated while shoes are intact. Position suggests effort to raise himself and keep going.

provided a wealth of information and took first place in the attention of all German scientists working on the subject of the causes of air raid deaths. They were the most carefully studied. The raids dominated the picture which existed at that time on the effects of bombings. A whole new field of medicolegal literature was opened and new terms coined.

In the course of the air war, the causes of death were more and more differentiated. In *The Medical Experiences of Air Raids*⁴ of March 27, 1944, it was stated that besides mechanical injuries only heat and carbon monoxide poisoning were of statistical importance, and that in large-scale fires, deaths resulting from heat and carbon monoxide poisoning can outnumber those from mechanical causes.

Mechanical causes

After studies and reports from other German cities became available it was evident that mechanical causes of death headed the list, as had been expected. Direct hits by bombs and the action of bomb fragments, burial under rubble, and burns, all associated with shock, were the main causes of death of air raid victims throughout Germany.

After the first excitement had quieted down and postmortem examinations were carried out more

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FIGURE 7. Example of a victim of heat. Position of hair shows clearly splitting and retraction of skin of skull and around orbits. Clothing practically intact.

regularly, it was found that many persons without external injuries had died of internal hemorrhages, skull fractures, and fat embolisms. Injuries due to mechanical causes, fractures, dislocations, sprains, and contusions, were listed as typical of air raids. This proves that there is little reason to believe that air raid injuries to civilians are any different from those encountered in ordinary war medicine. As shown by the handing of the responsibility for this work to the Luftwaffe medical services, it is a problem requiring all the emergency equipment, organization, and supply facilities necessary on the battlefield. This is described in detail in the report of the Civilian Defense Division of the United States Strategic Bombing Survey.

In the circumstances prevailing, shock must have played a tremendous role; just how much could not be stated. Rose quoted statistics from one hospital which gave shock as a cause of death in 12.6 per cent of all patients hospitalized from bombed areas.

One aspect of delayed shock was described as "decompression shock" (*Entlastungskollaps*). It was observed in persons who had been freed from rubble under which they had been buried anywhere from several minutes to many hours. A typical victim suffered contusions of muscle tissue of

various degrees, and when freed looked and felt well for hours or days. Then suddenly he went into clinical shock with low blood pressure and a rapid shallow pulse. The urinary output was diminished, and albumen and cylinders appeared in the urine. The patient died in anuria. Toxic substances liberated from the damaged tissues were thought to be the cause for this syndrome. Other authors claimed that increased capillary permeability in the damaged tissues, leading to a decrease of the circulating blood volume, was the cause of this syndrome.

Severe contusions with the typical decompression shock syndrome occurred in practically all bombed cities. From estimates of the *Luftgau* physicians, it can be stated that the mortality rate for this condition was about 90 per cent. The remainder recovered without permanent damage. Kidney function returned to normal in a surprisingly short period of time. Dr. Karl Scriba, pathologist in Hamburg, published reports of 3 and saw 50 of these cases. All died despite vigorous measures, in-



FIGURE 8. Effect of dry heat in a group of occupants of an air raid shelter. Splitting of skin, scalp and around orbits. Clothing practically intact.

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cluding the liberal administration of whole blood, plasma, and vasoconstrictor drugs. All were feeling well and conscious when liberated from the rubble. Pathologic changes consisted of necroses in the damaged muscle tissue and the histologic picture of a myoglobin nephrosis with numerous myoglobin cylinders in the kidney tubules. Whether the cylinders were hemoglobin or myoglobin could not be ascertained. The whole symptom complex had been described in the war of 1914-1918 and the Tokyo earthquake of 1923.⁵

The treatments for fractures, dislocations, sprains, and contusions did not differ from the universally accepted treatments for such conditions. Air raid first-aid posts were not set up to administer anti-shock treatment except in occasional cases when Periston, a synthetic blood substitute produced as a by-product in the manufacture of butadiene, was given. There were no facilities for whole blood transfusions in any of the medical installations except hospitals, and plasma was used very little in Germany.

Conjunctivitis resulting from dust and rubble particles occurred frequently and was treated with 1 per cent ammonium tartrate and boric acid. Perforations of the eye happened relatively frequently; if from metal fragments the victim was usually killed at the same time. Other causes were particles of glass, wood, and brick.

Heat

It can be stated that there is a definite relationship between the type of bomb dropped and the



FIGURE 9. Specimen of lungs and heart in a case of heat death. Organs shrunk to a fraction of their normal size. Hard consistency.



FIGURE 10. Specimen of brain and lungs of a heat death victim. Organs dry and hard. Note scale in centimeters.

type of death or injury to be expected. An incendiary attack, through the effects of heat (and carbon monoxide), would cause more dead than wounded, whereas in high-explosive raids mechanical injuries would outnumber deaths.⁵ The crowded conditions of a city, the height of apartment houses, the age of the dwellings—all these are contributory factors (Figure 4) towards the spread of fire and the outbreak of a panic. There is a difference between peacetime fires and fires subsequent to air raids but the difference is only quantitative. Thus, 16,000 buildings were aflame at the same time in Hamburg in July, 1943. Furthermore, people rarely seek refuge in the basement if their house is on fire in peacetime.

The effects of heat were classified as:

(1). The effect of direct heat of short duration through conduction or radiation with production of burns proper.

(2). The effect of high temperatures over long periods of time which did not immediately lead to protein coagulation but which caused a syndrome identical with that of heat stroke.

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FIGURE 11. *Another victim found in the streets of Hamburg after the incendiary raid of July 27/28, 1943; effect of heat. Note absence of clothing and presence of shoes.*

The time at which injury from heat occurs varies with several factors such as the humidity of the air, the cessation of sweat production, and the amount of heat to which the body has been exposed. In humid air, heat stroke may occur at a temperature of 60° C. and does not need to be associated with subjective complaints. This accounts for the many bodies which were found dead in rooms from which escape would have been possible, and which were in a position not suggestive of agony before death occurred (see Figure 5).

Police engineers in Hamburg estimated that temperatures in the burning city blocks went as high as 800° C. (1472° F.). Literally hundreds of people were seen leaving shelters after the heat became intense. They ran across the street and were seen to collapse very slowly like people who were utterly exhausted. They could not get up (Dr. Helmut Baniecki of Hamburg). Many thus killed were found to be naked (Figure 6). Two explanations have been offered for this phenomenon: that flames spurted across the street with the speed of a tornado and consumed the victims' clothing, singeing their skin, or that the intense heat made the clothes dissolve without actual fire. The shoes were usually the only covering left on the bodies.

Most of these people were not burnt to ashes when recovered, but dry and shrunken, resembling mummies. In many the intense heat had caused the



FIGURE 12. *Victim of heat found lying on his stomach, rolled over on his back to show intact skin on chest and abdomen. Genitalia greatly swollen. Note extensive carbonization.*

skin to burst and retract over typical areas such as the elbow, the knee, the scalp, and the orbit (Figures 7 and 8). Baniecki thought that the cause of death in these cases was shock. In approximately 80 autopsies he found all organs shrunken (Figures 9 and 10), showing venous stasis with increased permeability of the small blood vessels. Damage to the chromatin in practically all the cells of the abdominal organs and the lungs also was seen, which this investigator attributed to the inhalation of superheated air. However, it has not been admitted that inhalation of superheated air was the actual cause of death.

In *The Medical Experiences of Air Raids*⁵ of October 22, 1944, Professor Rose, chief consultant in hygiene to the Air Ministry, summarized the effects of heat. Besides immediate contact with flames, he wrote, the effect of heat through hot air as well as radiation of hot gases and from objects is of great importance. The main factor seems to be radiation. It is primarily the poorly clothed skin which is affected, whereby it and the subcutaneous tissues are damaged. This accounts for the severe heat changes in women who do not wear more than stockings on their legs or not even stockings. In many cases, when stockings were worn, they were not even singed although the skin and underlying structures were severely damaged. Radi-

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ation heat of over 225° C. can inflame clothes and air. Besides this local effect of heat, overburdening of the heat-regulating mechanisms of the body is important. This is brought about by a hindrance of the heat exchange between the body and the atmosphere. Thus many air raid shelters which had been closed off by rubble produced an atmosphere intolerable to the occupants. Heat damage was seen in members of rescue squads who entered basements and air raid shelters where proper ventilation had not been available for some time but the disturbances encountered were insignificant. Some of these rescue workers complained of vertigo, drowsiness, and headaches which lasted a day or so.

During escape from overheated shelters through burning city blocks, the danger was chiefly from radiated heat. The inhalation of hot air can cause severe damage to the respiratory passages such as ulcerous necroses of the mucous membranes. Whether this is a separate entity or the changes a part of a whole picture which lead to death is as yet unsolved. It should be kept in mind that the inhalation of dangerous gases or by-products of fires must be considered.

The actual street temperatures in large-scale fires could only be estimated. The degree of temperatures produced in incendiary raids gave rise to a question from the office of Professor Karl Brandt, commissar for sanitary and health matters for Germany. Professor Schuetz, a physiologist of

Muenster,⁶ answered from the Institute of Aviation Medicine: The question concerned is the effect on the human body of overheating to 41° C. (106° F.) for eight hours. The answer is: in the tissues increased temperature up to 50° C. is followed by death of all cells with subsequent vacuolization; higher temperatures are followed by shrinking and falling apart of the cells. According to Ludwig Aschoff, human cells die at 50° C., vesicles form in the tissues at 51° C., and hemolysis occurs at 60° C. Ganglionic cells are destroyed at 43° C. Animals die exposed to temperatures of from 60° to 100° C. in overheated rooms, usually in convulsion, after a few minutes to half an hour.

Professor Graeff, consulting pathologist to the *Wehrkreis X* (military defense area), in Hamburg, gave a very vivid description of the air raids on the night of July 27-28, 1943.^{7, 8, 9} The crowded conditions in a city of the size of Hamburg with its few parks and large squares, the height of the apartment houses, and the age of the dwellings are all contributory factors to the magnitude of the catastrophe. Soon after the sirens had sounded—a little before midnight on a clear night—the first bombs dropped. The warning was adequate for everyone to go to his shelter or bunker, and thereby evacuate the streets. High explosives and "air mines" destroyed houses, creating craters in streets and courtyards, ruining lighting and the power supply not only in the city at large but also in the individual blocks, and opening the gas and water mains (no gas escaped from the gas mains). In several bomb craters water accumulated from burst water mains ran into shelters and basements and thereby caused a great nuisance. At the same time incendiary bombs started fires which spread particularly in thickly inhabited parts of town in a very short period of time. Thus in several minutes whole blocks were on fire and streets made impassable by flames. The heat increased rapidly and produced a wind which soon was of the power and strength of a typhoon. This typhoon first moved into the direction of the fires, later spreading in all directions. In the public squares and parks it broke trees, and burning branches shot through the air. Trees of all sizes were uprooted. The "firestorm" broke down doors of houses and later the flames crept into the doorways and corridors. The "firestorm" looked like a blizzard of red snowflakes. More scientifically, firestorm is a mass of fresh air which breaks into burning areas to replace the superheated rising air.



FIGURE 13. *Body of a young woman; heat death. Induration of skin and underlying tissues.*

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FIGURE 14. Shelter occupant. Advanced state of cremation by dry heat.



FIGURE 15. Another shelter occupant. Almost completely charred body.

The heat turned whole city blocks into a flaming hell. Those who were still in the streets or for some reason had to leave their homes crowded into a high bunker (a concrete tower shelter) or into a subterranean air raid shelter. Thus the number of people in shelters was doubled and tripled over the number considered safe.

The first serious danger in houses which had not been hit and had withstood explosions nearby became apparent when the lights went out, the water stopped running, and cracks formed in the walls. Air raid wardens on the roofs were threatened by the "firestorm" and crumbling roofs. In many cases, windows and exits from shelters were blocked by rubble and thus the shelters were safe against fire. As the temperatures increased in the streets from the spread of large-scale fires many of the occupants of the air raid shelters realized the precariousness of the situation, yet very few tried to escape into areas not endangered by fire. In the course of hours the air in the shelters became increasingly worse. Matches or candles did not burn. People lay on the floors because the air was better there and they could breathe easier. Some vomited and became incontinent. Some became



FIGURE 16. Another example of a shelter occupant in advanced state of charring.

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tired and quiet and went to sleep. In some shelters oxygen cylinders were available and produced better breathing conditions for at least a short period of time. Wherever the ventilators were still working they brought in hot smoky air instead of cool fresh air, so that they had to be turned off. Filters, when available, proved insufficient to keep out smoke. The apparent safety of many shelters and basements closed in by rubble was only temporary as the approaching fire increased heat and smoke. In others, detonations and explosions nearby increased the pressure downward and directed the storm against the basements.

Thus the picture changed from hour to hour. Whoever was still able to make his own decision had one of two alternatives: to stay or escape. Many looked into the streets, saw that everything was on fire, decided they could not get through, and withdrew into the corners of the shelters. Some tried to get out of the burning areas, and for them it was a race with death among explosions, fire bombs, machine guns, and falling flak. Besides all this, flames spurted through the streets and the wind caught up with many and threw them to the ground. There were screams from victims all around. No eyewitness mentioned screams with pain. Many people were caught in the fire. Many stated that the air "just didn't come anymore" and breathing became very difficult. Otherwise they did not feel anything, and the rest went on over those who had fallen. One man was observed to fall. He was about to pull himself up with his hands when flames were seen to envelop his back and he burned within five minutes without changing his position.

The dead usually lay with their faces toward the ground. Many were lying in rows. Only a very few who had fallen got up by their own effort or with the help of others and reached safety in the areas which had not been hit. Some found safety in the bottom of a bomb crater; others found death by drowning in other water-filled craters.

Every possibility of escaping the "firestorm" behind rubble or remaining walls or corners was kept in mind. This was evident by the number of corpses found behind these ledges and corners. The same was true in open spaces where many sought safety behind tree stumps and parked cars.

The only safe refuge in all this time was the water of the canals and the port. Most of those who got there were entirely exhausted. Lips, mouth and throat were dry. They were blistered on the

nose and ears, on the hands and face, and their eyes burned with pain and could hardly be opened after having been exposed to so much smoke. Many collapsed, then lost consciousness and died. Many jumped into the water. Even here the heat was hardly bearable. They took blankets and handkerchiefs, soaked them in the water, and then protected their heads and the uncovered parts of their bodies with the wet cloths. But the water evaporated so quickly that this procedure had to be repeated every few minutes.

It is striking that thirst was not a generalized symptom. Some victims could not take enough water, yet some who were in utmost danger of heat death denied a feeling of thirst. They did not seek water, although water was available, nor did they report that they sweated more than normally. Others, however, took off their sweat-soaked clothes as soon as they had reached areas safe from fire and excessive heat.

Only a few generalizations could be made from the remarks of those who came to safety. In the first hours after they had successfully escaped, some complained of headaches and slight drowsiness. The desire for sleep was present in all and sleep very deep. After awakening there were no sequelae.

In the meantime the burned-out houses caved in. The rubble and debris on the streets prevented many from escaping. The heat decreased slowly, but the main danger was past. Many of the bodies were lying in the streets half clothed or nude. The only covering that they always had on were their shoes (Figure 11). The victims' hair was often burned, but frequently preserved. A few hours after the start of the raid the corpses had a peculiar aspect; they seemed blown up, lying on their stomachs. The buttocks were enlarged and the male sex organs were swollen to the size of a child's head (Figure 12). Occasionally the skin was broken and indurated in many places (Figure 13) and in the majority of cases was of a waxy color. The face was pale. This picture lasted only a few hours; after this time the bodies shrunk to small objects with hard brownish black skin and charring of different parts and frequently to ashes and complete disappearance (Figures 14, 15 and 16).

At the same time fate had caught up with many of those in the shelters and the basements. In houses which had caved in through the effect of high explosives or fires, the bodies were found covered with rubble. The air raid tower shelters and also

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the larger number of the subterranean shelters withstood the explosions and fire. There was no doubt that in many a shelter, death had come to the occupants without any one ever suspecting it. Several persons were sometimes found sitting or lying in the most natural position (Figure 17); others were sitting in groups as if talking to each other and some had slipped to the floor from chairs or



FIGURE 17. Another view of victim shown in Figure 5.

benches (Figure 18). The appearance of defense or escape movements could not be explained other than as death without premonition. In many shelters, however, bodies were found in a heap in front of the exit so that it must be concluded that escape was sometimes attempted.

Many such public air raid shelters and basements were examined from about the eleventh day up to several months after the raid. Immediately following the raids the air was sometimes moist, seldom dry. At later dates, normal temperatures were prevalent. In most cases, the air was hot or warm and in some shelters even after weeks the heat was intolerable and breathing most difficult.

As a rule, there was a strong, often nauseating odor of characteristic quality. The typical disagreeable odor of putrefied animal tissue was stronger than the odor of burnt flesh and fat. This typical odor helped experienced men to direct rescue work toward buried or hidden corpses. The odor increased in the course of weeks and was absent in shelters where only ashes were found.

In the shelters bodies assumed various aspects corresponding to the circumstances under which death had set in. Nowhere were bodies found naked or without clothing as they were in the streets. The clothes, however, often showed burned-out holes which exposed the skin. Bodies were frequently

found lying in a thick greasy black mass which was without a doubt melted fat tissue. The fat coagulated on the floors as the temperature decreased. The head hair as a rule was unchanged or only slightly singed. The bodies were not bloated except for a few which were found floating in water which had seeped into the shelters from broken mains. All were shrunken so that the clothes appeared to be too large. Those bodies were called ("incendiary-bomb-shrunken bodies") *Bombenbrandschrumpfleichen*. They were not always in one piece. Sleeves and trouser legs were frequently burned off and with them the limbs were burned to the bones. Frequently such bodies burned to a crisp weeks after death—apparently after oxygen had become available. In the same rooms with such bodies were found other more or less preserved or shrunken corpses and also some which had fallen to ashes and could hardly be recognized. Many basements contained only bits of ashes and in these cases the number of casualties could only be estimated.

Burns were seen in the living, as was to be expected. Surprising to the Germans was the great increase in tetanus secondary to burns. Figures were not published or available at the time of the Medical Branch survey but the problem was of sufficient



FIGURE 18. Scene confronting rescue workers shown entering air raid shelter some time after a raid. Victims succumbed to carbon monoxide.

magnitude to warrant a directive from Professor Rostock to administer tetanus antitoxin to every case of burns. The fact that many burned victims were buried under caved-in houses and could not be evacuated to medical installations where they might have received tetanus antitoxin allowed for the optimum conditions for the development of

tetanus. Tetanus immunizations were not given to the population at large.

The treatment of burns varied throughout Germany. New drugs containing tannic acid derivatives,¹⁰ massive sterile pressure dressings, and extensive debridement were all widely employed but without a definite over-all plan for the evaluation of the best method of treatment. No mention was made of injury from heat other than burns proper and without causing death. In personal interviews, opinions were expressed that all people in whom the previously described heat effect was found were dead, and that, therefore, the conclusion could be drawn that these changes had taken place during or after death. Blood substitutes were not used nearly as extensively as they are in the United States, and, in fact, the subject of the value of blood substitutes in the treatment of burns was to be worked out under sponsorship of the German National Research Council.

Conjunctivitis as a result of smoke and radiated heat often occurred. No permanent after effects were observed and the standard treatment throughout Germany was a nursing treatment—flushing the conjunctival sac with boric acid solution. In severe cases Biseptol Compositum (trade name of an ointment) was administered by physicians.

A pamphlet was distributed to *Luftgau* physicians concerning expected injuries and their management.¹¹

Carbon monoxide poisoning

Carbon monoxide as a major cause of death after aerial bombing was a possibility which few had expected before the war. It is now recognized as a typical "shelter or cellar death." Like heat death it occurred in rooms the exits of which were blocked by rubble or fire. In such cases, the origin of the carbon monoxide was almost always incomplete combustion. Also, in many instances, as much as 70 per cent of the gases liberated from an exploded bomb was carbon monoxide.

Carbon monoxide death assumed such an importance that the high command of the Luftwaffe issued an order to examining commissions to procure statistical evidence of carbon monoxide poisoning. In death resulting from burial in rubble, carbon monoxide poisoning was often the real cause of death. This is not surprising when it is kept in mind that many fires start when a house caves in, in bombing by incendiaries as well as by high explosives.

Death attributable to carbon monoxide was also known to occur in the open. The additional strain of an attempt to escape from fire and heat was often the difference between life and death. That carbon monoxide will damage an already diseased heart muscle more than a normal one, is well known. That carbon monoxide is taken up in increased quantities when respiration is rapid is obvious. In a fire which developed after a raid on Wesermünde, of 210 corpses, 175 presented the picture of acute carbon monoxide poisoning. In Hamburg, 70 per cent of all casualties apart from those resulting from mechanical causes or burns were caused by carbon monoxide. According to Schoen,¹ a concentration of 0.5 per cent carbon monoxide in the air can cause death after one hour. Even a concentration of 0.1 per cent may still produce symptoms. Schoen also states that the old theory that one cannot die in a room where a flame can still burn is incorrect. The reason is that, as has been mentioned, the concentration of 4 per cent coal or lighting gas (corresponding to 0.5 per cent carbon monoxide) will lead to death after one hour, whereas explosion does not occur until a concentration of between 8 and 16 per cent is attained. Fumes from ordinary fires are said to contain 3 per cent of carbon monoxide gas, coal gas to contain 6 per cent carbon monoxide, gas from a high-explosive bomb 60 per cent to 70 per cent carbon monoxide.¹

Qualitative and quantitative examinations for carbon monoxide were carried out in Hamburg and several other cities throughout Germany. A reliable laboratory test (Ponsold¹) was reported to be: One drop of blood from a corpse is added to 50 cc of water. If this retains its red color, carbon monoxide hemoglobin is present. If not, the test should be regarded as negative for carbon monoxide. High temperatures will destroy carbon monoxide hemoglobin.* Putrefaction will not destroy carbon monoxide hemoglobin.† The conclusion as to the importance of carbon monoxide poisoning as a cause of death in incendiary raids on large German cities is plainly dependent on the validity of this statement concerning the presence of carbon monoxide in the blood at a considerable time after death.

The conclusion arrived at by the German authorities was that there was a need for a good and

* Graeff: Cited in reference 2.

† K. Wenig: Reichsgesundheitsblatt, 19: 169; 1944, cited in reference 2.

sensitive test for the detection of carbon monoxide in living and dead persons, because in the hands of most investigators the tests were unreliable in people who had been dead more than a few hours. The examination of splenic blood was suggested when it was impossible to test peripheral blood.

Concentrations up to 95 per cent were found in many "shelter dead." The fact that many shelters and basements could not be entered for many days after a raid made qualitative and quantitative examinations for carbon monoxide unreliable or even impossible. The typical characteristic of carbon monoxide deaths in aerial war is the so-called peaceful position of the bodies (Figure 18), which is suggestive of a complete lack of apprehension of danger.

Rose^{1, 5} stated that in aerial warfare different concentrations of carbon monoxide could not be found in one and the same room, as have been found, for instance, in the garage of the typical peacetime suicide.

Two conclusions about death from this cause were arrived at and disseminated to everyone concerned in the treatment of aerial casualties: to keep in mind at all times the possibility of carbon monoxide poisoning even if the patient had been found in the open air; to give the unconscious victim preference over a victim of physical injury.

It has been known for a long time that small birds are particularly sensitive to carbon monoxide, and it was therefore recommended that they be taken into air raid shelters. This measure, however, did not prove very practical as the birds would not be quiet and peaceful during the raid and could not be watched for the excitement and subsequent drowsiness indicative of carbon monoxide poisoning. The only thing to do, then, it was stated, would be to leave a burning building even if there was danger from other sources in the street. It should be kept in mind that the average gas mask or chemical warfare filters as used in ventilators do not keep out carbon monoxide.

It was stressed at the conference in Jueterbog that the public should not be informed as to the danger of carbon monoxide originating in large-scale fires. In view of the inadequacy of preventive measures only unrest and even panic would be caused.¹

Because carbon monoxide poisoning is often not recognized, severe sequelae are frequently encountered. Residual lesions in the central nervous system resulting from carbon monoxide poisoning

were expected in large numbers because even after exposure to carbon monoxide for only a few hours extrapyramidal lesions are known to occur. However, only occasional cases of permanent damage were seen up to the time of the Medical Branch survey. Just how many survivors from shelters and basements had sequelae resulting from carbon monoxide poisoning was not ascertained. Nor was it possible to obtain reports from pathologists as to the frequency of myocardial necroses, fatty degeneration of the liver and the kidneys, thromboses, and softening of the basal ganglia, all typical changes known to occur after carbon monoxide poisoning.

In the absence of specific therapy for carbon monoxide poisoning uniform directives as to the management of this condition were not issued. But H. Desaga¹ stressed the importance of prompt "heroic" treatment with large intravenous doses of analeptics, such as cardiazol, until the patient responded to external stimuli. He warned against overlooking carbon monoxide poisoning in the presence of concomitant injuries.

Air blast

Air blast is caused by bombs containing a greater amount of explosive material than bombs which, when exploding, exert their effect on the human body by their fragments. Bombs containing a greater quantity of explosive material produced their damage through a blast wave of compressed air which was pushed ahead of the detonated gas in the form of a ball. In general, the Germans found that after an explosion of a bomb any human being nearby would be injured by fragments of the bomb and debris or be thrown by the air pressure, in which case he might suffer only external injuries. Under certain circumstances, however, neither fully explained in Britain or Germany, air blast injuries can occur without external injuries. This type of damage, even with the heaviest bombs, occurred only within a radius of 30 meters. A good deal of experimental work had been done on the subject in Germany (see Desaga).^{1, 12}

The air blast wave attacks the body surface, but does not produce damage throughout the upper respiratory system as was suspected in England early in the war. It is a purely mechanical effect, and was compared with that of a faulty dive into the water when the chest and abdomen hit the water's surface. Suction does not play a role in the production of air blast injuries, according to the German authorities.

THE NATURE OF AIR RAID CASUALTIES

In the air blast the most typical injury was found to be a single or bilateral perforation of the ear drum (when it had not been plugged as a preventive measure). The most important injuries were those of the lungs. Massive hemorrhages into the alveoli and around the bronchi occurred. Histologically, the damaged lung tissue was described as resembling red hepatization in lobar pneumonia. The lungs did not contain any air, and bloody foam was present in the bronchi and the trachea. Most of the damage was near the hilum, but it was also found near the heart and in the region of the lower lobes. The upper lobes were usually unchanged. In severe cases, the pleura was found to be torn in the direction of the ribs. Lung tears have been seen with such consequences as pneumothorax, hemothorax, and mediastinal emphysema as the result of a blast. The abdominal organs were very rarely damaged by air blast, and in order to avoid unnecessary laparotomies warnings were given of the possibility.

In air blast casualties there was almost always unconsciousness of some duration, so that patients could not account for the circumstances leading to their injuries. The German authorities contend that air blast injuries may as a rule be excluded if the explosion occurred more than 30 meters away. Only under special circumstances air blast injuries were reported over a greater distance. Scriba described air blast injuries in the occupants of a shelter at the entrance of which a bomb exploded. The pressure wave shot through the tunnel of the shelter, as it could not find another outlet. In March and April of 1945, Baniecki performed 39 autopsies on air blast victims who were found in *Stollen* (tunnels) about 40 to 50 meters long, dug into the ground. In each case the victim had been in such a tunnel when a bomb exploded near the entrance. The blast wave was transmitted into the tunnel and caused death to many occupants.

Air embolism also occurred in air blast victims. The 39 autopsies just mentioned were done under field conditions with only a little water available, yet care was taken to open the thoracic cavity under water (urine was sometimes used) and in 18 cases the cause of death was found to be air embolism. In 15 cases the left ventricle was found to contain liquid blood and foam, and in 2 cases there was air in the right ventricle only. Numerous subdiaphragmatic and subpleural tears and hemorrhages were found. The air may be presumed to have entered from these tears. Conjunctival hemorrhages

were found in half the cases. There were perforations of the ear drums in about half the cases. Retinal hemorrhages were occasionally seen in people who presented other evidence of air blast injury.

After regaining consciousness the injured persons usually complained of severe shortness of breath and of pain in the chest and abdomen accompanied by precordial pain. The victims frequently stated that they could not move at all in the first thirty minutes or so. There was pain in their ears from ruptured drums. Deafness was observed in several instances. In slight cases middle ear deafness occurred. In severe cases the air wave transmitted pressure through the labyrinthine liquor on Corti's organ. This type of deafness may cover the entire range of hearing and was often seen without perforations of the drum.

Zangemeister¹³ stressed the difference between damage to the ears subsequent to air blast and damage resulting from sound waves. Physically, the difference is only quantitative as the amplitude and frequency of air waves are different from those of sound waves; this is proved by the absence of perforated drums in ear damage from sound. Furthermore, in sound damage, the cochlear nerve is damaged almost exclusively in a range corresponding to the frequency of the exciting sound wave. Air blast damage to the inner ear is a mechanical damage and will not become better or worse, whereas damage from sound waves is called acoustic trauma and will improve after from two to ten weeks. Skull injuries, frequent in air blasts, can increase the damage to the ear. People who have been suffering from middle ear infections will be more vulnerable to air blast than others. Such cases, however, are yet to be studied.

Those air blast victims who did not die recovered in a surprisingly short time. The pain in the chest and abdomen ceased and they were wide awake and in high spirits as early as twenty-four hours after the raid. Cardiac stimulants were no longer needed after twenty-four hours. Hemoptysis ended on the fourth or fifth day, and after six to eight days the patient was well clinically and roentgenologically. The majority of air blast injured could be discharged from hospitals after three to four weeks. No sequelae were seen in any, even in those very severely injured by air blast.

There was no treatment for this syndrome except for bed rest and cardiovascular stimulants when indicated. It was advised even when minor or major

surgical work had to be done that the air blast injured should for two reasons be admitted to medical wards. The medical wards were less crowded after air raids than the surgical wards and the air blast injuries did present more of a medical problem than anything else.¹²

In summary, it can be stated that air blast deaths and injuries were relatively infrequent because they affected, as a general rule, only those people who were in the open. Bombs which exploded near the entrance of an open tunnel or hallway caused damage through the pressure wave which was transmitted. Injuries to the ears, consisting of perforated drums and damage to Corti's organ resulting in inner ear deafness, tearing of lung tissues with resulting air embolism, and conjunctival and retinal hemorrhages were the typical conditions occurring from air blast.

Dust inhalation

The inhalation of dust was seldom found to be a cause of death in the air raids. According to the *Medical Experiences in Air Raids*¹⁴ of April 5, 1944, more than one thousand times the concentration of particles in the air is required than is encountered in the dustiest street or industrial plant to cause a closing off of the upper respiratory tract. In the case observed, the upper respiratory passages down to the larynx were blocked with dust. Only small amounts of dust were able to enter the alveoli of the lung. Therefore, the disturbance of the gas exchange in the alveoli does not appear to play an important role in air raid deaths. In unconscious people who were lying face down in an accumulation of dust, a complete blockage of the respiratory passages did occur. After a very few breaths, they "drowned in dust." Professor L. Singer, a pathologist of Munich, reported that after a raid was over and people left the shelters, the dust settled down on the city, and several cases of dust death were seen. He observed three cases where the larynx was filled with a pseudo-membranous mass of dust and mucous membrane.

In cases without external injuries, dust was often found in the respiratory tract, but in most cases the real cause of death was something else, such as carbon monoxide poisoning.

Drowning

Death from drowning can be expected in air raids near large bodies of water and dam facilities. For instance, according to public utilities authori-

ties, 1,194 people were drowned in the Ruhr Valley after the Moehne Dam had been bombed and blown up by the RAF on May 16-17, 1943. No other large-scale instances of drowning subsequent to air raids have been reported. Broken water mains permitted water to seep into shelters, basements, and bomb craters and caused death to the occupants of shelters and basements and people who had sought refuge in bomb craters (see report on the Hamburg raids^{8,9}).

Pre-existing organic disease

This kind of death is very frequent and consists of cardiac death and cerebral accident. Accurate figures could, of course, not be obtained as it is not known how many people in the population have more or less developed arteriosclerosis. The majority of cases in the reports of the examining commissions were attributed to fright and over-exertion when everyone was engaged in rescue work following the air raids. Dr. Wilhelm Stepp, Professor of Medicine at the University of Munich, described this as the "shelter death of the aged." On many occasions they were surprised to find that when the "all clear" signal had sounded, older people did not get up to leave and had died quietly during the raid. However, sudden death was seen in younger people of thirty and older in whom coronary disease did not exist. Professor Siegmund, a pathologist of Muenster,¹⁵ described cases with undetermined cause of death in young people who were leaving their shelters and collapsed and died after the raids when fright could no longer play a role. In some of these people, it had to be assumed that carbon monoxide poisoning and the great excitement of a raid produced a cardiac arrest, a syndrome which has not been explained satisfactorily.

Poisoning by industrial gases

Nitrose gas which is liberated in the explosion of dynamite and nitrocellulose, caused an occasional death. The pure poisoning with nitrose gas lead to pseudo-membranous changes in the respiratory tract with edema of the lungs. Furthermore, methemoglobin was formed. Experimentally, the combination of carbon monoxide and nitrose gas is known to be a very lethal mixture. Only one-half the lethal dose of each gas is necessary to kill animals experimentally (Wirth²). In these cases carbon monoxide hemoglobin and methemoglobin can be shown to be present in the blood, but methemoglobin changes into nitrous oxide hemoglobin after

two hours, and resembles spectroscopically carbon monoxide hemoglobin. It can, therefore, be confused with the latter.

Aldehydes were liberated after bombing of industrial plants and were observed to cause irritation to the mucous membranes.

Akrolein, a gas which originates after heating or burning of glycerine and fats, was observed to produce vertigo and drowsiness in isolated instances where factories processing meats, fats, oils, soaps, and varnish were hit.

All of these gases produced irritation of the upper respiratory tract. A manuscript by Schoen² of Goettingen described 44 clinically observed cases of poisoning by smoke and irritant gases. Of these 44, 12 were unconscious; 6 were admitted with edema of the lungs and 3 died; 6 cases developed broncho-pneumonia, 2 with subsequent lung abscesses, and 1 of these died; in 5 cases an abnormal electrocardiogram as indicated by a particularly prolonged P-R interval, suggested myocardial damage.

Phosphorus

Examining commissioners complained bitterly that not only laymen, but also doctors called every burn a phosphorus burn.⁵ It is stressed that a burn can be attributed to phosphorus only if it lights up in the dark or smells of phosphorus. Wounds resulting from phosphorus are very rare, and lighting up in the dark can be caused by insignificant quantities of phosphorus which do not need to be dangerous. Rose⁵ stated that the psychologic effect of phosphorus bombs was far greater than any actual damage which they caused. Only the 30-pound incendiary bomb contained phosphorus. Although phosphorus burns were not infrequent and occurred in people who had come in contact with unexploded phosphorus canisters lying about in the streets and under the rubble and in fields, death through phosphorus alone was not observed. As incendiary agent the direct contact with an exploding incendiary bomb is a freak, and was never seen in Germany. No cases have been reported in which organic damage resulting from the absorption of phosphorus through the skin could be proved. No skin damage from phosphorus occurred where there was no burn at the same time. No cases of ingestion of phosphorus with systematic after effects were observed. No eye injuries resulting from phosphorus were seen, although directives were issued for the treatment of eye injuries caused by phosphorus burns.

Summary and conclusions

1. Medical commissions working under the direction of the German Air Ministry studied all causes of death and injuries peculiar to aerial warfare. They submitted their reports to the Air Ministry in Berlin where periodic pamphlets were issued through which the medical profession was kept informed on developments.

2. Reports on casualties resulting from aerial bombings were kept by the municipal police department. All reports were held secret, and no figures were given. The figures mentioned in this chapter were given by members of the various commissions when interviewed.

3. It can be stated that there was a definite relationship between the type of bomb dropped, and the type of death or injury to be expected. An incendiary raid was expected to cause more dead than wounded, through the effects of heat and carbon monoxide; in bombings with high explosives, mechanical injuries outnumbered deaths.

4. It should be kept in mind that season, geographical location, and type of city bombed are very important factors in the evaluation of air raid casualties. German scientists found it impossible to get an accurate list of the causes of death in the order of their importance. The order in which the causes of death are listed in this chapter is only an approximation.

5. Direct hits, action of bomb fragments, and burial under rubble were listed as mechanical effects of air raids. The effects of heat in incendiary raids as well as high-explosives raids were the burns and very high temperatures to which the population were exposed. In all the cities visited carbon monoxide poisoning was regarded as the primary cause of death or injury, sometimes reaching to as much as 80 per cent of all incendiary raid casualties. Air blast was found to be a relatively infrequent cause of death and affected only people within a radius of 30 meters from the explosion of a bomb. Perforation of the ear drums, inner ear deafness resulting from the effect of the pressure wave on Corti's organ, tearing of lung tissue with resulting air embolism, and hemorrhages in the eyes were described as typical of air blast. Dust inhalation was seen in occasional instances; drowning occurred in approximately 1,200 people after a dam in the Ruhr Valley had been blown up. Industrial gases accounted for an occasional death.

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REFERENCES

1. Tagungsbericht 9/44. Ueber eine wissenschaftliche Besprechung am 13. und 14. Dezember 1943 bei der Sanitaets Versuchs- und Lehrabteilung der Luftwaffe in Jueterbog ueber aertzliche Luftschutzfragen.
Publications on Aviation Medicine. Secret Document. Published by the Inspector of Sanitary and Medical Matters, German Air Force.
2. Beobachtungen and Befunde der aertzlichen Untersuchungsgruppen zur Erfassung neuartiger Personenschaeden nach Luftangriffen.
Published by Supreme Command, German Air Force.
No. 1. Saalow. October 30, 1944.
3. Beobachtungen und Befunde der aertzlichen Untersuchungsgruppen zur Erfassung neuartiger Personenschaeden nach Luftangriffen.
Published by Supreme Command, German Air Forces.
No. 2. Saalow. January 24, 1944.
4. Aertzliche Erfahrungen im Luftschutz.
No. 1. Todesursachen bei Luftangriffen unter besonderer Beruecksichtigung von Flaechenbraenden.
Published by the Reichs Minister for Air and the Chief, Sanitary and Medical Matters, German Air Force, in collaboration with the Reichs Minister of the Interior and the Reichs Leader of National Health.
Berlin, March 27, 1944.
5. Aertzliche Erfahrungen im Luftschutz.
No. 5. Todesursachen und gesundheitliche Gefahren im Luftkriege.
Colonel Prof. Rose; Consultant Hygienist to the Chief, Sanitary and Medical Matters, German Air Force, Berlin, October 22, 1944.
6. Ueberhitzung des menschlichen Koerpers.
Report to the Commissar of National Health from the Institute of Aviation Medicine. Berlin, June 15, 1944.
7. Pathologisch—Anatomische Erfahrungen bei Flaechenbraenden.
Abbrev. Extract from a report to the meeting of consultants to the Armed Services at Hohenlychen. 1944. Unpublished Manuscript.
8. Tod durch Luftangriff.
Prof. Dr. Siegfried Graeff, Hamburg. Unpublished Manuscript. Hamburg, 1945.
9. Die Nacht des Luftangriffes auf Hamburg vom 27/28 Juli 1943.
Prof. Dr. Siegfried Graeff, Hamburg. Unpublished Manuscript. Hamburg, 1945.
10. Gerbstoff S 63 der Deutschen Hydrierwerke A. G. Chemnitz.
A new drug for the treatment of burns.
11. Augenaertzliche Hinweise fuer die Versorgung von Verletzten bei Luftangriffen.
Reprinted from Klin. Monatsblaetter fuer Augenheilkunde, 1943.
12. Klinik und Therapie der Luftstossverletzungen unter Beruecksichtigung chirurgischer Massnahmen.
Dr. H. Desaga. Unpublished Manuscript. To be published in Klinische Wochenschrift, 1944, p. 297.
13. Unsere Erfahrungen und Anschauungen ueber Luftstossverletzungen des Ohres und verwandte Fragen.
Dr. H. E. Zangemeister, Hamburg. Unpublished Manuscript. 1945.
14. Aertzliche Erfahrungen im Luftschutz.
No. 2. Die Staubwirkung. Berlin, 5 April 1944.
15. Pathologisch—Anatomische Untersuchungen an Todesfaellen nach Luftgriffen.
Prof. Dr. Siegmund, Muenster. Unpublished Manuscript, 22 November 1944.

CHAPTER FOUR

COMMUNICABLE DISEASES AND OTHER DISORDERS

Air war against large crowded cities created conditions for which we had no precedent. In preparing to assess the influence of aerial bombing on the morbidity and mortality of many different diseases and disorders, the investigators who have written this chapter had to start from scratch in the truest sense of that expression. Training, experience, and knowledge would lead one to expect a tremendous increase in communicable diseases to epidemiologic proportions when visualizing the destruction of German cities, but there were no major epidemics. That the nervous strain of trying to keep somewhat of a normal life going amid such desolation would exhibit itself in an increase in

the psychosomatic disorders was expected and was indeed found.

Before the war the statement was frequently made that large-scale bombings would drive people mad. In England, R. D. Gillespie, the well-known psychiatrist of Guy's Hospital, said that he and his colleagues held long discussions in the period after Chamberlain's trip to Munich, to decide how to meet the tremendous incidence of psychiatric disorders anticipated once the Germans started bombing London. Looking back on it in 1945 he added, "We might as well have saved our breath." What happened in Germany under conditions even more trying for the individual is described in the final section of this chapter.

COMMUNICABLE DISEASES

CAPTAIN FRANZ K. BAUER, MEDICAL CORPS, AUS

LIEUTENANT COLONEL JOHN H. WATKINS, SANITARY CORPS, AUS

Disease is the third of the Four Horsemen of the Apocalypse. In every war it has played a major role in the outcome of the conflict. Many factors arise in a wartime population to increase the incidence and mortality of disease. The aerial bombing of civilian populations is new, except for the zeppelin raids in World War I, and it is the purpose of this chapter to attempt to indicate the effect of this factor upon disease and disease mortality. The assignment is not an easy one, for no epidemics arose in Germany during World War II of a degree in any sense comparable to such previous wartime epidemics as that of influenza in 1918. Many of those which were recorded would have originated in the absence of a wartime regime. Usually the question to be answered was "Did bombing accentuate the incidence of the disease?" rather than "Did the epidemic occur because of

the bombing?" Relationships are frequently involved; for example, the nutritional state of a population following bombing may be the precipitating cause of an outbreak of disease rather than the bombing itself. The results presented here are largely statistical in nature, reinforced wherever possible by the opinions of many reliable German medical authorities interviewed during the course of the survey.

Typhus fever

Typhus fever did not appear in German cities until foreign laborers had been imported and labor camps established. It is generally believed that the increased incidence of typhus in Germany during the war is attributable to the influx of foreign workers from those eastern countries where this disease is endemic. Foreign laborers were examined

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TABLE 1. ANNUAL CASE INCIDENCE OF TYPHUS FEVER
IN SEVEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	0.00	0.00	0.00	1.22	1.11
Duisburg	0.00	0.00	0.00	0.00	0.00
Frankfort	0.00	0.00	0.00	0.38	5.72
Hamburg	0.00	0.00	0.06	0.81	0.98
Kiel	0.00	0.00	0.00	0.35	0.00
Magdeburg	0.00	0.00	1.16	0.89	39.28
Nuremberg	0.00	0.00	1.08	0.58	7.76
Combined Cities	0.00	0.00	0.23	0.65	5.51

on two different occasions at the time they were imported, but the labor camps in which they were forced to live provided those conditions of overcrowding and insanitation under which typhus is spread. This is no doubt responsible for the appearance of epidemics among these individuals; and it is believed that the breaking down of the line of demarcation between forced laborers and German citizens caused by the air raids is responsible for the spread of typhus to the civilian population.

No cases of typhus fever were reported in 1938 and 1940 among residents of the seven German cities listed in Table 1. In 1942 the case rate per 100,000 population in the combined group of cities was 0.23, in 1943, 0.65, and in 1944, 5.51. The high incidence in 1944 was accounted for by increased numbers of typhus cases in Frankfort on Main, Magdeburg, and Nuremberg. Until the heavy air attacks on Germany were started the incidence of the disease appeared to be sporadic and low. This is clearly indicated by Table 2 which lists the cases of typhus fever in Magdeburg during the years 1943 and 1944.

In 1943, during which no air raids were made on the city, only 2 cases of typhus fever appeared among residents in spite of the fact that 98 cases occurred among displaced persons. In 1944, on the other hand, after the bombing in January, 8 cases of typhus fever appeared among the residents in April, the incidence rising to an epidemic number of 74 in May, and declining again to 4 cases in June as the war summer months approached.

The charts of monthly air attacks and the monthly case incidence of typhus (Figure 19) show a relatively small amount of typhus occurring in the resident population of this group of cities, other than in Cologne and Magdeburg. Aside from Magdeburg the charts do not bring out the effect of bombing on typhus incidence, partly because of the small numbers involved, and partly because of

TABLE 2. REPORTED CASES OF TYPHUS FEVER
IN MAGDEBURG IN 1943 AND 1944

<i>Date</i>		<i>Number of cases reported among</i>	
		<i>Residents</i>	<i>Displaced persons</i>
1942	December	0	1
1943	January	0	5
	February	2	46
	March	0	43
	April	0	1
	October	0	0
1944	January	0	6
	February	0	37
	March	0	5
	April	8	19
	May	74	46
	June	4	12
	December	0	1

FIGURE 19

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
TYPHUS FEVER
 IN NINE GERMAN CITIES

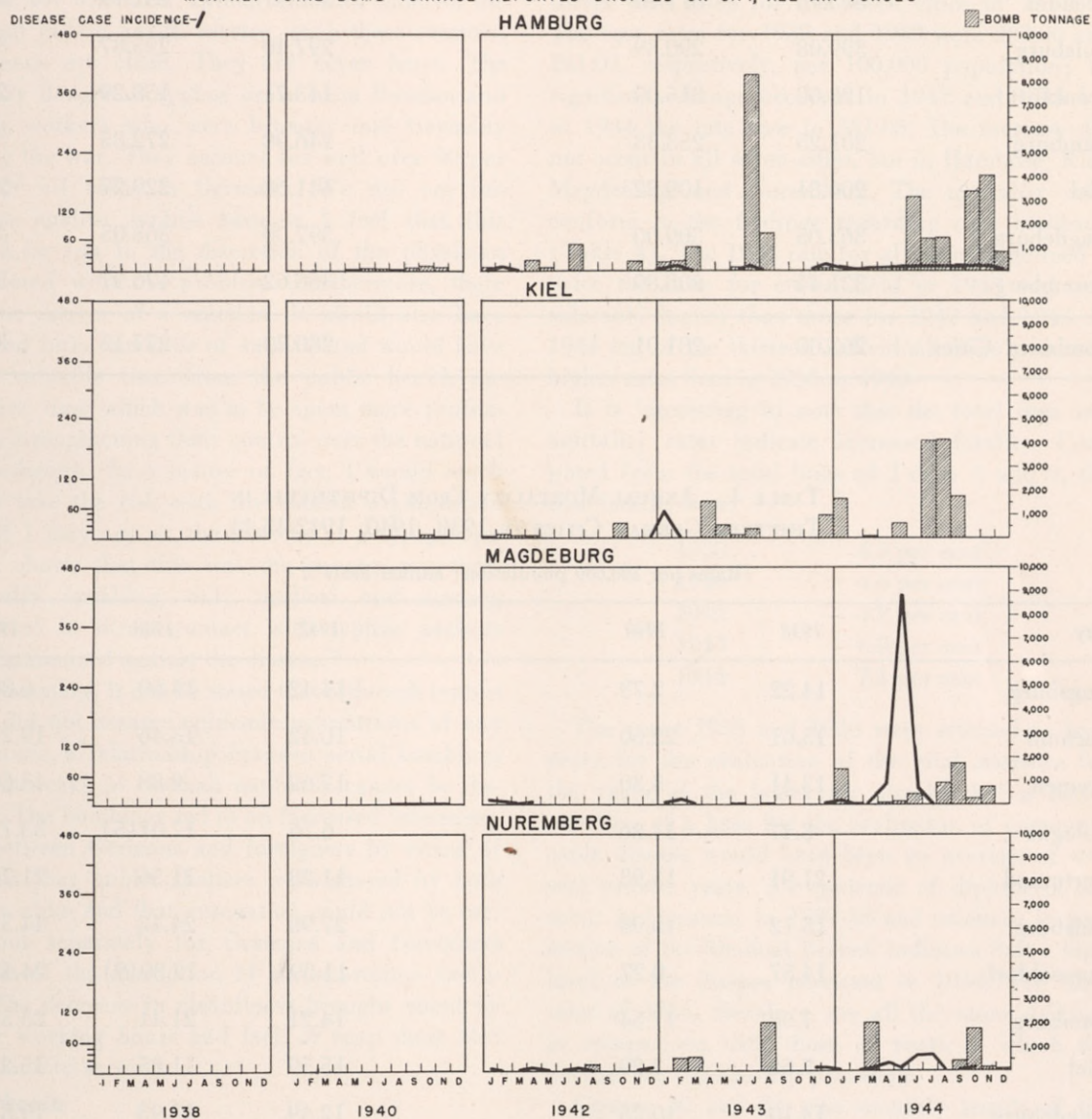
MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



FIGURE 19 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
 TYPHUS FEVER
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



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TABLE 3. ANNUAL CASE INCIDENCE OF DIPHTHERIA
IN SEVEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis.)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	503.18	571.90	303.91	281.79	363.70
Duisburg	399.08	290.39	297.40	225.87	379.19
Frankfort	128.00	315.09	143.71	158.29	202.86
Hamburg	201.25	253.33	246.98	272.85	341.94
Kiel	206.81	109.32	441.68	229.27	237.42
Magdeburg	363.05	309.00	397.00	363.05	425.46
Nuremberg	321.44	208.89	366.62	476.97	562.95
Combined Cities	263.00	281.01	280.70	277.15	351.05

TABLE 4. ANNUAL MORTALITY FROM DIPHTHERIA IN
THIRTEEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis*.)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	14.22	2.73	14.42	14.60	6.88(10)
Bochum	15.61	22.60	10.42	13.46	19.27(10)
Bremen	13.41	5.30	17.62	9.88	43.66(10)
Cologne	8.47	11.86	6.76	17.07(5)	33.72(8)
Dortmund	21.91	15.93	11.28	11.56	21.76(9)
Duisburg	15.12	15.98	27.98	24.42	44.53(10)
Duesseldorf	14.57	8.27	11.39	12.80(9)	24.47(7)
Hamburg	7.68	17.54	14.21	21.41	23.55(10)
Kiel	7.62	7.29	15.59	11.85	15.24(10)
Magdeburg	13.10	10.25	12.49	13.93	19.83(10)
Mulheim	5.17	17.32	11.19	17.48	14.94(10)
Nuremberg	13.21	6.29	12.92	18.66	11.70(10)
Solingen	8.46	1.50	4.86	8.61	18.26(10)
Combined Cities	11.74	12.80	13.36	16.70	25.02(10)

* All rates are computed on an annual basis. But in this and in following tables, wherever the data used are for less than the complete year, the number of months actually included is indicated in parentheses.

COMMUNICABLE DISEASES

the added factor of the size and location of foreign labor camps. It is interesting to note that the typhus fever reported in Frankfort, Magdeburg and Nuremberg occurred in the late spring and summer months following periods of air attacks.

German nationals were not immunized against typhus, for which Dr. Leonardo Conti, Chief of the German public health service, gave these reasons: "Germans are clean. They are never lousy. The primary danger of typhus arose from Russian and Polish workers who were brought into Germany during the war. They account for well over 90 per cent of all cases in Germany. We did not immunize against typhus because I feel that this should be left to the discretion of the physician confronted with the problem. Furthermore, there was the danger of a reaction. It would also have required large amounts of vaccine and would have taken valuable time from the public health authorities, time which was to be spent more profitably in strengthening their control over the national public health. As a matter of fact, I would much rather take the risk with my control organization and, if I may say so, the absence of a typhus epidemic shows that this was the proper approach. Generally speaking, only medical and nursing personnel in direct contact with typhus patients were immunized against the disease."

In summary, it can be stated that although typhus fever did not assume epidemic proportions of any magnitude, a relationship between aerial bombings and outbreaks in German nationals cannot be disputed. The bombings led to an increased intermingling between Germans and foreigners by virtue of the fact that public shelters were shared by both groups alike and that evacuation could not be carried out separately for Germans and foreigners because of the disruption of transportation facilities. The decrease in cleanliness brought about by longer working hours and lack of soap must also be taken into account.

Diphtheria

Diphtheria showed a marked increase in 1940 and 1941 (before the bombing of Germany began). This increase corresponded to the periodic increase in diphtheria which is known to occur in Europe every three to five years. By 1941 compulsory immunization for children and voluntary immunization for adults against the disease had been instituted by national decree, with the result that there was less diphtheria and of a more benign form. Further, no deaths were reported among patients

who had received immunization within three years of the onset of the disease. The diphtheria rate went down all over Europe in 1942 and 1943.

After the aerial bombings on Germany began the incidence of diphtheria went up rapidly, particularly in 1944 as shown by the combined diphtheria case rates for the seven cities of Table 3. The case rates for 1938 and 1940 were 263.00 and 281.01, respectively, per 100,000 population; no significant change occurred in 1942 and 1943 but in 1944 the rate rose to 351.05. The increase did not occur in all seven cities, but in Hamburg, Kiel, Magdeburg, and Nuremberg. The mortality rates conform to the findings regarding case incidence (Table 4). The 1944 rate for all cities combined is twice the rates for either 1938 or 1940 and considerably higher than those for 1942 and 1943. In 1944 ten of the thirteen individual cities possessed higher rates than in 1938 or 1940.

It is interesting to note that the total case and mortality rates indicate increased fatality. Computed from the total lines of Tables 3 and 4, the case fatality was:

1938	4.5 per cent
1940	4.6 per cent
1942	4.8 per cent
1943	6.0 per cent
1944	7.1 per cent

The years 1938 and 1940 were selected as base years for the evaluation of the vital statistics for the years of the heavy air attacks, but a better selection of a base for the evaluation of communicable disease would have been an average of several prewar years. An epidemic of diphtheria did occur in Germany in 1937-38 and evidence in possession of the Medical Branch indicates that a high level of the disease persisted in 1940. The high rates of 1944, therefore, are all the more striking, in comparison with those of years in which the disease was excessively prevalent.

Figures 20 and 21 give monthly trends of the case and mortality rates for cities in Germany, contrasted with the monthly bomb tonnage of the air attacks upon each city. Some evidence does exist in these figures that incidence of the disease rose after periods of heavy bombing. In Bochum, Cologne, Dortmund, Duisburg, Hamburg, Kiel, and Nuremberg the rate in 1943 increased following the heavy air attacks of the summer months. A considerable part of the increases, however, is fallacious. Diphtheria case rates normally rise in the

FIGURE 20

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
DIPHTHERIA
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

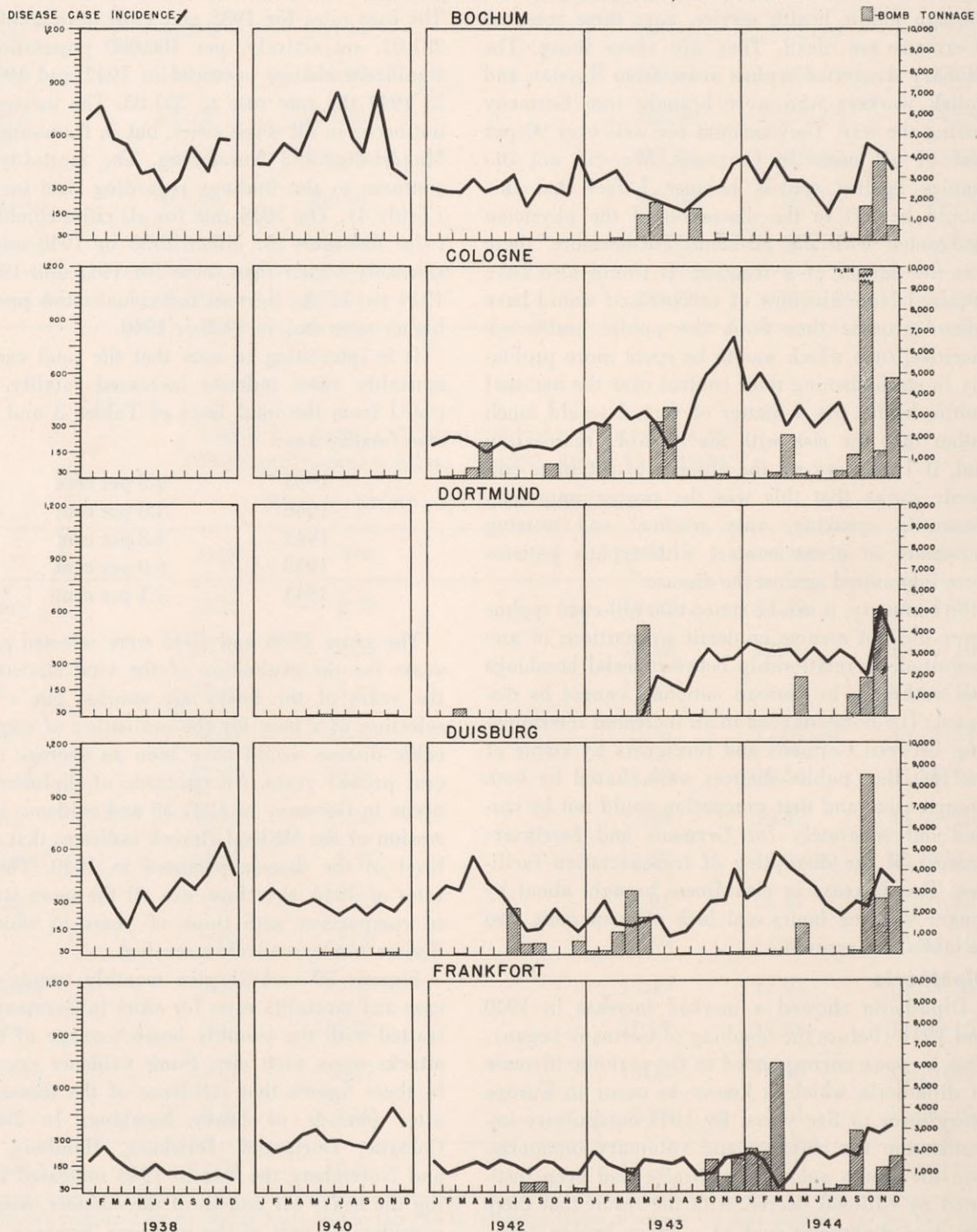


FIGURE 20 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
DIPHTHERIA
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

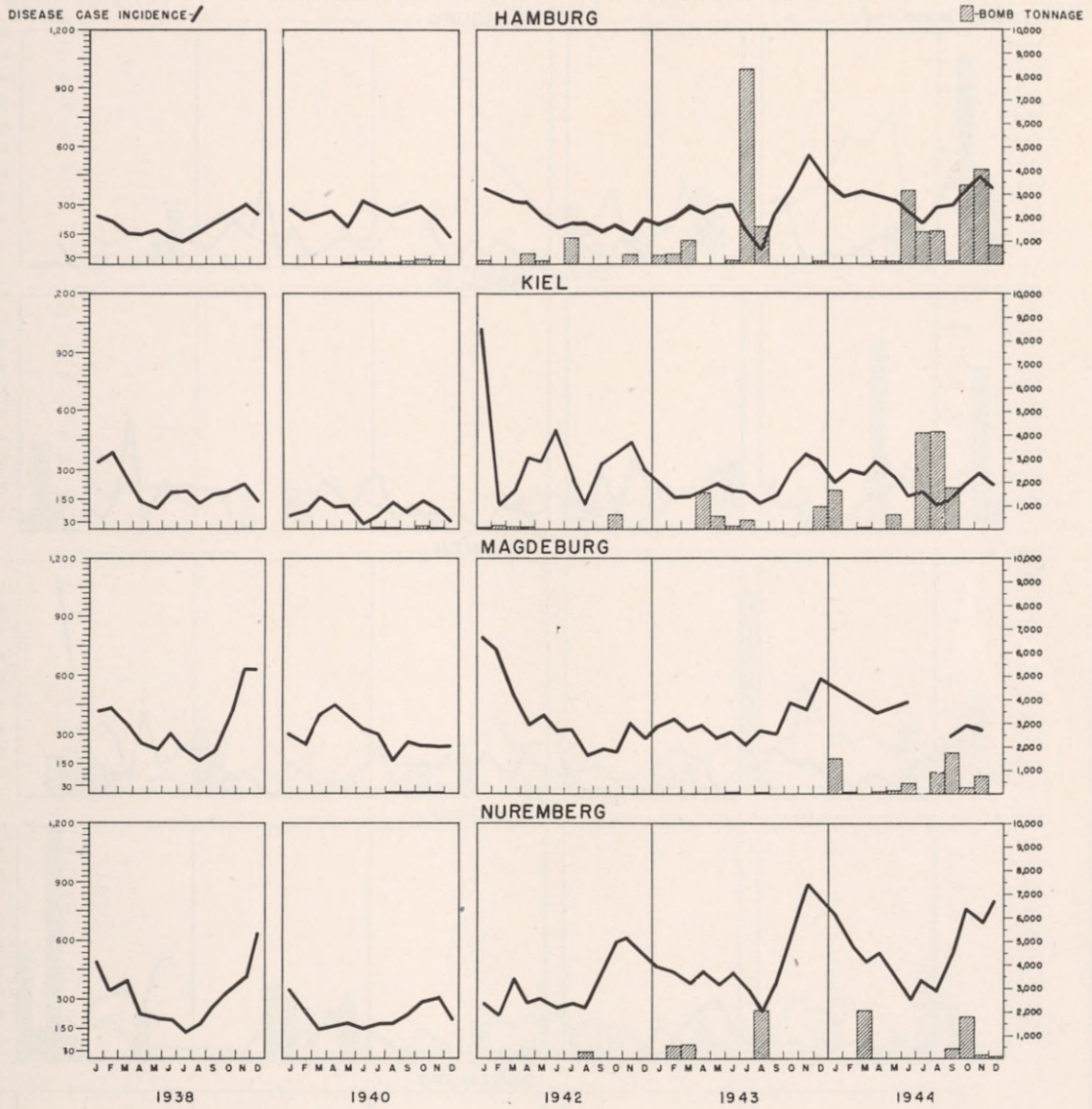


FIGURE 21

THE BOMBING EXPERIENCE AND MORTALITY FROM
DIPHTHERIA
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

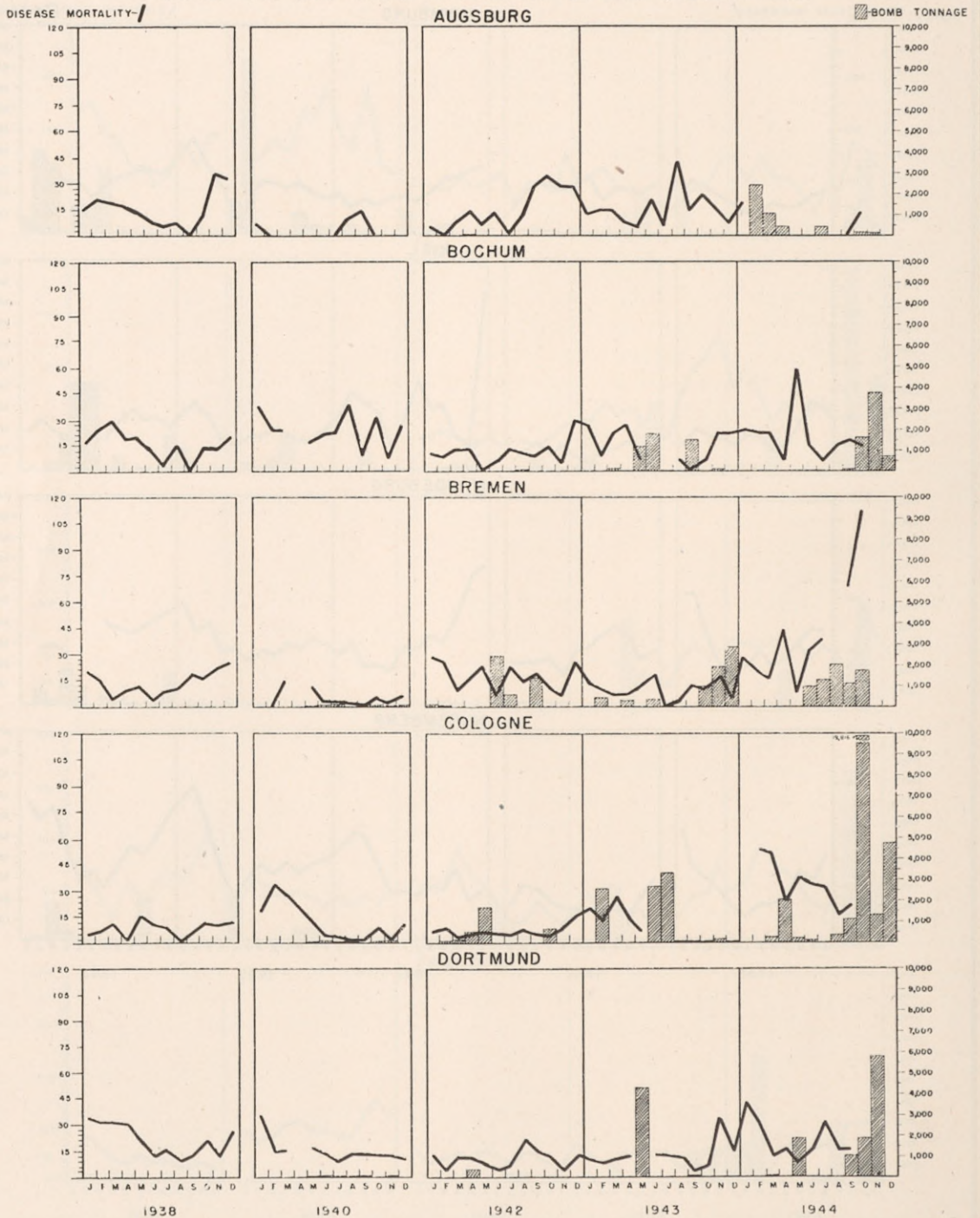


FIGURE 21 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
DIPHTHERIA
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

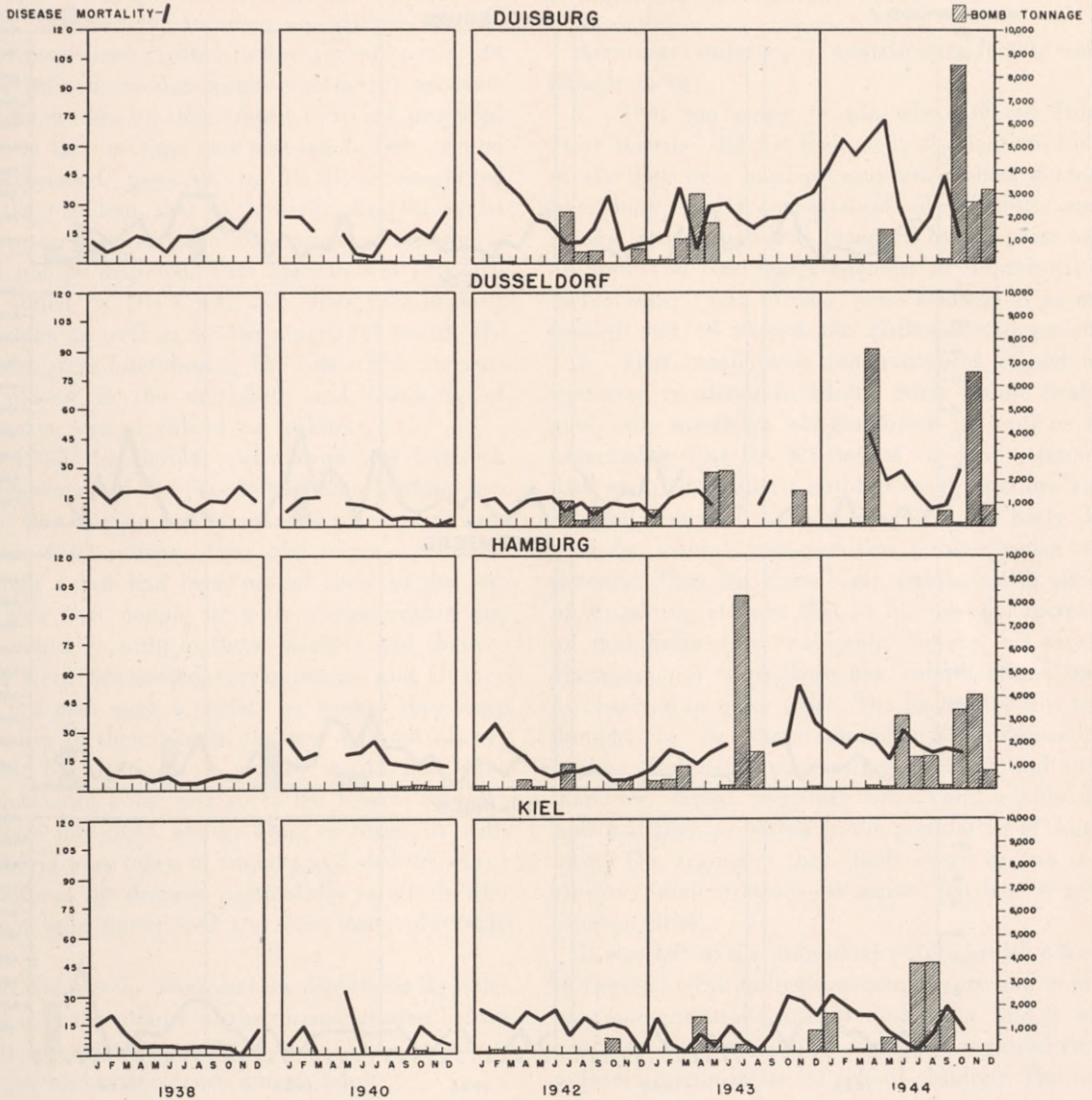
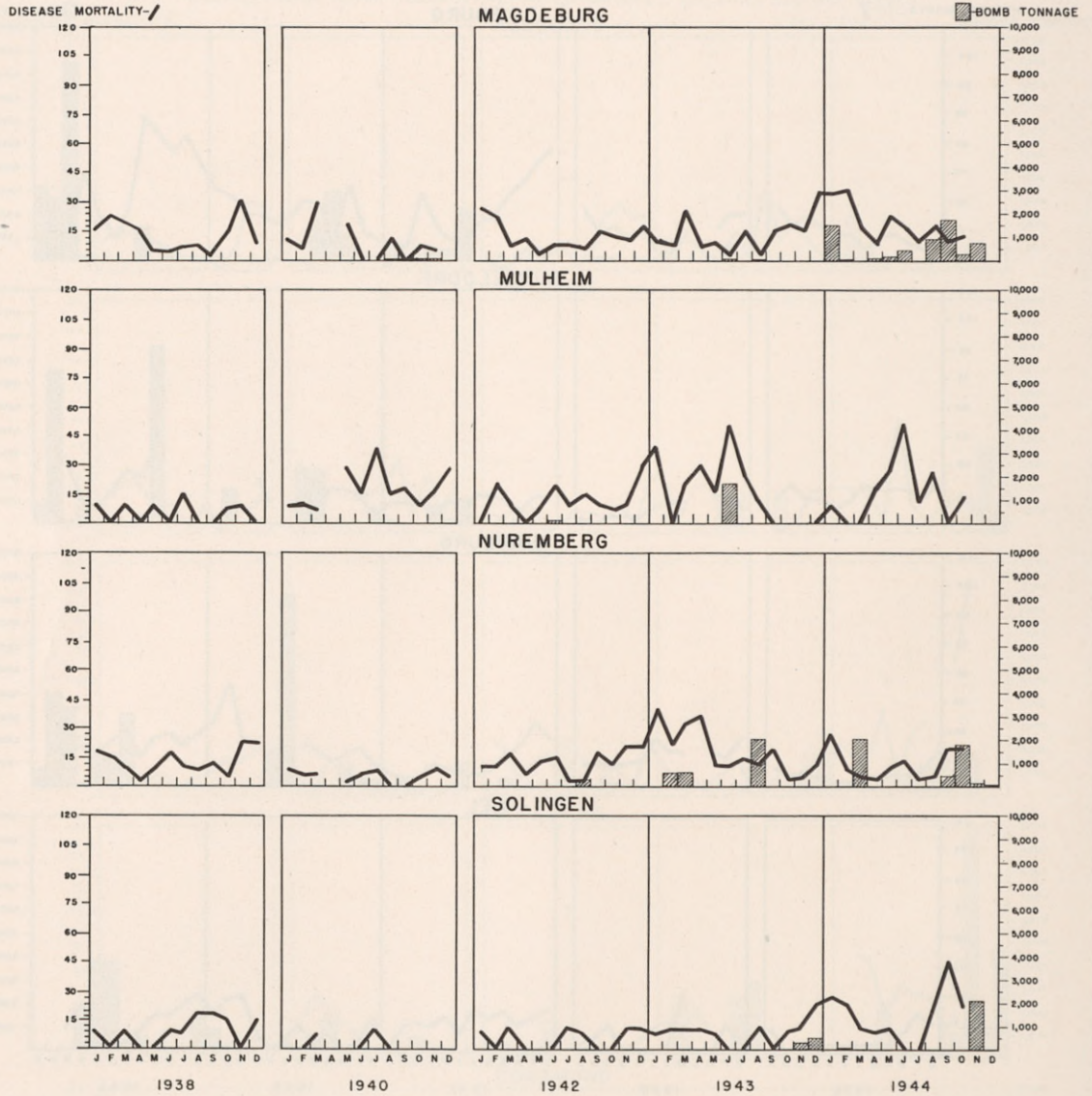


FIGURE 21 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
DIPHTHERIA
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED ON CITY, ALL AIR FORCES



autumn, and in the present instance the increase is accentuated by the fact that reporting was defective in the early period following heavy air raids. However, the increase in Cologne, Hamburg, and Nuremberg is well above the incidence for the previous year, and can hardly be attributed to factors other than those incurred during and following air attacks. Whether the increase was entirely the result of conditions created by the air war could not be ascertained, as immediate records for accurate scientific studies on this subject were not prepared owing to lack of time and personnel. The opinion was expressed, however, by all those concerned with the problem, that an indirect effect of aerial warfare on the incidence and course of diphtheria could not be disputed. This opinion was categorically stated by Dr. Conti and other high-ranking physicians as well as by the municipal health officers who were interviewed. The role which air warfare played in the morbidity and mortality of diphtheria was explained as follows:

By 1943, the German population was fatigued. The resistance of the people had been lowered owing to poor living conditions and to constant cuts in their food rations. They had become careless: although a law had been passed early in the war providing that people ill with communicable diseases could go only to those bunkers and shelters which were designated for isolation, and if they were not near such a shelter or bunker they were to remain in their homes, the law was not always obeyed. For instance, a mother would not leave her sick child home and go to the bunker herself; she took the child along. Thus children ill with diphtheria were taken to bunkers and shelters where they spread the disease, particularly to adults who had not been immunized and were thus vulnerable to it.

The changes in morbidity in diphtheria as compared with the picture of the disease as seen before the air war started were:

1. A higher incidence among adults.
2. A more malignant and rapid course.
3. A mortality which averaged 4.5 per cent for most of Germany, but in some places went up to 7 per cent.
4. Multiple and serious sequelae such as myocardial damage, paralyzes of the soft palate, and polyneuritides.

These polyneuritides were particularly resistant to therapy as were the other complications of diphtheria. Large doses of thiamin chloride were given

without effect, and Professor Stepp of Munich, Germany's leading expert on vitamins and nutrition, stated in a personal interview that the whole subject of complications was conditioned by the poor nutritional state of the patients. He did not think the virulence of *Klebsiella diphtheriae* had changed, a belief which was borne out by bacteriologic studies.

Additional causative or contributory factors were thought to be:

1. That too many people who suffered from "sore throats" did not seek medical attention. First of all, they were hard pressed and rushed, doctors were busy, and transportation off schedule, and, second, absenteeism was blazoned by the press and all state and Nazi party agencies as unpatriotic—so too many "sore throats" were allowed to go untreated and to spread the pathogenic organism.

2. That compulsory immunizations caused an increased incidence in adults. Some public health men with somewhat old-fashioned conceptions of immunology (as Dr. W. Bolt of Cologne) claimed that many immunized children were carriers and infected nonimmunized adults. This was hotly denied by several well-qualified public health authorities. Thus Dr. Hans Eller, public health officer of Augsburg, showed that in his city the increase of diphtheria was noticeable but by no means alarming, nor were there any complications such as observed in other cities. The reason for this was thought to be that compulsory immunization against diphtheria was started in 1935 and that, therefore, active immunity of a considerable degree had been produced in the population of Augsburg. The argument then, boils down to one conclusion: immunization was started too late in most German cities.

It was left to the individual public health officers in German cities to institute compulsory and voluntary immunizations against diphtheria, and it was not until 1941 that all of Germany required compulsory immunization of school children. The reason for this rather unusual procedure in a country as rigidly organized as Germany, was given by Dr. Conti, the chief of the German public health service:

"Immunization against diphtheria was instituted locally and encouraged by national propaganda. Other immunizations were left up to the individual physicians because it was felt that legislation in this respect would mean an encroachment upon the judgment and prerogatives of the individual doctor.

COMMUNICABLE DISEASES

TABLE 5. ANNUAL CASE INCIDENCE OF SCARLET FEVER
IN SEVEN GERMAN CITIES IN 1938, 1940, 1942-43-44
(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	230.25	403.33	586.97	437.92	205.62
Duisburg	278.58	286.22	692.34	482.60	343.08
Frankfort	160.36	187.72	542.74	581.28	322.10
Hamburg	188.27	263.14	719.42	446.36	326.05
Kiel	262.12	322.13	753.11	465.51	374.77
Magdeburg	192.79	241.05	715.01	618.22	354.84
Nuremberg	169.13	140.44	393.81	635.86	462.71
Combined Cities	200.65	256.00	652.92	505.31	341.64

TABLE 6. ANNUAL MORTALITY FROM SCARLET FEVER IN
THIRTEEN GERMAN CITIES IN 1938, 1940, 1942-43-44
(Rates per 100,000 population, annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	2.19	0.55	8.54	3.79	4.91(10)
Bochum	1.91	6.46	9.45	9.79	4.65(10)
Bremen	0.57	0.46	6.26	5.09	8.00(10)
Cologne	3.26	3.00	6.76	6.40(5)	9.09(8)
Dortmund	1.69	3.19	4.21	6.74	1.99(9)
Duisburg	6.41	6.25	19.72	8.03	13.97(10)
Duesseldorf	1.31	2.76	6.37	2.02(9)	5.43(7)
Hamburg	0.71	2.01	11.42	8.19	3.87(10)
Kiel	1.20	0.73	10.74	4.18	8.27(10)
Magdeburg	1.22	2.05	9.58	9.78	7.83(10)
Mulheim	0.74	5.77	13.43	11.65	2.30(10)
Nuremberg	0.96	1.26	3.50	8.45	3.76(10)
Solingen	—	—	7.30	7.75	2.15(10)
Combined Cities	1.73	2.60	9.08	7.08	5.94(10)

Our doctors did not desire to vaccinate everyone because of the danger of covering up the carriers. Furthermore, it is much better to rely upon careful and thorough public health controls than to depend upon immunizations which at best are uncertain. I believe that immunization should be resorted to only when we have determined definitely that a specific danger exists in a given area."

Scarlet fever

Germany experienced an epidemic of scarlet fever in 1941. Detailed data on mortality and case incidence for this year were not secured for the present study, but with the fact in mind it is apparent from the annual case incidence of Table 5 and the annual mortality figures of Table 6 that a high incidence of the disease still persisted in 1942 and 1943. For the seven cities of Table 5 the case incidence in 1940 was 256.00 per 100,000, while in 1942 it was 652.92 and in 1943, 505.31. The rate had fallen to 341.64 in 1944. A similar picture is shown for the annual mortality rates of Table 6, as well as for the case incidence rates of the individual cities. The mortality rates for the individual cities, shown in Table 6, are not as clear cut; for Augsburg, Bremen, Cologne, Duisburg, Duesseldorf, and Kiel the scarlet fever mortality rate in 1944 was higher than in 1943.

Case incidence and mortality, by months, for the cities under discussion are given in Figures 22 and 23. The general conclusion to be read from these charts is that no relation existed between bombing attacks and the incidence of scarlet fever. Isolated instances, however, may be cited to show an increase in the disease after air attacks. In Munich, as a striking example, the number of reported cases before the air attacks averaged 20 a week. Since 1942 the weekly number of reported cases averaged 100. Reasons for this sharp rise were thought to be overcrowding in homes, at work, and in air raid shelters.

The course of the disease was mild, very few complications were observed, and the mortality was low.

The incidence of streptococcus infection was not well known, primarily because people did not seek medical attention for such "trivial" conditions, and second, because bacteriologic studies became more and more difficult as laboratory facilities, personnel, and reagents became scarce with the increased destruction of cities. Of interest is one outbreak of streptococcus infection in the nursery in the air

raid bunker of the Municipal Hospital in Nuremberg: 53 newborn infants developed streptococcus infections such as otitis, mastoiditis, and pyoder-matosis. All this happened in one week and cost the lives of 14 infants. The reason for this was thought to be the airborne spread of pathogens from the emergency room where dirty bandages were unwrapped and dried before being sterilized and reused. It became apparent from these charts and from interviews with German physicians that scarlet fever and streptococcus infections were not a particular problem after the heavy air attacks set in. In contrast to the similar charts on diphtheria, scarlet fever rates rose again following the bombings only to the level attained before the months of the air attacks.

Whooping cough

Mortality from whooping cough increased in 1943 and 1944, as did the complications from this condition. The reason for this increase in mortality was thought to be the frequent disorganization of home and hospital life, the disruption of heating facilities, and other factors resulting from aerial warfare. Thus infants and small children had to be moved from the wards to shelters or bunkers as often as two or three times daily, which practice led to an increase in the duration of the disease and in its complications.

The year 1940 was epidemic for whooping cough in Germany, a fact responsible for the high case incidence rate for that year in the seven cities of Table 7, and the high 1940 mortality rate in the thirteen cities of Table 8. The case rates for 1942-1944 were well below that of 377.40 for 1940 while the mortality rates of 4.18 and 4.27 for 1943 and 1944 are less than the epidemic rate for 1940 of 5.90, but greater than in the nonepidemic year of 1938 when the rate was 3.51. From the mortality table it is apparent that more whooping cough was encountered in Germany in 1943 and 1944 than the table of case incidence shows. Table 8 lists mortality figures for seven cities not included in the case incidence table, four of which, Augsburg, Bremen, Cologne, and Duesseldorf, show high rates of mortality from whooping cough. It is not apparent, however, that the disease increased in 1944 over 1943.

Monthly air attack bomb tonnages are compared with monthly case rates of whooping cough in Figure 24 and with mortality rates in Figure 25.

COMMUNICABLE DISEASES

TABLE 7. ANNUAL CASE INCIDENCE OF WHOOPING COUGH
IN SEVEN GERMAN CITIES IN 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	244.45	128.99	93.37	25.98
Duisburg	451.80	127.38	246.75	164.01
Frankfort	446.42	177.81		66.14
Hamburg	321.97	127.89	145.59	182.99
Kiel	693.46	195.03	366.20	170.59
Magdeburg		344.44	308.52	124.46
Nuremberg	321.65	138.09	168.22	109.41
Combined Cities	377.40	159.87	193.61	140.95

TABLE 8. ANNUAL MORTALITY FROM WHOOPING COUGH IN
THIRTEEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	3.83	2.73	4.27	11.90	2.95(10)
Bochum	3.18	2.58	3.26	4.49	0.00(10)
Bremen	2.57	6.68	1.62	5.39	6.91(10)
Cologne	3.91	8.60	4.96	5.55(5)	0.97(8)
Dortmund	4.31	1.87	1.72	0.72	1.57(9)
Duisburg	2.52	12.97	4.26	9.00	3.06(10)
Duesseldorf	5.79	11.39	2.51	6.06(9)	11.42(7)
Hamburg	4.58	5.61	1.84	3.15	5.98(10)
Kiel	1.60	3.28	2.08	2.09	2.61(10)
Magdeburg	1.83	2.64	2.03	3.85	3.65(10)
Mulheim	0.74	0.00	0.75	0.83	2.30(10)
Nuremberg	0.96	3.52	1.08	2.04	2.92(10)
Solingen	0.00	1.50	1.62	3.45	4.30(10)
Combined Cities	3.51	5.90	2.50	4.18	4.27(10)

FIGURE 22

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
SCARLET FEVER
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

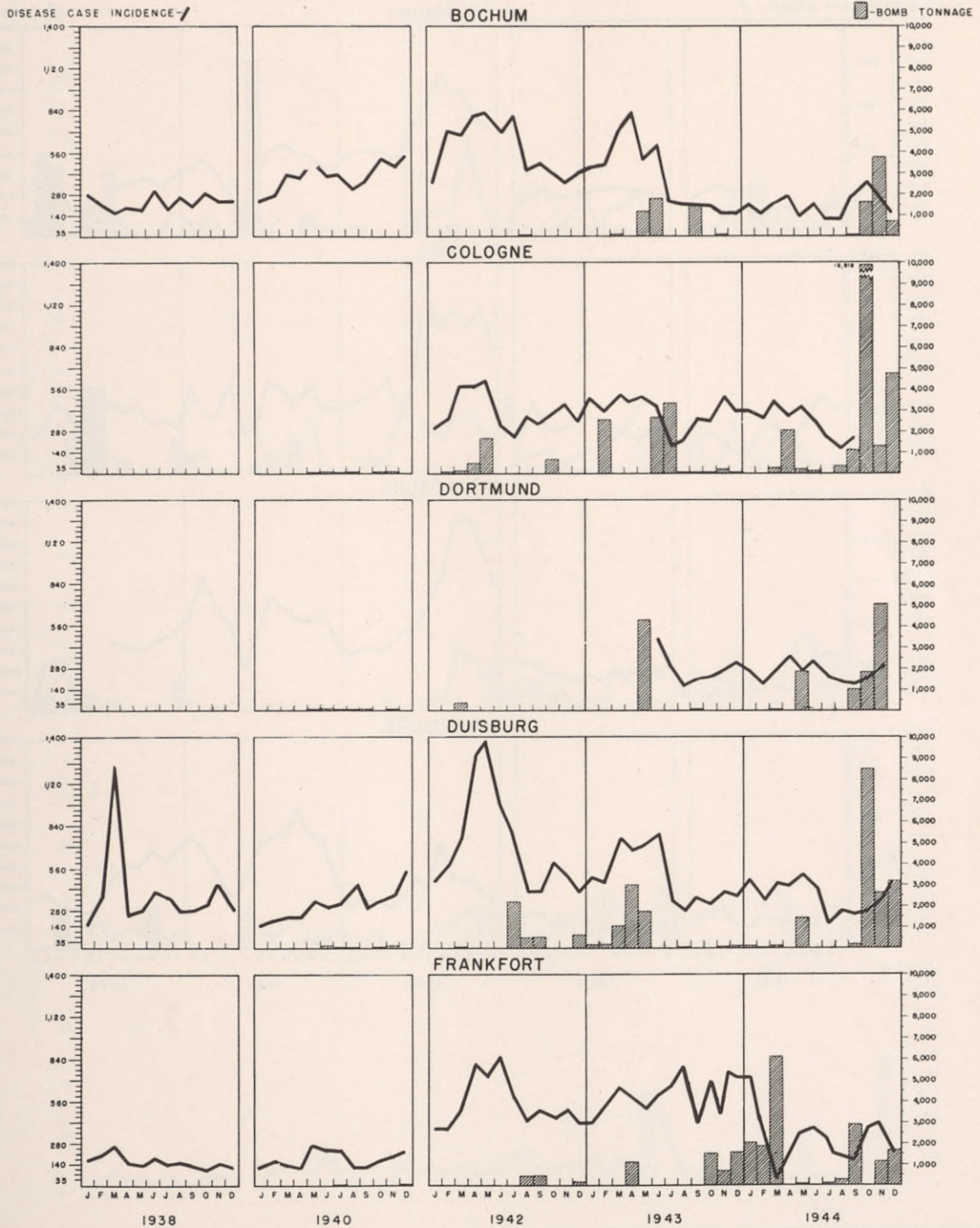


FIGURE 22 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
SCARLET FEVER
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

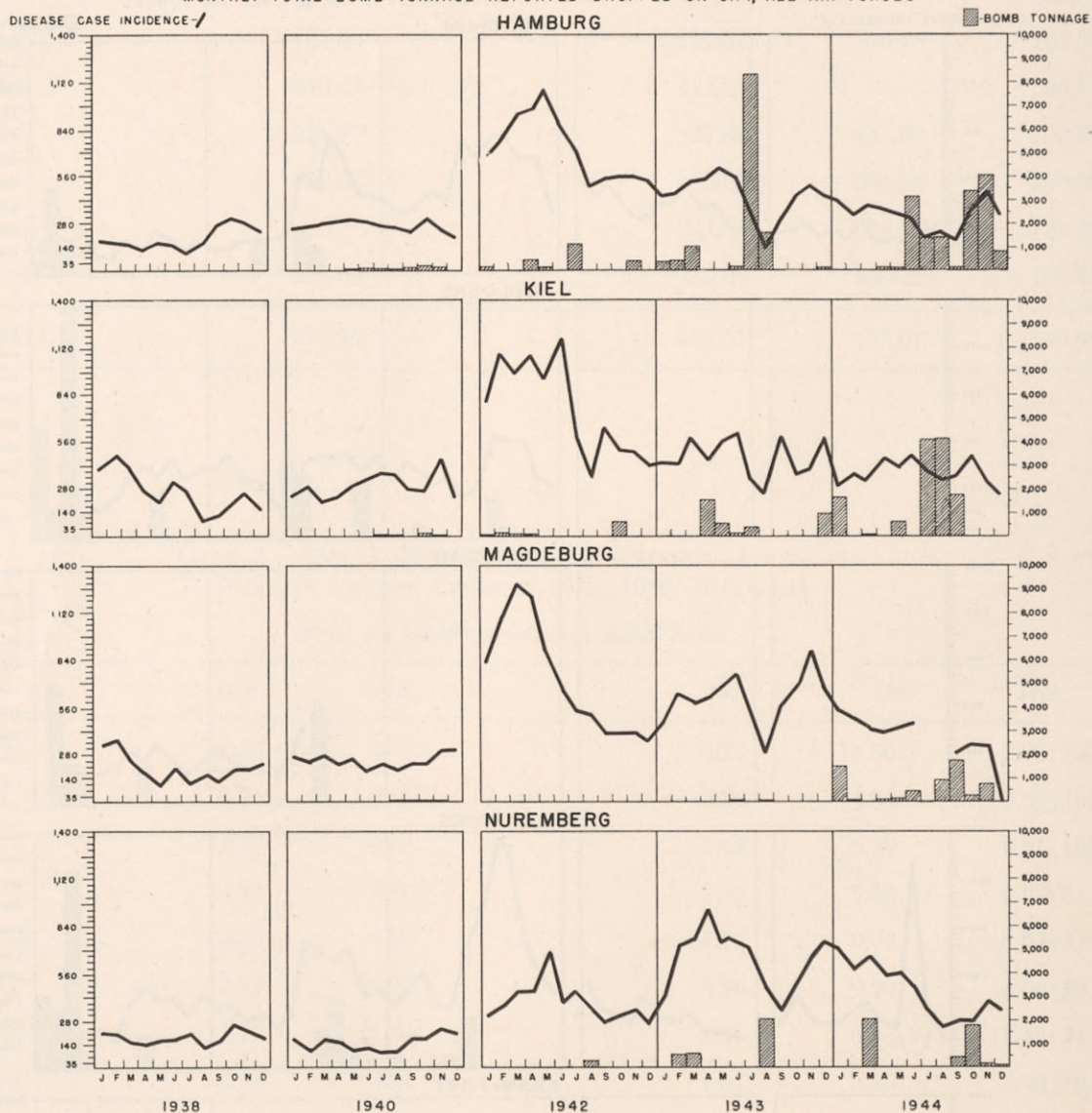


FIGURE 23

THE BOMBING EXPERIENCE AND MORTALITY FROM
SCARLET FEVER
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

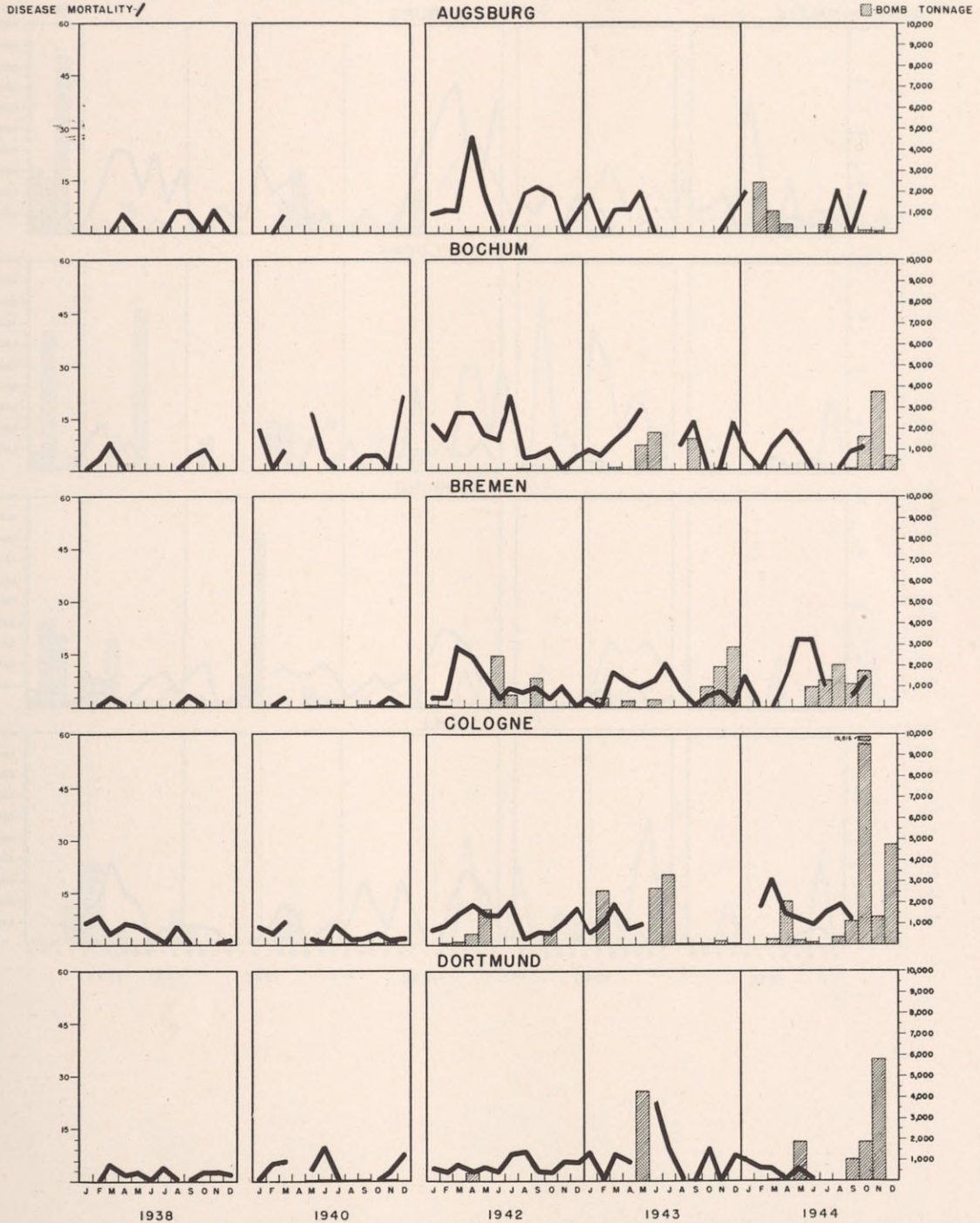


FIGURE 23 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
SCARLET FEVER
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

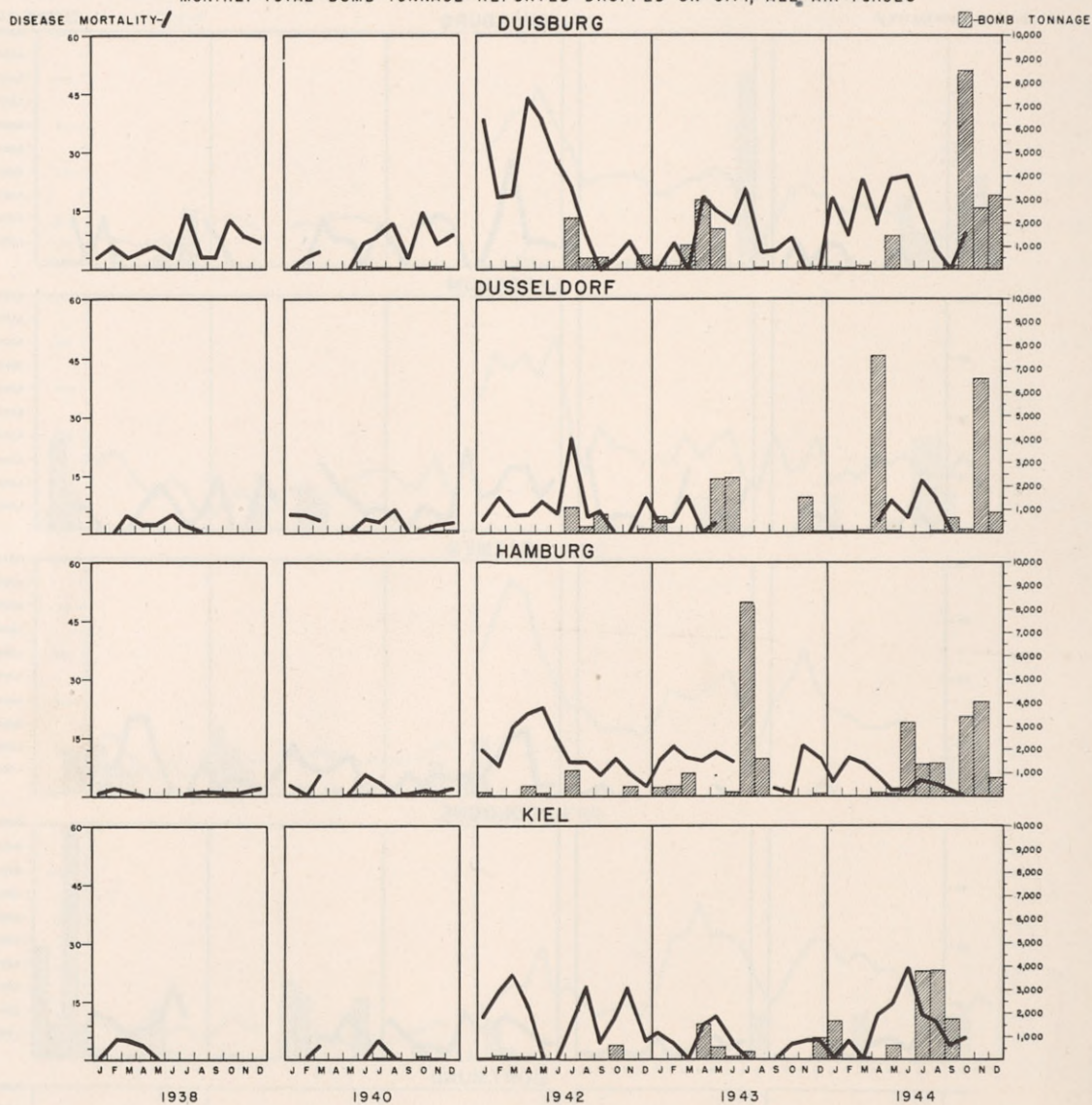


FIGURE 23 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
SCARLET FEVER
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

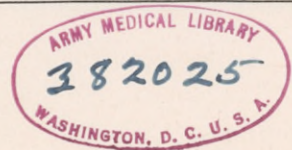
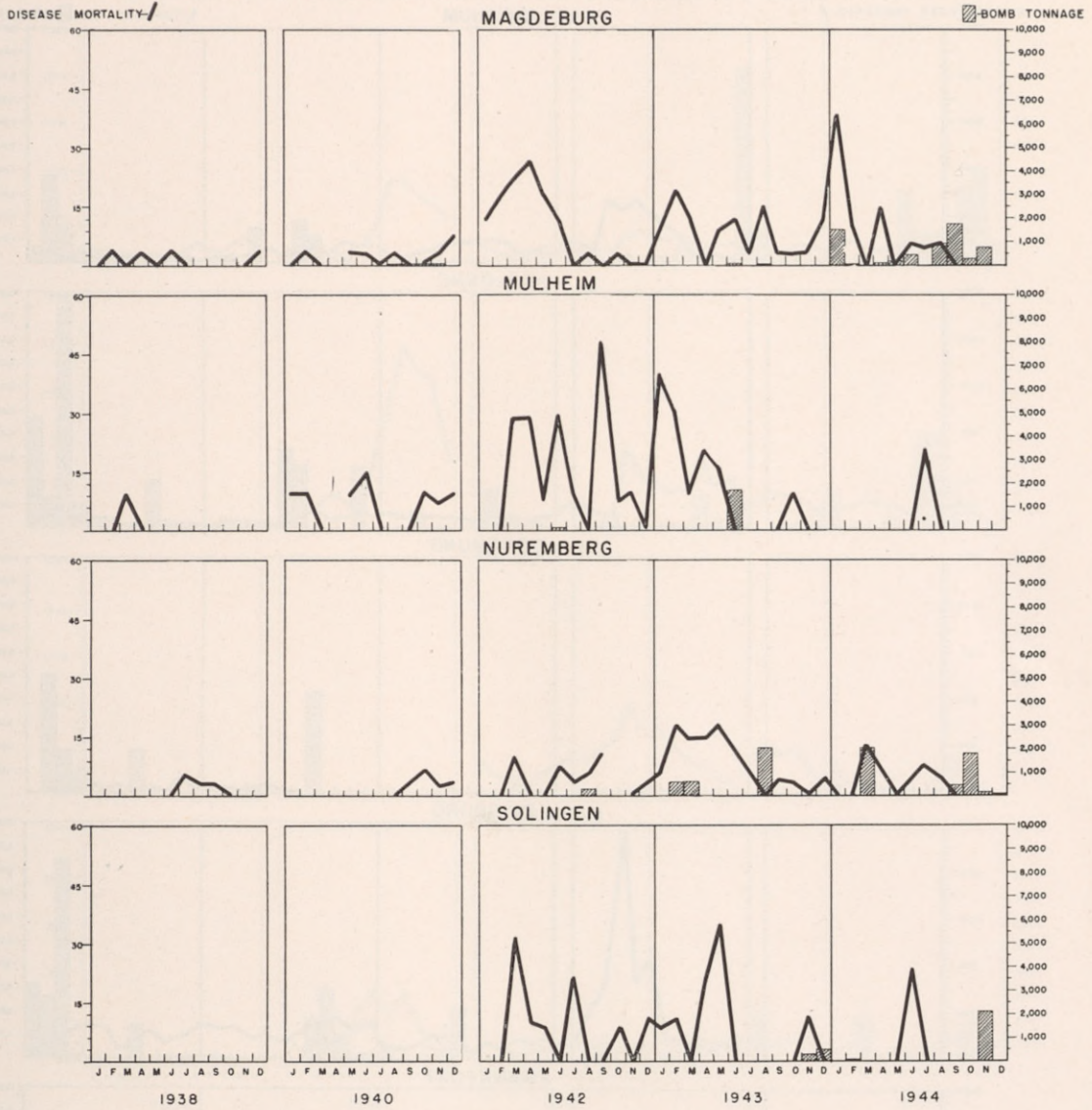


FIGURE 24

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
WHOOPING COUGH
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

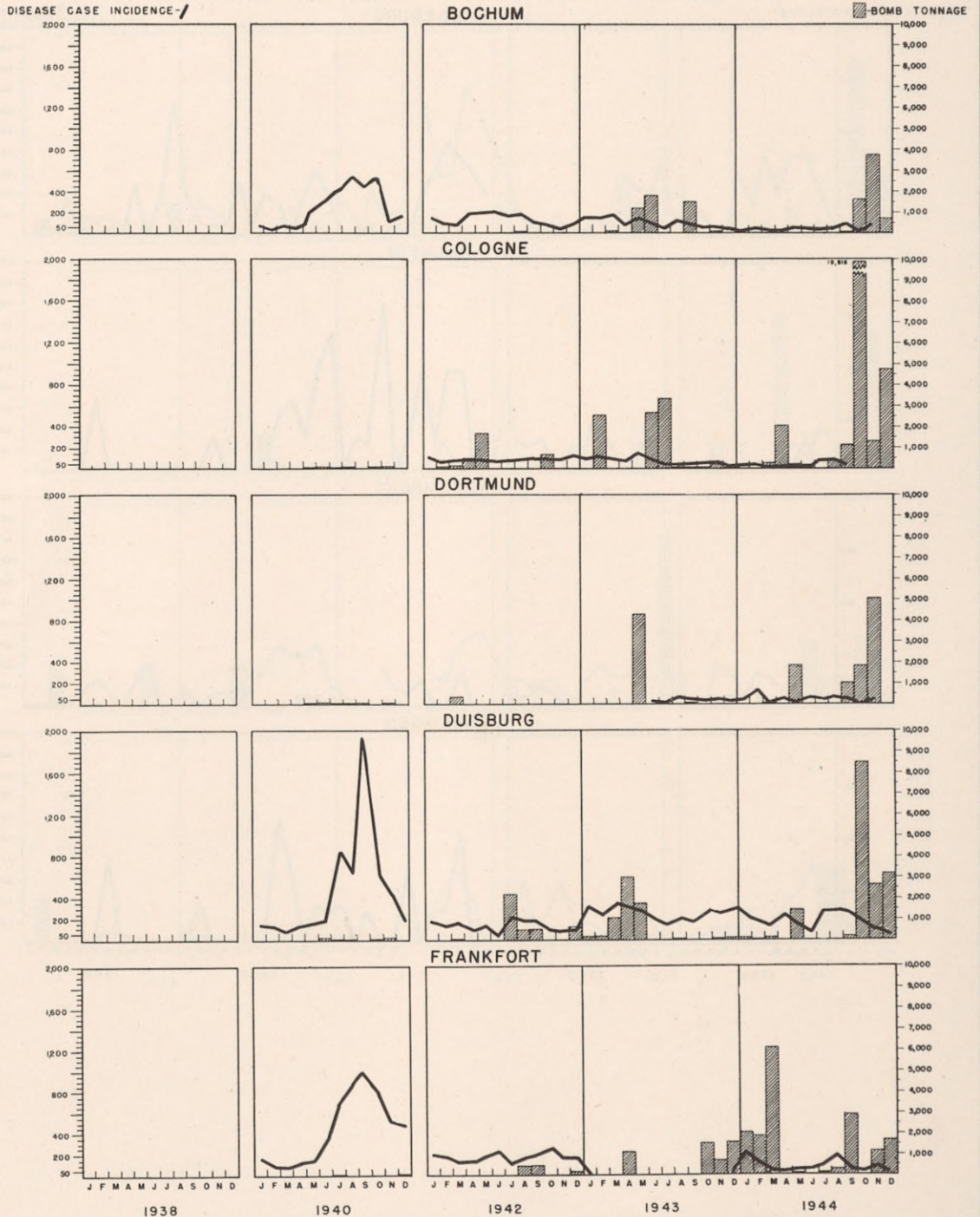


FIGURE 24 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
WHOOPING COUGH
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

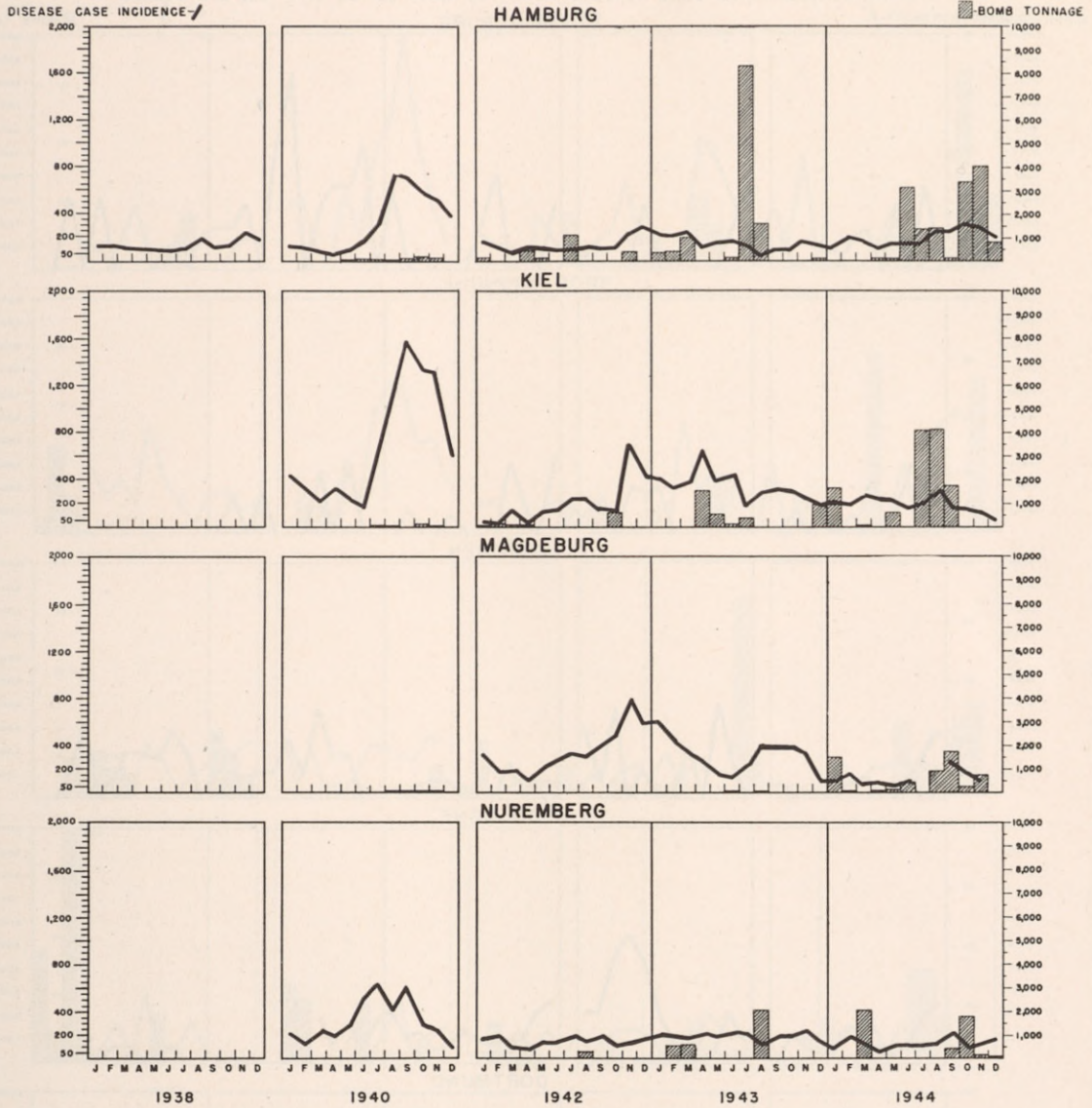


FIGURE 25

THE BOMBING EXPERIENCE AND MORTALITY FROM
WHOOPING COUGH
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

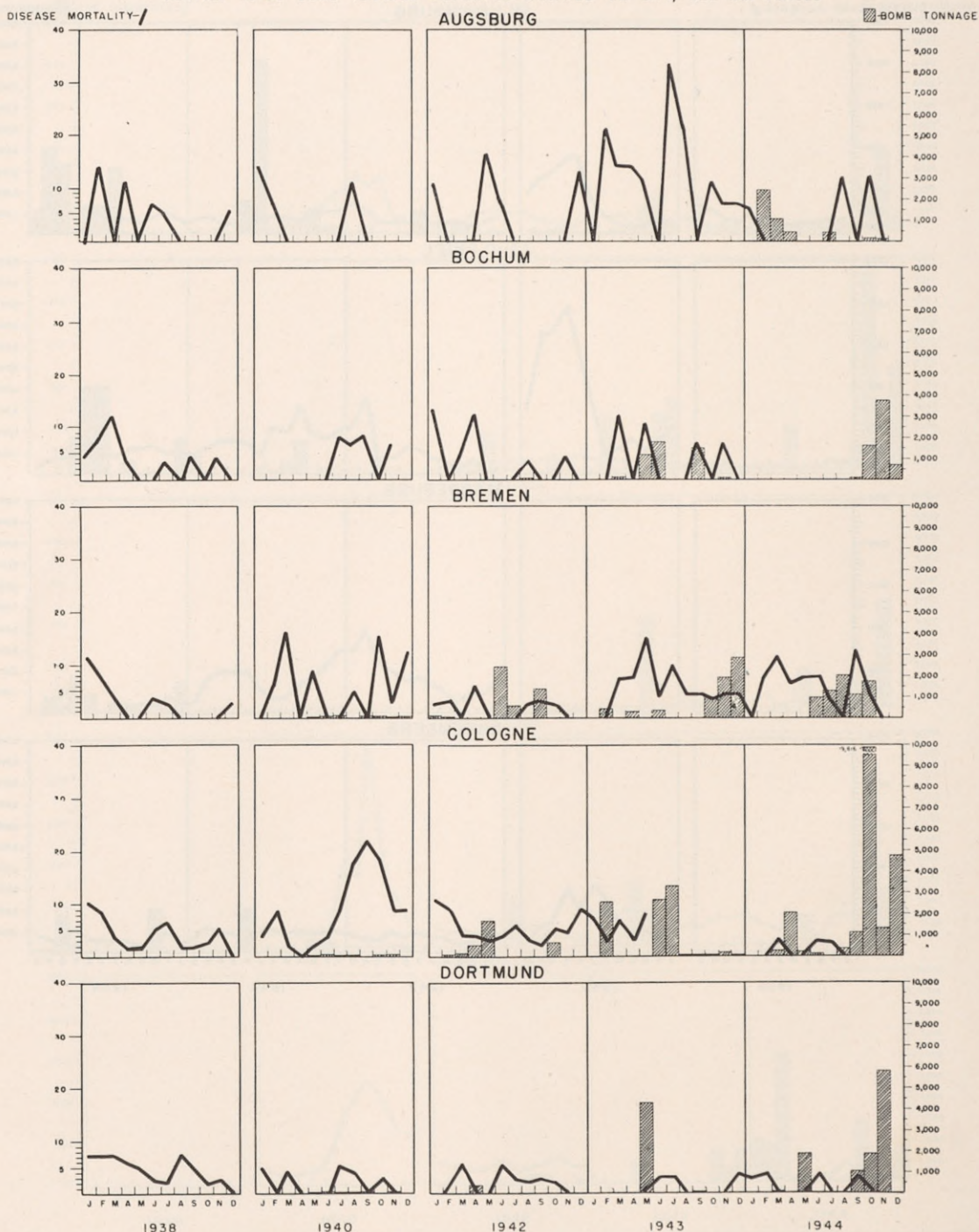


FIGURE 25 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
WHOOPING COUGH
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

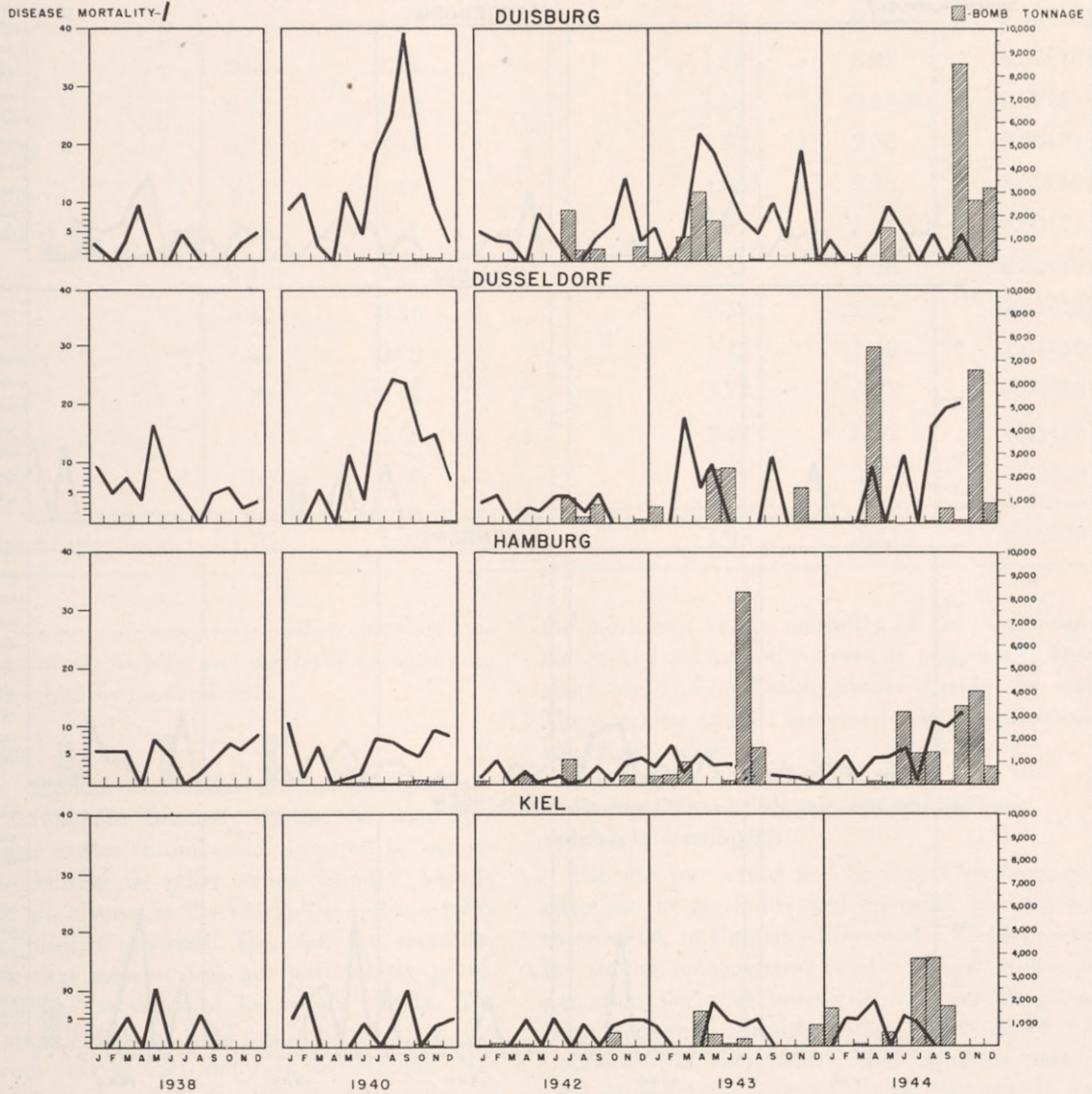
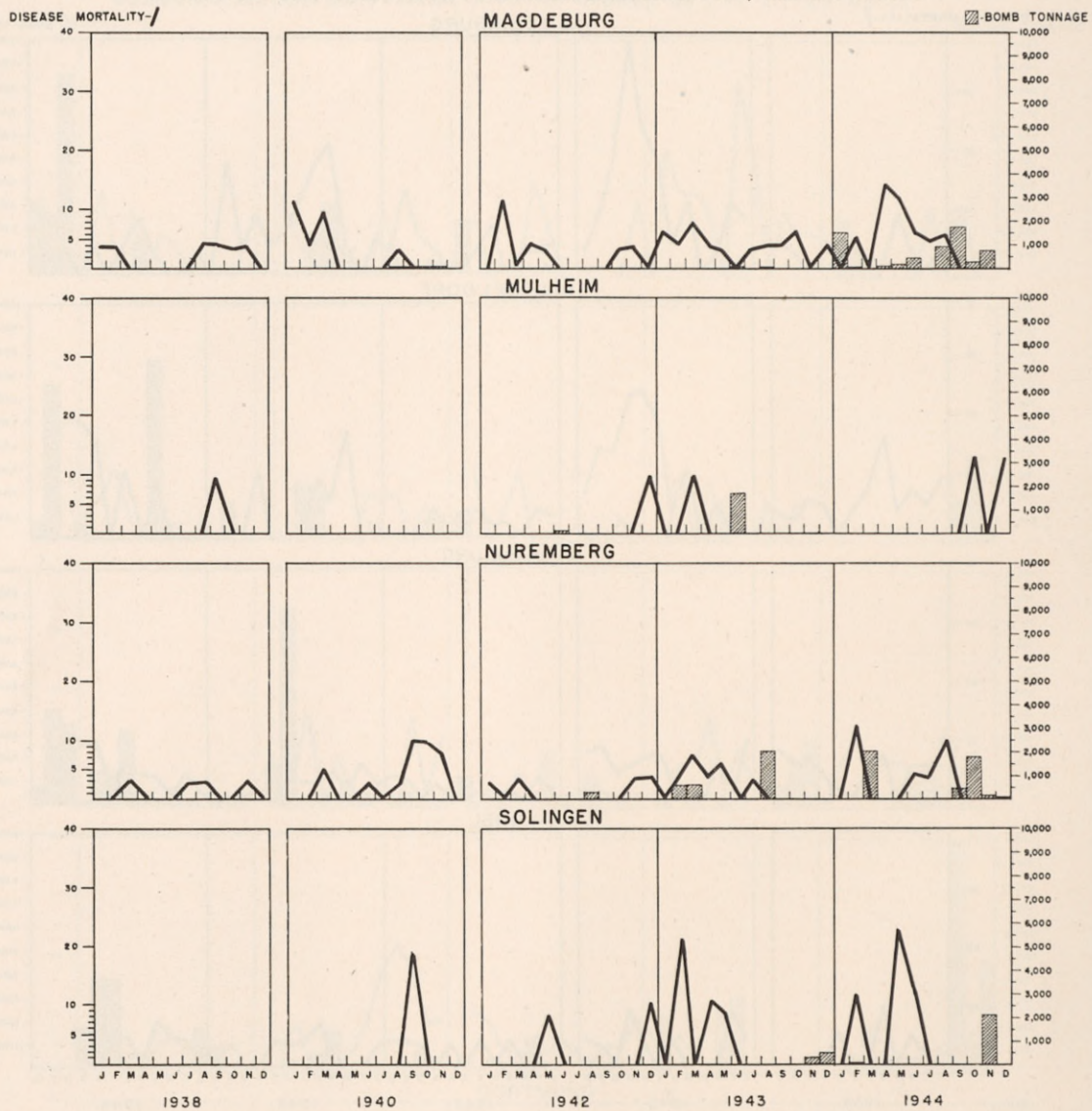


FIGURE 25 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
WHOOPING COUGH
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



COMMUNICABLE DISEASES

TABLE 9. ANNUAL MORTALITY FROM MEASLES IN THIRTEEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

City	1938	1940	1942	1943	1944
Augsburg	3.28	1.09	4.81	1.08	0.00(10)
Bochum	1.27	4.20	2.28	0.82	0.66(10)
Bremen	0.86	2.54	1.39	5.09	9.82(10)
Cologne	3.52	2.22	1.38	0.43(5)	2.59(8)
Dortmund	0.75	0.94	1.72	2.65	0.80(9)
Duisburg	2.75	3.47	4.00	3.53	3.06(10)
Duesseldorf	3.55	3.31	2.90	1.34(9)	6.00(7)
Hamburg	0.48	0.71	1.31	1.48	0.82(10)
Kiel	0.40	0.36	0.35	0.35	2.61(10)
Magdeburg	1.83	0.88	1.45	1.48	1.04(10)
Mulheim	2.22	1.44	3.73	3.33	0.00(10)
Nuremberg	2.40	0.50	2.42	2.62	0.84(10)
Solingen	0.00	0.00	1.62	1.72	3.22(10)
Combined Cities	1.70	1.63	1.91	1.82	2.46(10)

No indication of any relationship between the intensity of air attacks and the level of whooping cough is given by these charts.

Measles

The incidence of measles did not change materially throughout Germany during the war. Sporadic and explosive outbreaks occurred in various cities, whereas in other cities equally heavily bombed no change in the morbidity and mortality of the disease occurred. The data on mortality indicate that measles was not particularly prevalent during the years of heavy air attacks. The rates per 100,000 of 1.70 and 1.63 in 1938 and 1940 rose only to 1.91 and 1.82 in 1942 and 1943 and to 2.46 in 1944 for the thirteen cities of Table 9. The rate for 1944 was high because of increased mortality from measles in Bremen, when the rate rose from 1.39 in 1942 to 9.82 in 1944, and in Duesseldorf where it increased from 1.34 in 1943 to 6.00 in 1944. Whatever relationship existed between bombing attacks and mortality in this disease can be seen in Figure 26.

The German physicians interviewed regarding measles stated that aerial warfare had not changed

the morbidity or the mortality of the disease and that it had not caused concern to practicing physicians and public health officers during the war. There was no marked increase in the complications attending measles.

Poliomyelitis—epidemic encephalitis—epidemic meningitis

The air war could not be shown to have any effect on the morbidity and mortality of three diseases which in Germany presented a problem similar to that encountered in the United States. In numerous personal interviews with private physicians and public health officers it was stated that poliomyelitis, encephalitis, and epidemic meningitis caused little concern during the war. It was stressed that diagnostic facilities were handicapped through the widespread destruction of transportation facilities, and that the diagnoses reported were oftentimes unreliable.

Poliomyelitis. The case incidence rates for poliomyelitis are only occasionally high for the cities of Table 10. The case rates for 1938 are higher, on the whole, than the subsequent years, 1938 being a year in which the disease was epidemic in Germany.

COMMUNICABLE DISEASES

TABLE 10. ANNUAL CASE INCIDENCE OF
POLIOMYELITIS, EPIDEMIC MENINGITIS, AND EPIDEMIC ENCEPHALITIS
IN SEVEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

City	<i>Poliomyelitis</i>				<i>Epidemic Meningitis</i>				<i>Epidemic Encephalitis</i>						
	1938	1940	1942	1943	1944	1938	1940	1942	1943	1944	1938	1940	1942	1943	1944
Bochum	1.91	0.00	0.98	0.41	1.11	0.32	0.65	1.95	0.00	0.00	3.50	6.78	2.28	3.67	2.76
Duisburg	4.35	0.00	0.53	1.93	1.50	0.23	0.93	0.00	0.32	0.00	4.35	9.73	2.66	2.89	2.26
Frankfort	27.09	1.62	5.29	1.90	1.27	0.36	0.18	0.00	0.19	0.00	0.91	5.40	2.19	3.23	2.23
Hamburg	3.45	2.24	7.43	2.22	2.65	0.18	0.35	0.24	0.67	0.69	2.08	8.33	3.57	2.48	3.63
Kiel	1.20	10.20	0.35	3.14	1.48						0.80	0.73	0.00	1.39	1.48
Magdeburg	0.91	0.29	1.16	1.19	0.44	0.30	0.00	0.00	0.00	0.00	4.26	8.49	3.49	4.45	2.81
Nuremberg	12.25	3.27	2.15	1.46	11.29	0.00	0.00	0.54	0.87	0.71	6.97	4.03	5.92	3.50	2.21
Combined Cities	7.27	2.22	4.39	1.92	2.89	0.21	0.35	0.33	0.46	0.39	2.89	7.02	3.14	2.91	2.82

FIGURE 26

THE BOMBING EXPERIENCE AND MORTALITY FROM
MEASLES
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

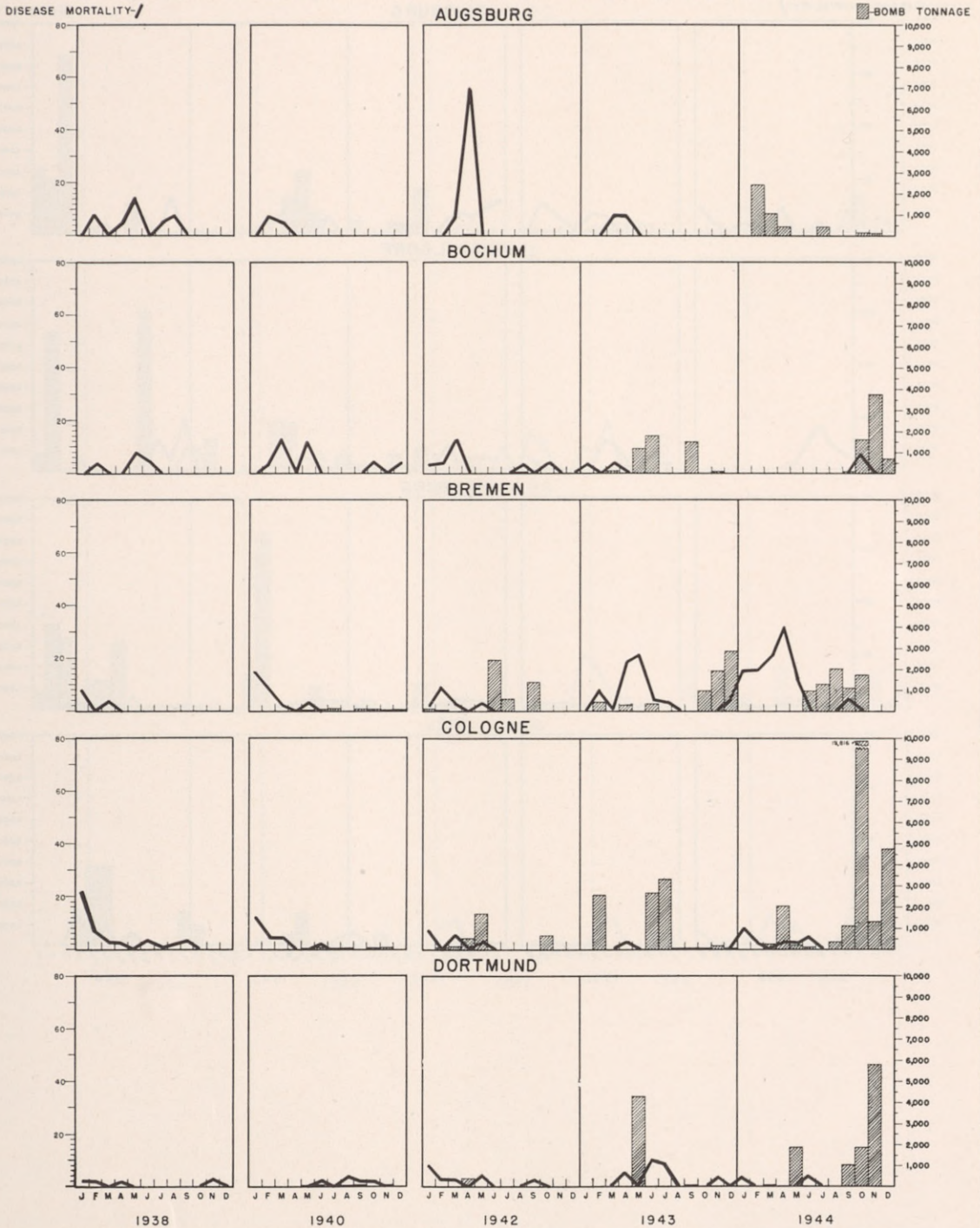


FIGURE 26 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
MEASLES
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

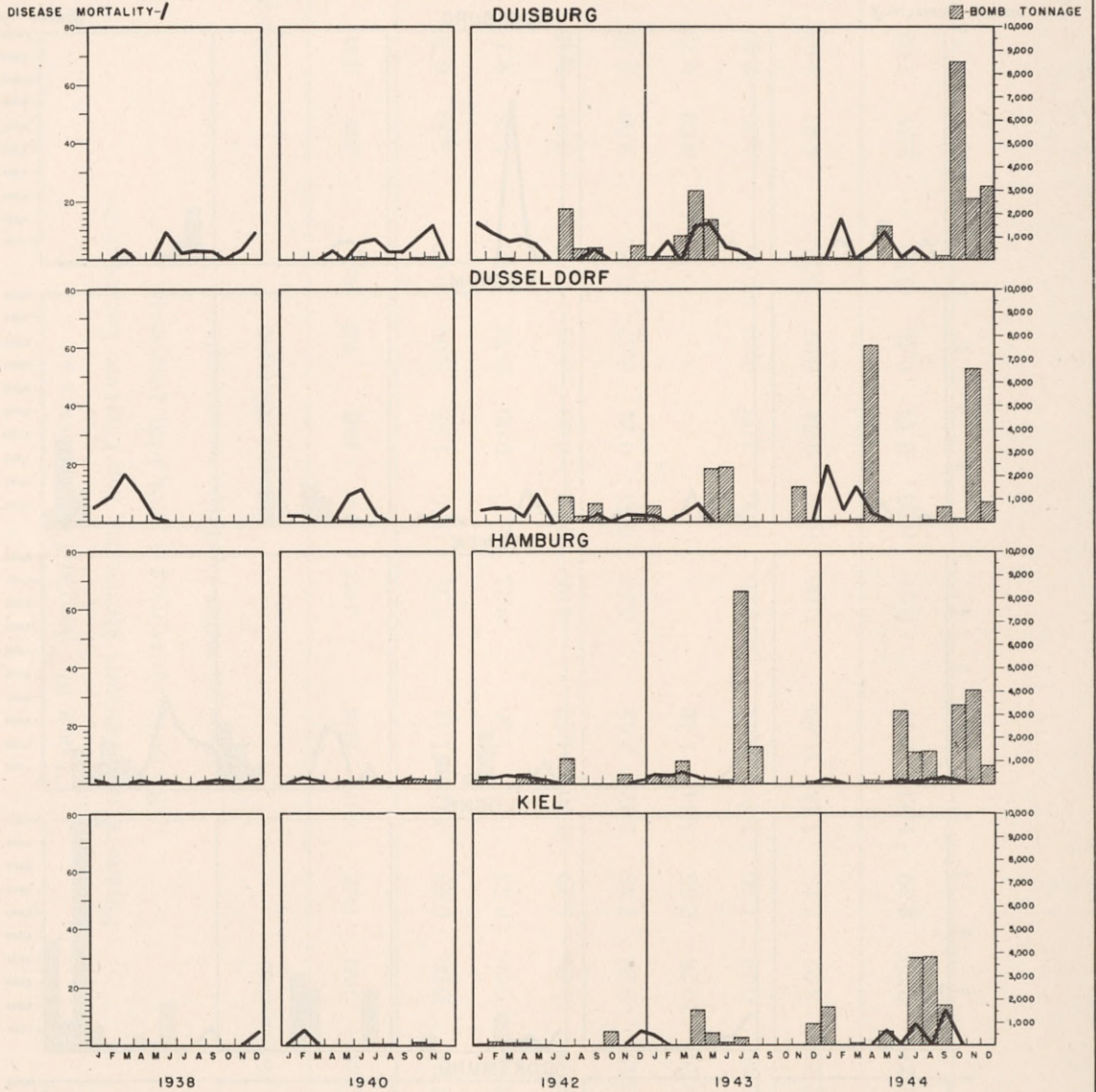


FIGURE 26 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
MEASLES
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

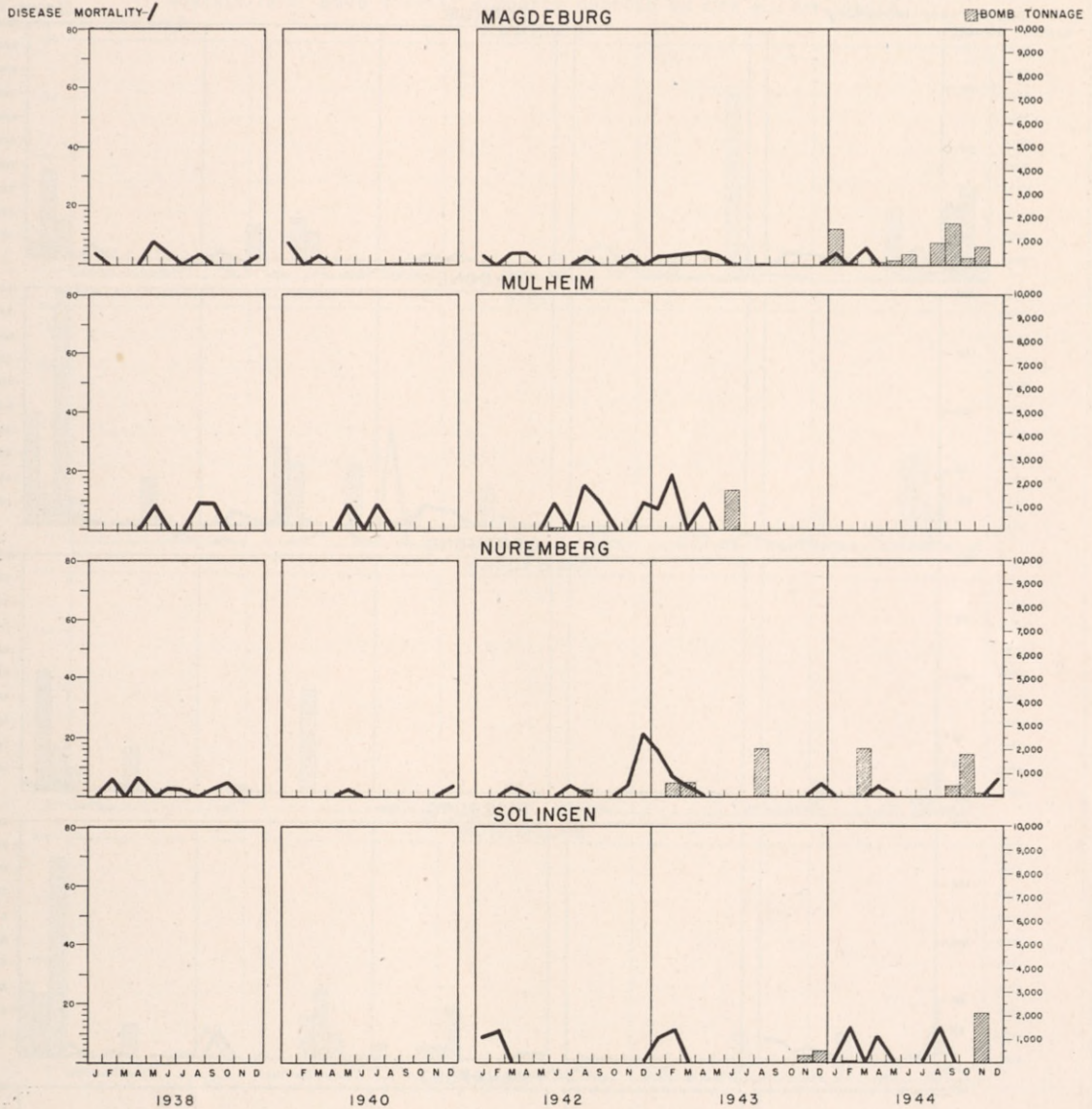


FIGURE 27

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
POLIOMYELITIS
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

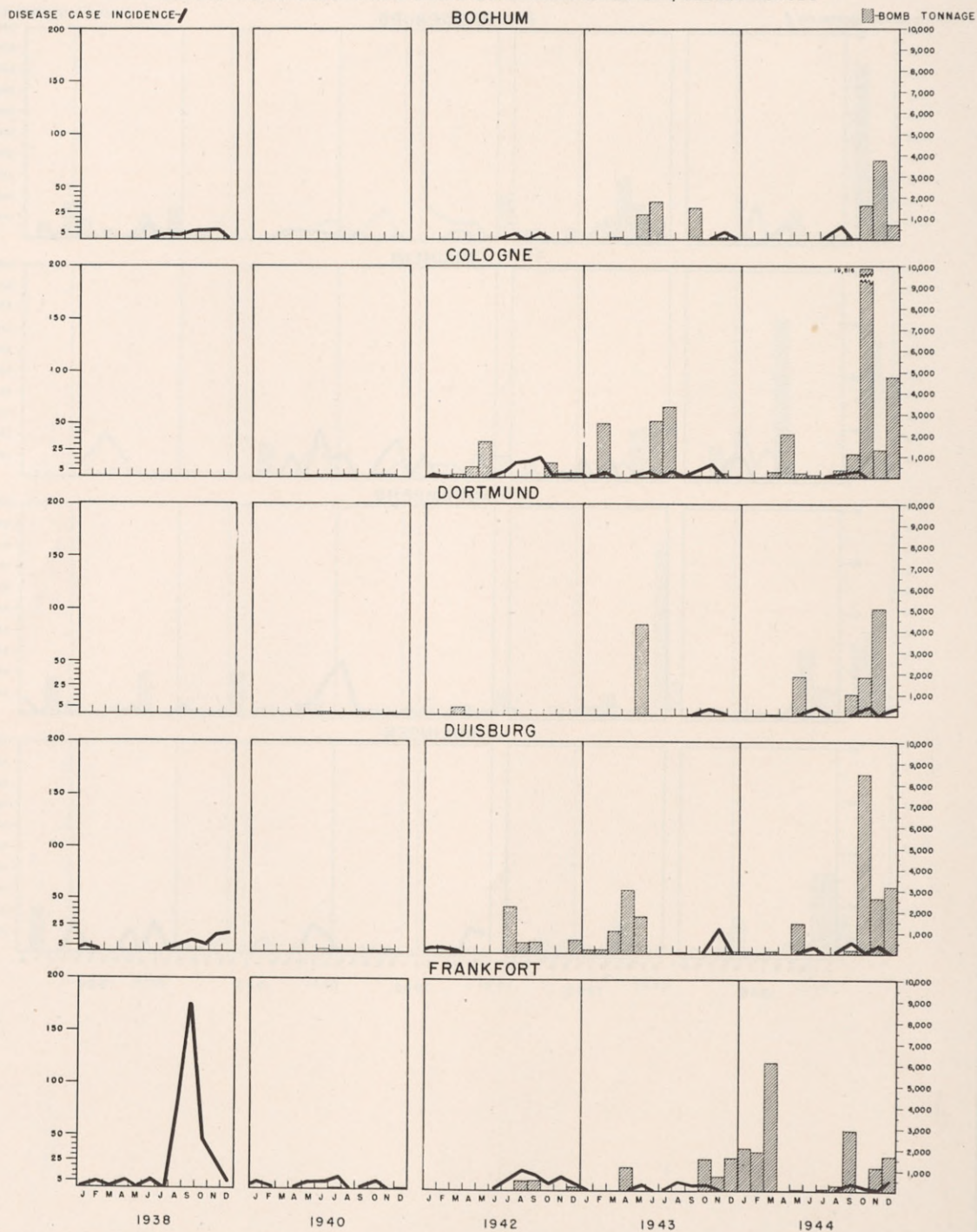


FIGURE 27 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
POLIOMYELITIS
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



COMMUNICABLE DISEASES

Case incidence of this disease was high in Frankfurt and Hamburg in 1942 and in Nuremberg in 1944. Figure 27 does not show, however, any consistent relation between the disease and the months of air attacks. The July 1944 air attack on Hamburg was followed by a heavy incidence of poliomyelitis, but the heavier bombings in 1943 and 1944 were followed by a normal incidence.

The information obtained in interviews with leading public health men and practicing physicians in Germany was that poliomyelitis presented a similar problem in Germany to that in the United States. The highest incidence was found to be in September and October and in general from two to four weeks later than in the United States. The question of transmission of the virus through flies or water did not seem to take an important part in the epidemiologic considerations in Germany during the war.

Epidemic encephalitis. The annual case incidence of epidemic encephalitis in 1938 and 1940 was 0.21 and 0.35 respectively for the six cities of

Table 10. These rates were not exceeded in any excessive amount in 1942 to 1944. The case rates for epidemic encephalitis were somewhat higher in Hamburg and in Nuremberg for 1943 and 1944 than for the previous years. No relationship between the monthly course of the disease and the occurrence of air attacks is shown in any of the charts of Figure 28.

No information was obtained as to what agents were responsible for the disease referred to as encephalitis. Most physicians interviewed concerning this point stated that they had only seen occasional cases, and that diagnostic tests such as animal inoculations and neutralization tests as required for the confirmation of the diagnosis in the United States were not carried out in Germany except in rare instances where such facilities were immediately available and the physician particularly interested in the laboratory aspects of this disease entity.

Epidemic meningitis. The period 1939-1941 was one in which epidemic meningitis was epidemic in

TABLE 11. ANNUAL MORTALITY FROM INFLUENZA AND PNEUMONIA IN THIRTEEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

City	1938	1940	1942	1943	1944
Augsburg	60.17	70.52	65.69	69.76	79.61(10)
Bochum	116.56	93.65	99.02	75.03	110.30(10)
Bremen	56.49	64.99	53.33	74.27	101.15(10)
Cologne	80.89	115.84	97.78	115.22(5)	84.63(8)
Dortmund	109.19	99.12	97.32	97.51	111.61(9)
Duisburg	147.77	118.57	124.98	125.62	167.62(10)
Duesseldorf	100.31	134.66	95.19	98.96(9)	86.51(7)
Hamburg	84.31	126.46	104.29	95.78	81.78(10)
Kiel	68.14	127.54	50.23	55.40	71.41(10)
Magdeburg	85.28	68.83	72.60	73.20	81.43(10)
Mulheim	124.06	105.35	118.66	107.35	112.64(10)
Nuremberg	82.40	108.98	89.37	88.05	74.79(10)
Solingen	121.20	123.00	90.81	65.47	74.13(10)
Combined Cities	92.38	110.53	92.99	92.11	92.91(10)

Germany, so that the high case incidence rates of this disease given in Table 10 for 1940 are indicative of the degree of prevalence during an epidemic year. The case rates for the period 1942-1944 are again normal in comparison with rates for the year 1938. No evidence is given that epidemic meningitis was a health problem during the years of heavy bombing. The monthly course of case incidence shown in Figure 29 shows no relation between the incidence of the disease and the months or severity of air attacks.

The problem of this disease was quite similar to the one in the United States. The disease did not seem to be feared as much as before the sulfonamide era. Preventive measures were much the same before the war as during the war, and whatever outbreaks occurred were usually blamed on overcrowding. A number of the physicians and public health officers interviewed showed little concern about the disease and all stated that its morbidity and mortality had not changed during the time of aerial warfare against Germany, although living conditions had definitely changed, and crowding in shelters and homes had constituted a good prerequisite for outbreaks of epidemic meningitis.

Influenza and pneumonia

Mortality from influenza and pneumonia was low during the years of concentrated air attacks (Table 11). The combined rates per 100,000 for the years 1942-1944, 92.99, 92.11, and 92.91 respectively, compare favorably with the rates for 1938 and 1940, which were 92.38 and 110.53. The rates for each of the cities lead to the same conclusion. Duisburg alone possessed an unduly high rate in 1944, 167.62; however, this rate was not greatly higher than that of 147.77 for the city in 1938.

In numerous interviews it was brought out that no differentiation was made by the Germans between bacterial and virus pneumonia, or as to the type of pneumococcus responsible for cases of pneumonia. It was emphasized that influenza *per se* rarely causes death, which is usually the result of a complicating bronchopneumonia. Diagnosis has always been left to the individual physician. Health officers did not require proof by laboratory tests before accepting the diagnosis. In addition to this long established practice, the disruption of transportation facilities and shortage of personnel, laboratory animals, and reagents made it difficult to establish accurate diagnoses.

It is difficult to assess the effect of air attacks

on mortality from influenza and pneumonia, as shown by the monthly trends of Figure 30. Increases in the rate following months of heavy attacks are shown for a number of cities, including Bremen, Hamburg, Nuremberg, and Solingen, but the increases are along the lines of normal seasonal expectation, and cannot, as here shown, be entirely attributed to the effects of air raids. A further study of the direct effect of air raids on mortality rates, eliminating the effect of seasonal variation, was carried out, the results of which are presented in Chapter Six. It was found there that mortality from influenza and pneumonia did show an increase after periods of air attacks.

Enteric fevers

The total case incidence of the gastrointestinal diseases—typhoid fever, paratyphoid fever, dysentery, and bacterial food poisoning—is shown in Table 12 for six German cities. It is apparent that for the cities as a group the case incidence of these diseases did not rise during the years of heavy air attacks, in fact, the rates fell from 36.28 in 1942 to 21.30 in 1944. Case rates for the cities separately show years in which a high incidence occurred; in Bochum, for example, the rate was 51.38 in 1943 as compared with 14.00 in 1942 and 23.21 in 1944. However, no trend is evident for the four diagnostic groups taken together.

Typhoid and paratyphoid caused little concern during the war. The German physicians said that whatever sporadic outbreaks did occur were usually traced to foreign laborers who had polluted some source of water. Immunizations against typhoid and paratyphoid were voluntary (for which see Dr. Conti's explanation under the previous discussion of diphtheria). In view of the fact that in many towns the fire departments used raw, untreated sewage to fight fires which subsequently ran into the sources of drinking water, the absence of epidemics is most surprising. But prior to the war Germany had established a most elaborate "typhoid carrier" control and placement system.

Bacillary dysentery has always been fairly common in Germany and has its seasonal high during the summer months. The pathogenic organisms in question were the Sonne and Kruse strains. The course of the disease was so mild that the patients were ill from four to five days only and often were able to go to work. There was rarely any blood in the stools and there were no deaths. In 1943 in

FIGURE 28

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
EPIDEMIC ENCEPHALITIS
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



FIGURE 28 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
EPIDEMIC ENCEPHALITIS
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

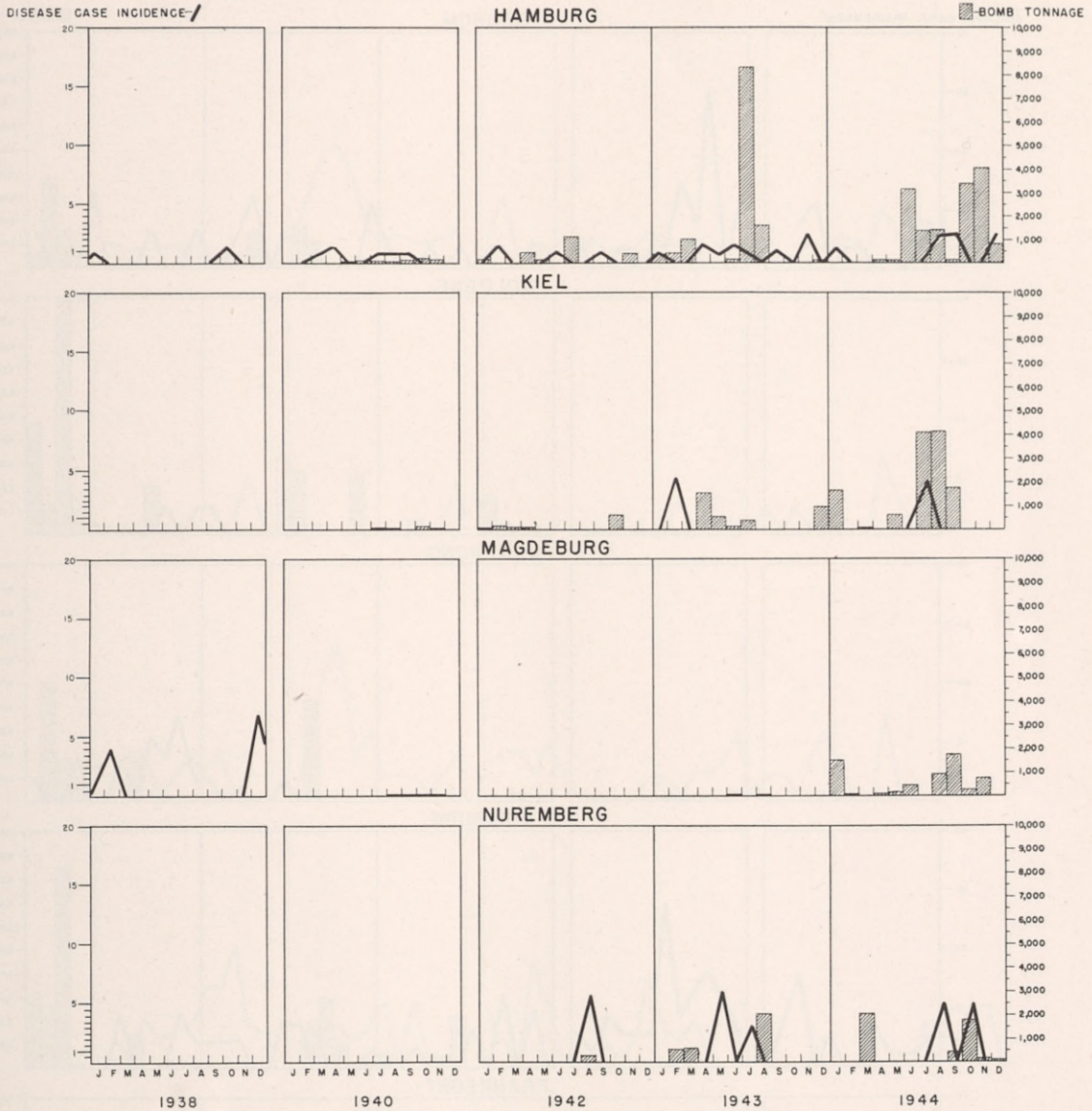


FIGURE 29

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
EPIDEMIC MENINGITIS
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

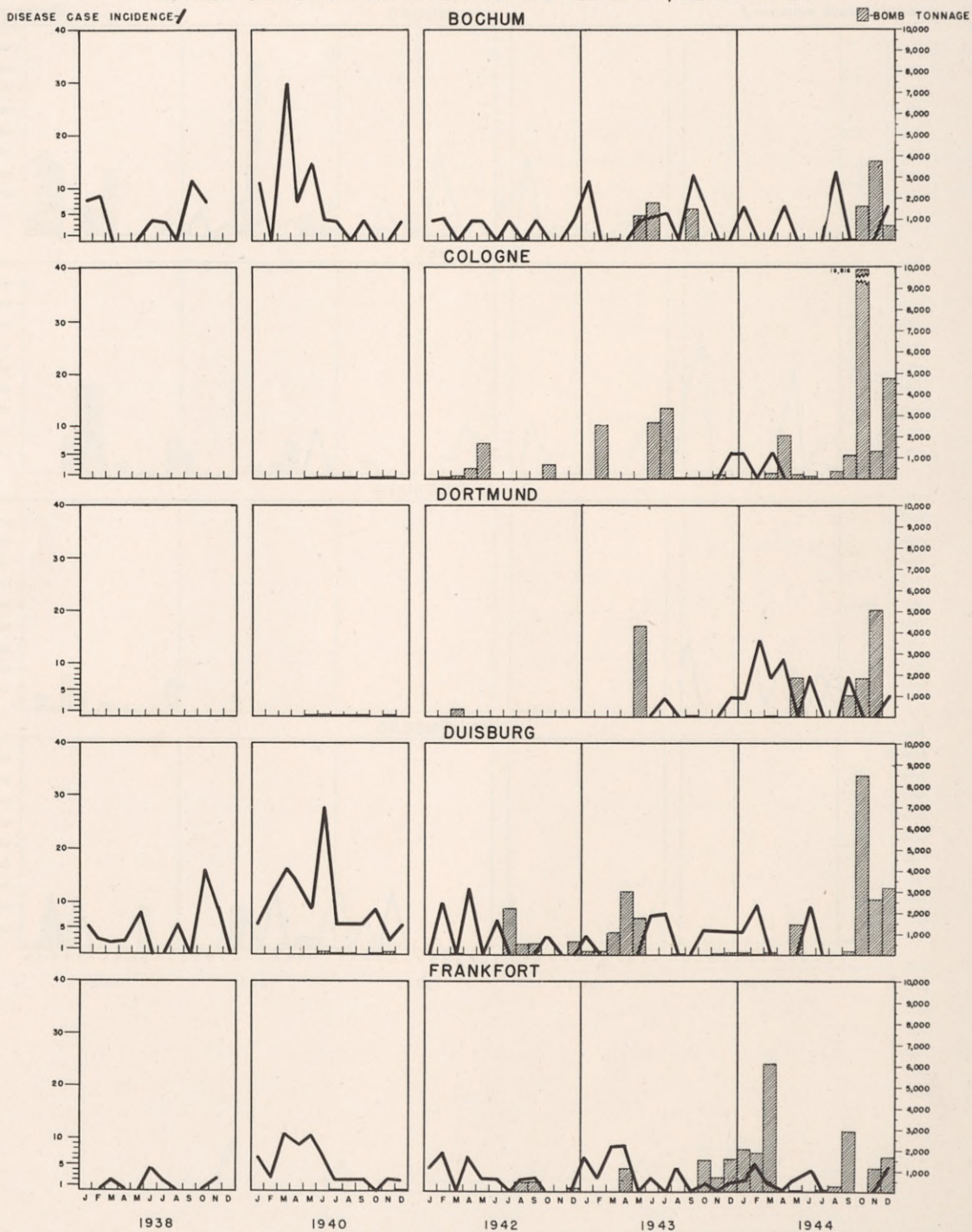


FIGURE 29 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
EPIDEMIC MENINGITIS
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

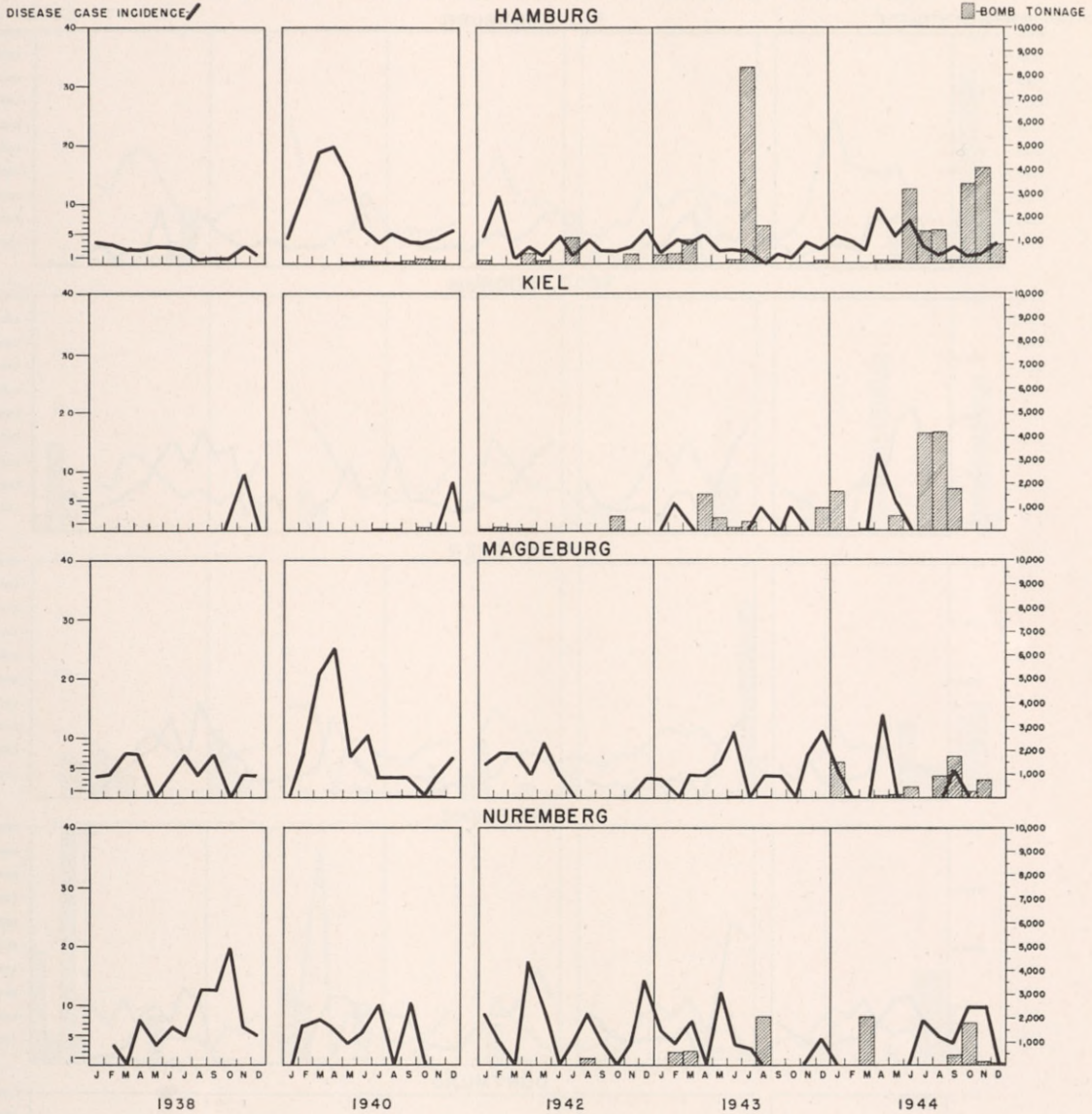


FIGURE 30

THE BOMBING EXPERIENCE AND MORTALITY FROM
INFLUENZA AND PNEUMONIA
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

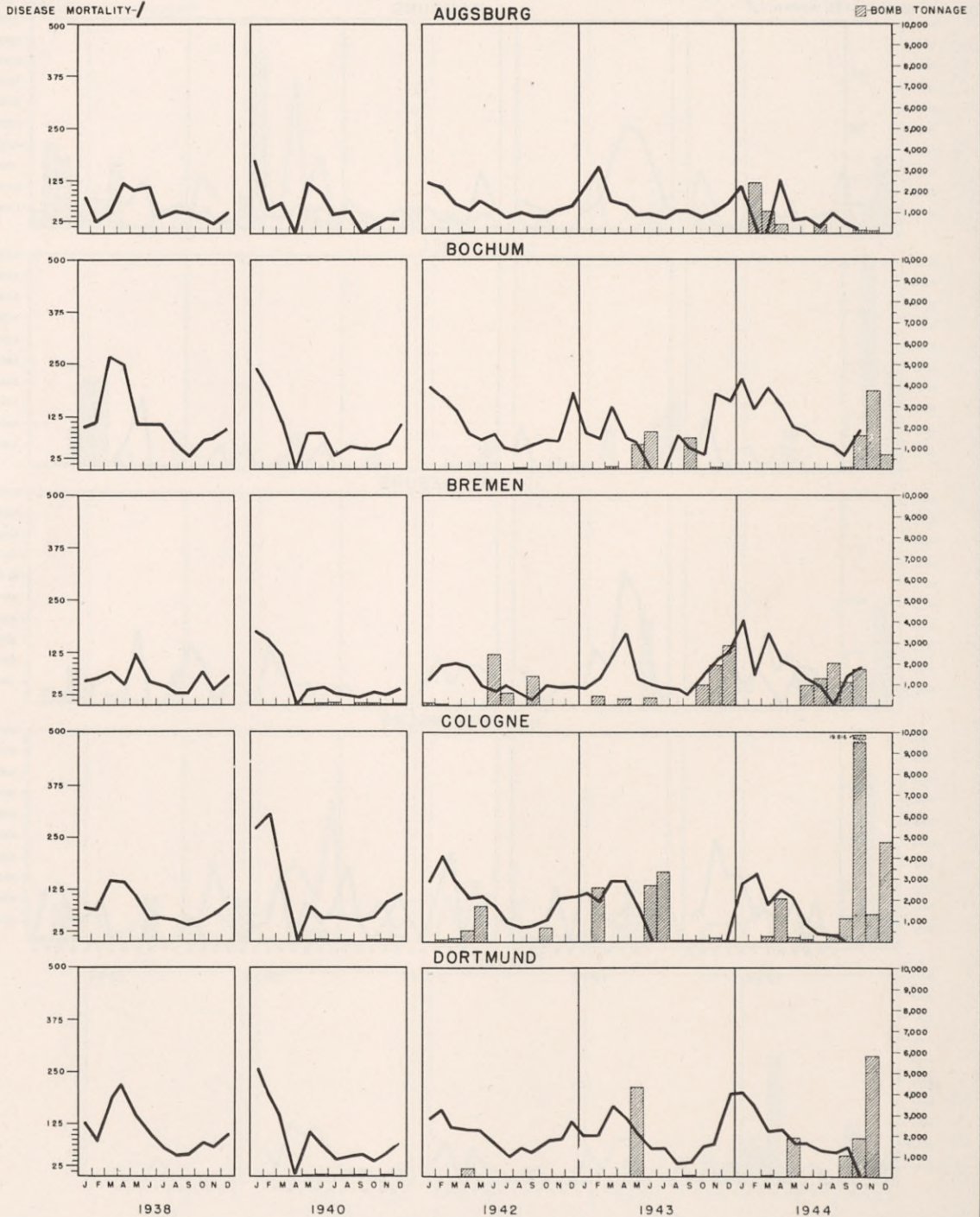


FIGURE 30 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
INFLUENZA AND PNEUMONIA
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

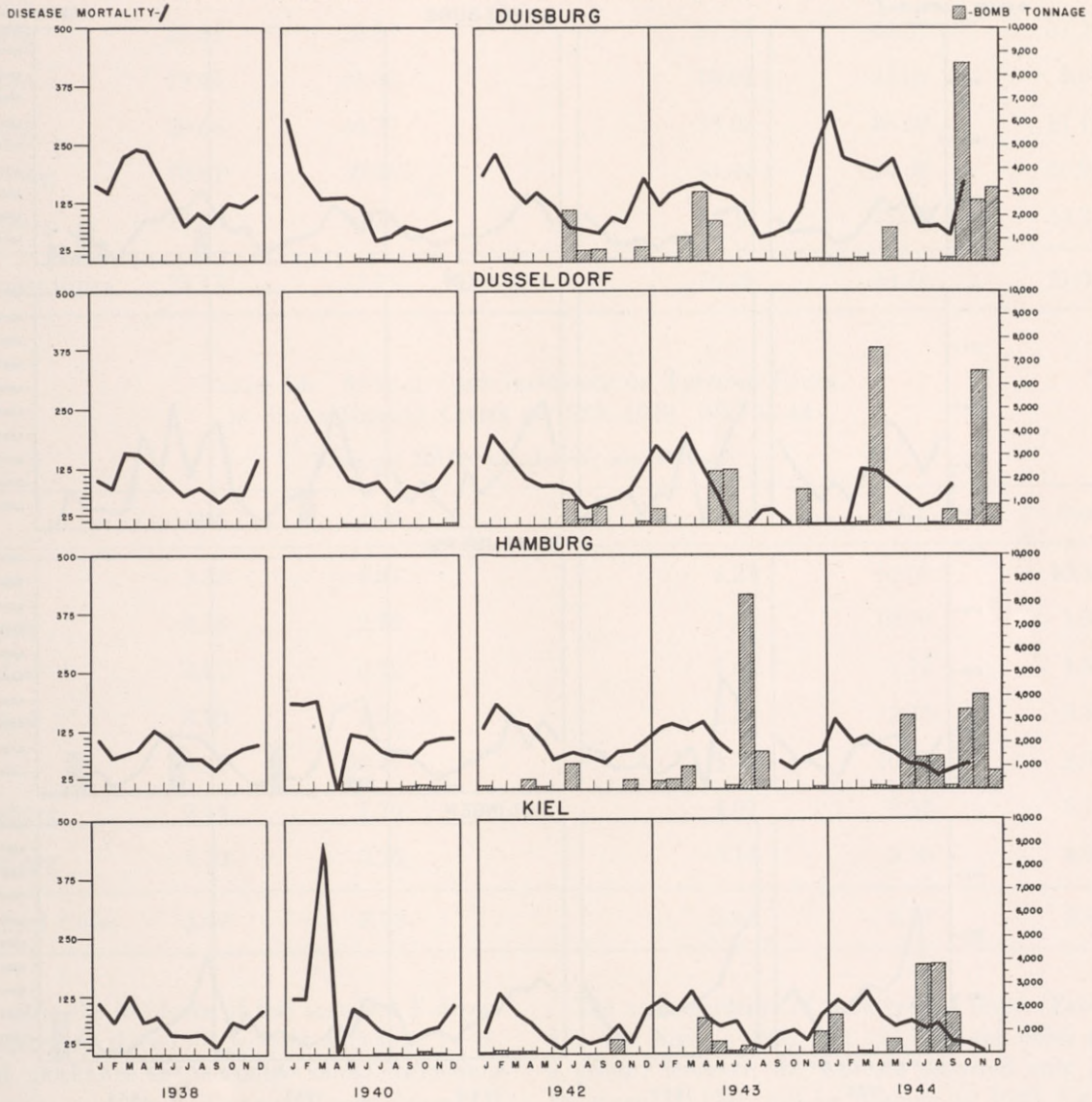
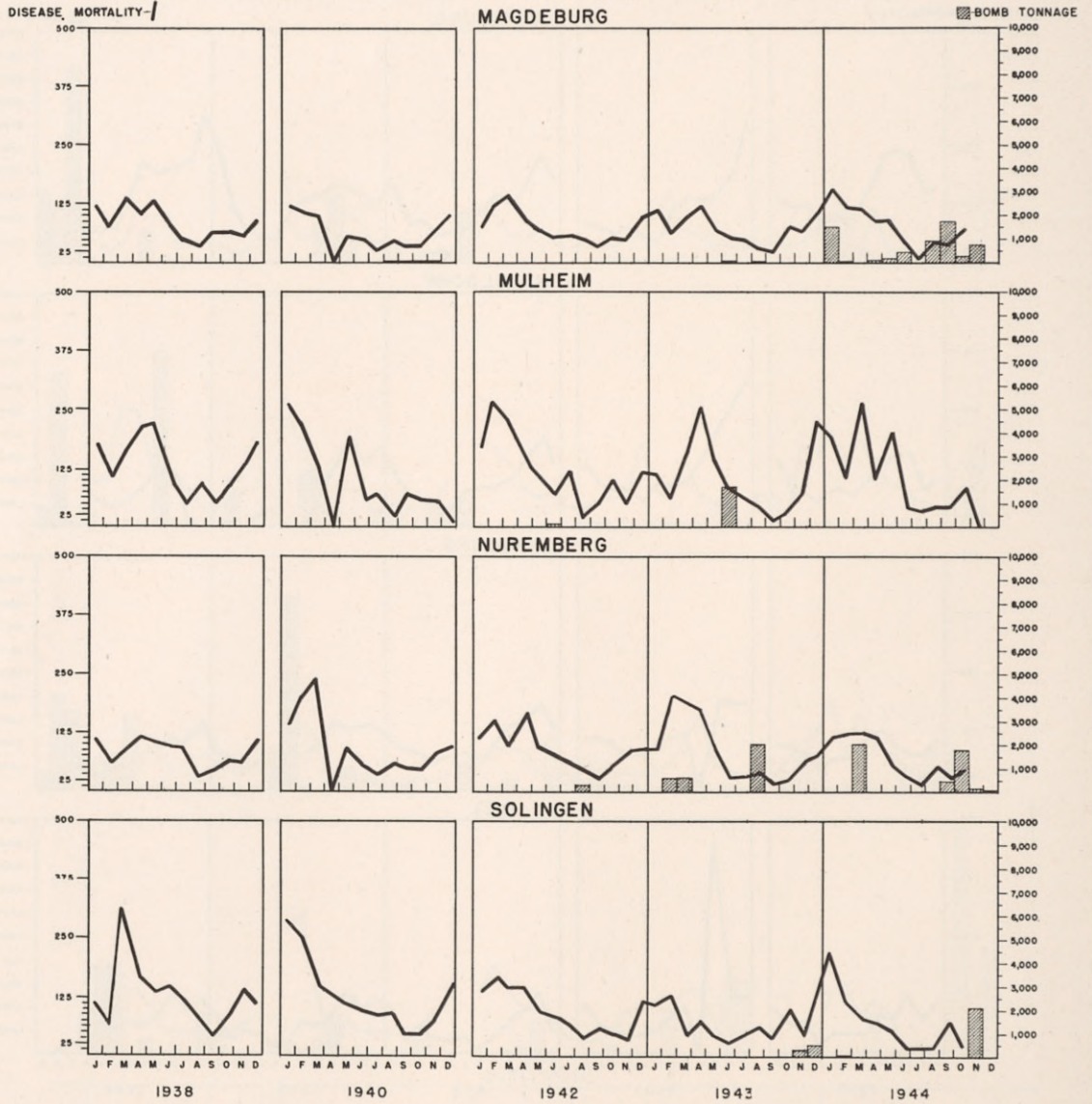


FIGURE 30 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
INFLUENZA AND PNEUMONIA
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



COMMUNICABLE DISEASES

TABLE 12. ANNUAL CASE INCIDENCE OF GASTROINTESTINAL DISEASE
IN SIX GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	15.93	16.46	14.00	51.38	23.21
Duisburg	21.31	26.87	81.27	64.57	37.24
Frankfort	19.45	21.08	18.05	21.85	5.09
Hamburg	29.66	44.77	35.62	25.10	17.17
Magdeburg	10.67	30.76	51.99	24.30	26.92
Nuremberg	15.86	34.74	26.38	25.37	34.23
Combined Cities	23.17	35.75	36.28	30.78	21.30

TABLE 13. ANNUAL CASE INCIDENCE OF TYPHOID FEVER
IN SEVEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	3.82	4.84	4.23	14.68	10.50
Duisburg	4.58	2.78	3.46	10.60	1.50
Frankfort	3.27	0.72	7.66	1.71	1.59
Hamburg	3.10	1.24	2.26	2.75	3.43
Kiel	9.22	20.41	1.39	10.45	2.95
Magdeburg	2.44	1.76	4.07	2.37	5.74
Nuremberg	1.20	0.76	5.11	3.50	4.94
Combined Cities	3.47	2.92	3.65	4.77	3.83

many cities the incidence of this so-called E dysentery increased three-fold without a change in reported morbidity or mortality rates. Infractions against the rules for boiling water were blamed for this increased incidence.

The annual case incidence of typhoid fever is given in Table 13. Nuremberg is the only city in which incidence of the disease appears to have risen during the air attack years. The other cities exhibit rates which are normal in comparison with those of 1938 and 1940 except for occasional years in certain cities, as in Bochum in 1943, Duisburg in 1943, Frankfort in 1942, and Kiel in 1943.

The case incidence of paratyphoid fever (Table 14) was high in 1942 and 1943 for the cities as a group; however, the increase occurred only in Duisburg in 1942 and in Bochum in 1943. Case rates for the other cities are fairly normal, except in Nuremberg, where the rates rose from 0.29 in 1943 to 7.06 in 1944.

The incidence of dysentery (Table 15) was higher among the cities of this set of tables than for the other three enteric diseases. The rates declined, however, during the heavy air attack years of 1942-1944. For individual cities, the reported number of cases was high in Duisburg during these

COMMUNICABLE DISEASES

TABLE 14. ANNUAL CASE INCIDENCE OF PARATYPHOID FEVER
IN SIX GERMAN CITIES IN 1938, 1940, 1942-43-44
(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	4.14	3.55	2.28	28.54	5.53
Duisburg	2.29	3.01	24.78	4.82	0.38
Frankfort	3.45	1.62	2.19	7.03	0.32
Hamburg	5.06	4.84	6.96	4.63	3.24
Magdeburg	1.22	1.76	2.03	1.78	1.32
Nuremberg	9.37	4.03	0.27	0.29	7.06
Combined Cities	4.56	3.67	6.53	6.09	2.97

TABLE 15. ANNUAL CASE INCIDENCE OF DYSENTERY
IN SIX GERMAN CITIES IN 1938, 1940, 1942-43-44
(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	5.10	8.07	7.49	7.75	6.63
Duisburg	5.73	12.74	50.37	38.23	32.73
Frankfort	12.73	12.43	5.65	13.11	2.54
Hamburg	20.96	37.80	25.98	17.32	9.32
Magdeburg	4.57	25.48	45.89	20.15	19.86
Nuremberg	5.29	29.19	19.92	19.83	16.94
Combined Cities	13.42	26.61	25.14	18.48	12.88

TABLE 16. ANNUAL CASE INCIDENCE OF BACTERIAL FOOD POISONING
IN SIX GERMAN CITIES IN 1938, 1940, 1942-43-44
(Rates per 100,000 population; annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Bochum	2.87	0.00	0.00	0.41	0.55
Duisburg	8.71	8.34	2.66	10.92	2.63
Frankfort	0.00	6.31	2.55	0.00	0.64
Hamburg	0.54	0.89	0.42	0.40	1.18
Magdeburg	2.44	1.76	0.00	0.00	0.00
Nuremberg	0.00	0.76	1.08	1.75	5.29
Combined Cities	1.72	2.55	0.96	1.44	1.62

years, as compared with 1938 and 1940, and in Magdeburg in 1942. No mention of the pathogenic organisms in question was made by any German physician interviewed.

A large bacterial food poisoning outbreak occurred in Duisburg in 1943 and another in Nuremberg in 1944 (Table 16). Aside from these two instances of high incidence, cases of this diagnosis reported were normal in comparison with rates for 1938 and 1940.

The monthly trends of case incidence of these diseases are shown for German cities in Figures 31, 32, 33, and 34. The incidence of typhoid fever rose in Bochum and Cologne following air attacks in 1943, while the epidemic in Duisburg began three months after a series of heavy bombings on the city. The incidence of the disease does not appear altered in any manner related to air raids in any of the other cities for which charts are presented in Figure 31.

Paratyphoid fever seemed to increase in a fashion more directly related to air attacks than did typhoid. Incidence of this disease was increased in Bochum, Cologne, and Frankfurt during and following months of heavy air raids. On the other hand, no increase in incidence was shown in the other cities, among which were the badly damaged cities of Hamburg and Kiel (Figure 32).

Dysentery also showed several striking increases in incidence following heavy bombing attacks. Of the nine cities included in Figure 33, only three, Dortmund, Kiel, and Nuremberg, showed no increase in dysentery after bombing attacks. However, the fact that the increases came at about the same time of the year, and in a period of high expectancy of the disease impels us to state that the indicated rise in dysentery following air attacks is coincidental rather than as a result of the attacks.

Figure 34, the last of the monthly trend charts, for bacterial food poisoning, demonstrates no particular increase in reported cases of this diagnosis and certainly none associated with the bombings of the cities. It would appear then that except for occasional outbreaks of paratyphoid fever, gastrointestinal disease was not altered in incidence during or following air raids on German cities.

Smallpox

Smallpox has been a reportable disease in Germany, and vaccination has been compulsory

since 1874. The disease has been so rare that most physicians have never seen a case, and the same held true for the war years. Sporadic cases were observed among the foreign laborers, but most persons interviewed had seen no cases at all.

Smallpox vaccination was the only compulsory vaccination in Germany. It was established by law for the entire Reich, whereas all other vaccinations and immunizations were left up to the individual provinces and states. (See Dr. Conti's explanation given in the discussion of diphtheria.)

It is of interest that in 1942 vaccinations against smallpox were discontinued upon instigation of the Reich Ministry of the Interior. In 1942 a tremendous increase in skin diseases, particularly furunculosis, was seen throughout Germany (see Chapter Five on Industrial Health), and it was believed that children with vaccinia or vaccinoid reactions would be endangered by sitting in a crowded air raid shelter, and, on the other hand, that these lesions might spread pyogenic infections among other children and among older people who were less resistant. No untoward effect was observed, and the rate of smallpox remained negligible.

Scabies—Weil's Disease—Other Diseases

In the bombed cities there was a great increase in scabies and head lice owing, no doubt, to overcrowding in the air raid shelters. The ease with which these conditions could be spread may be seen in the instance when the large underground shelter in Essen, built to accommodate 35,000 persons, was packed with 57,000 during one raid. In several cases it was reported that as many as one-third of a city's population was burdened with scabies. These conditions were also prevalent among evacuated children because of the lack of soap.

The comment on Weil's disease (spirochaetal jaundice) secured in Hamburg is interesting. Before the war, 50 per cent of all rats were infected. After the raids of 1943, very few cases of this disease were encountered in the city, it is thought because the rat population had been decimated by the bombings, or had left the city for safer areas.

No evidence exists that plague, undulant fever, psittacosis, rabies, or anthrax showed any variation from the prewar normal, nor did German medical officials express any concern about these diseases.

FIGURE 31

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
TYPHOID FEVER
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

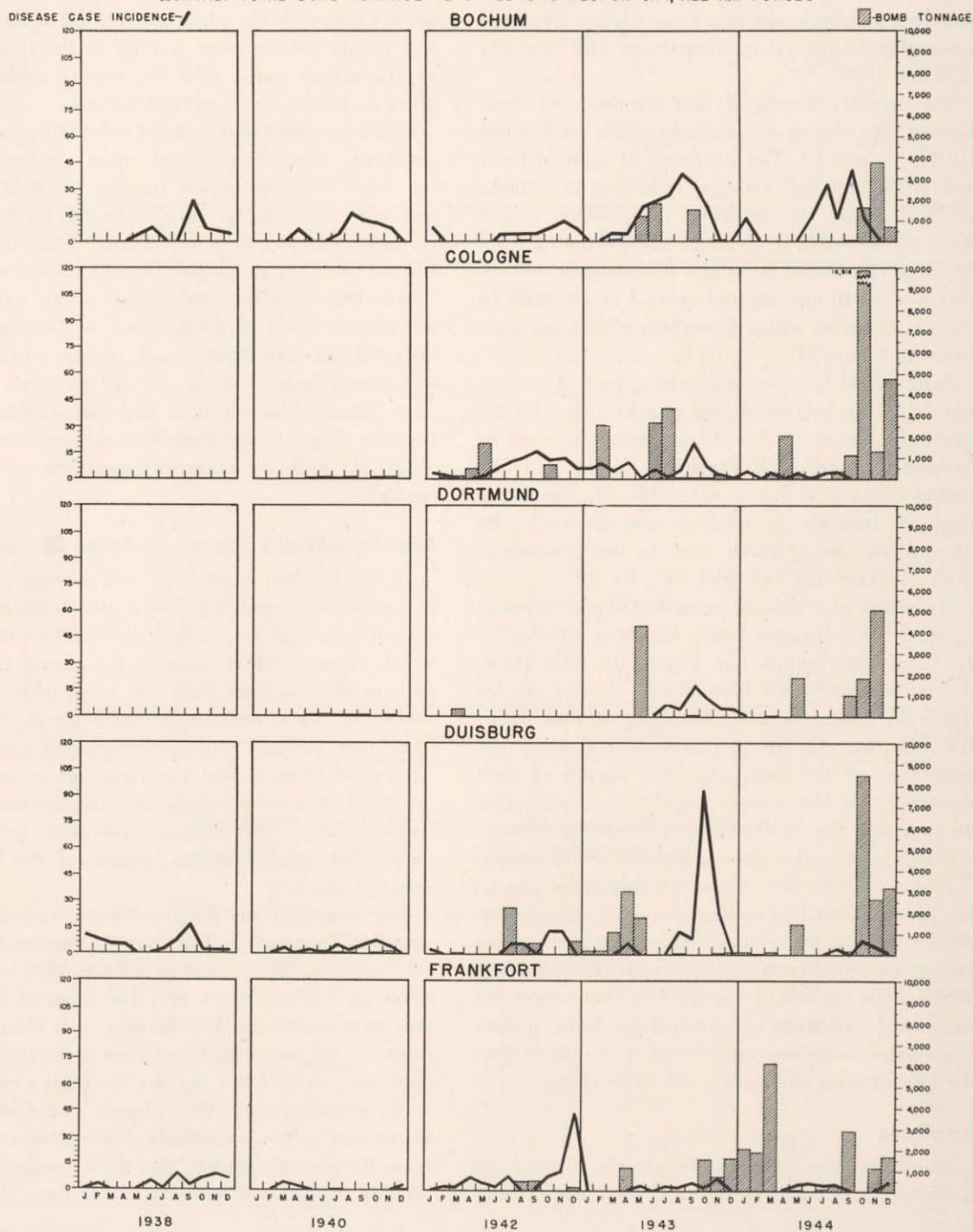


FIGURE 31 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
TYPHOID FEVER
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

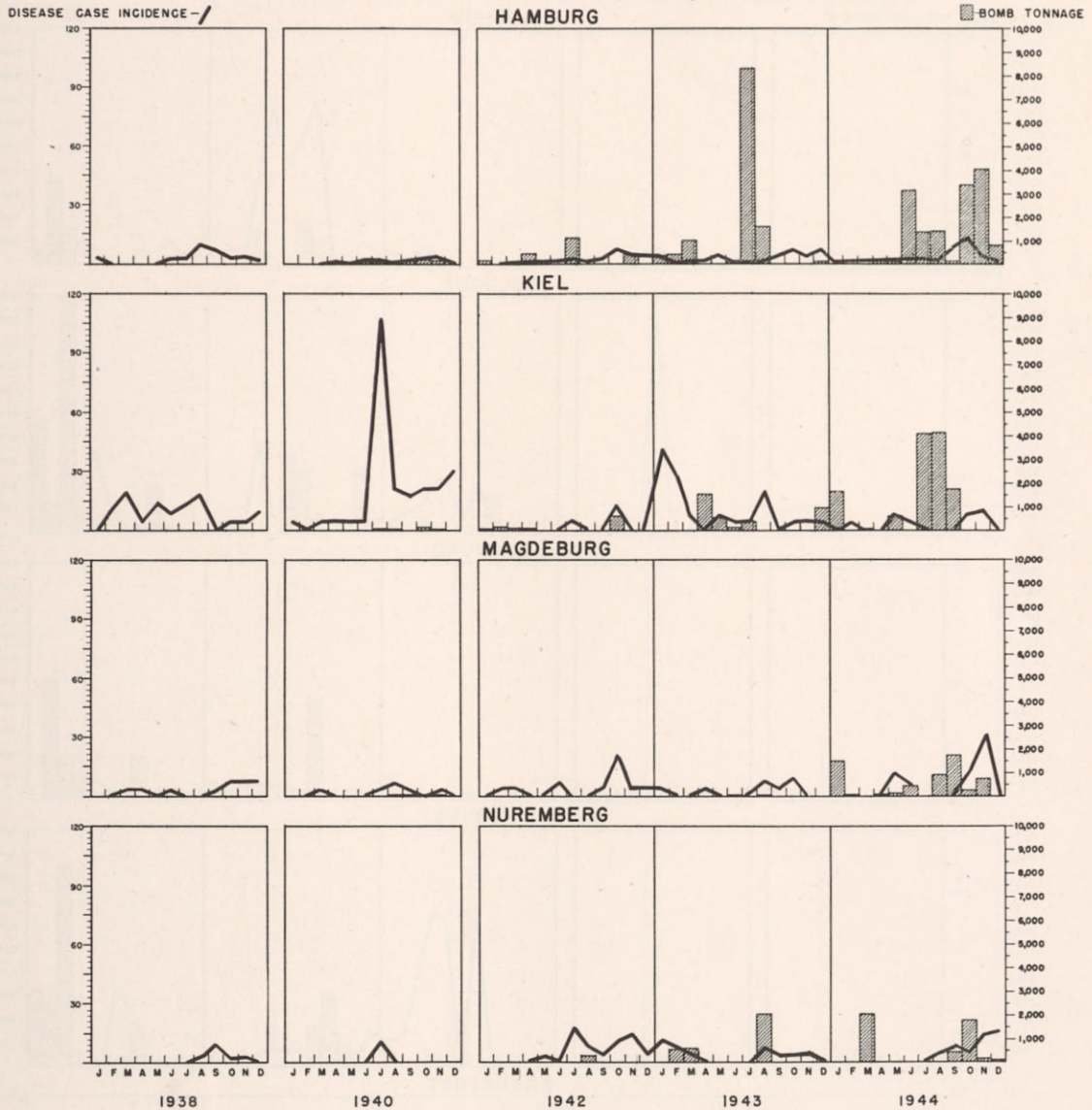


FIGURE 32

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
PARATYPHOID FEVER
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

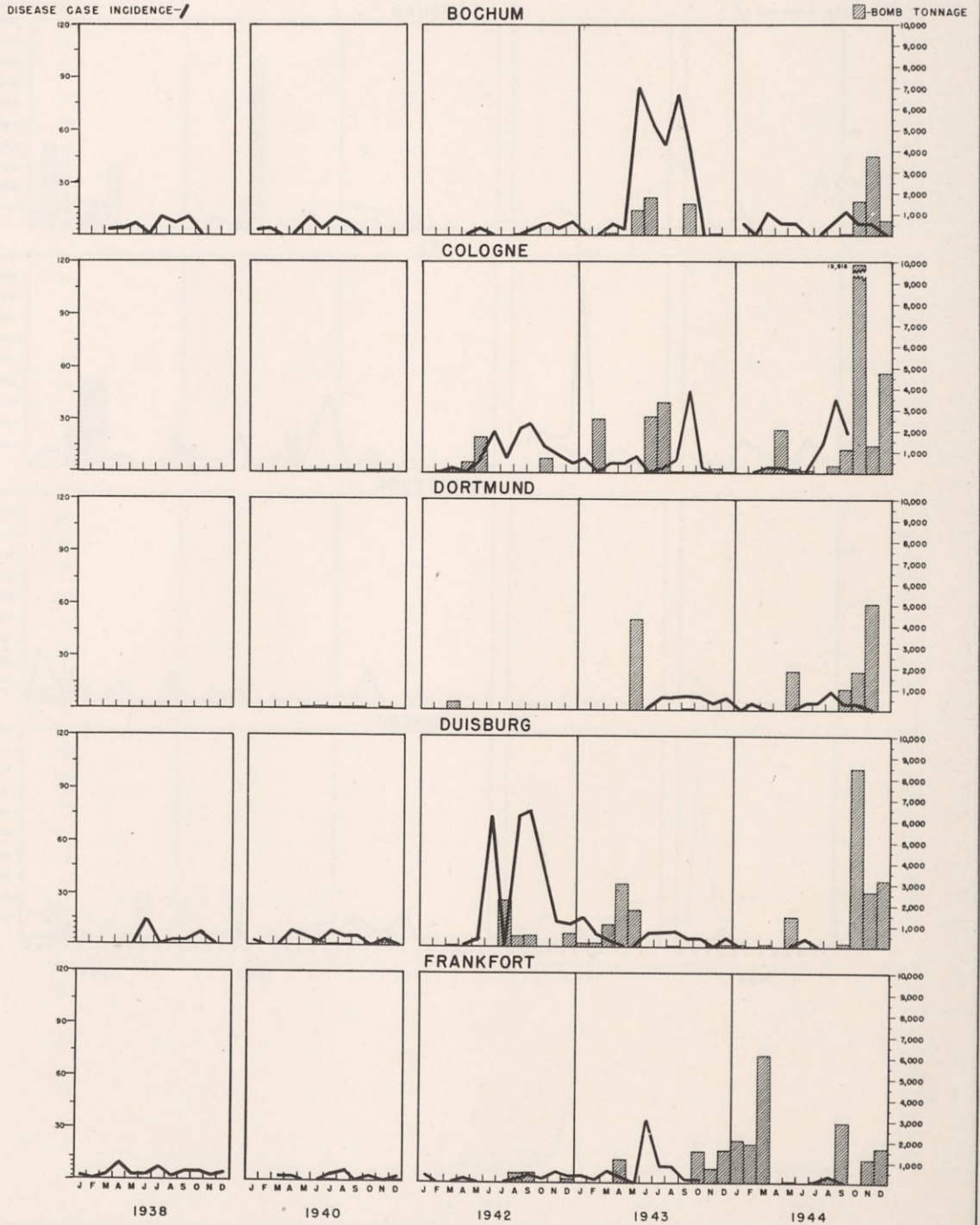


FIGURE 32 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
PARATYPHOID FEVER
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

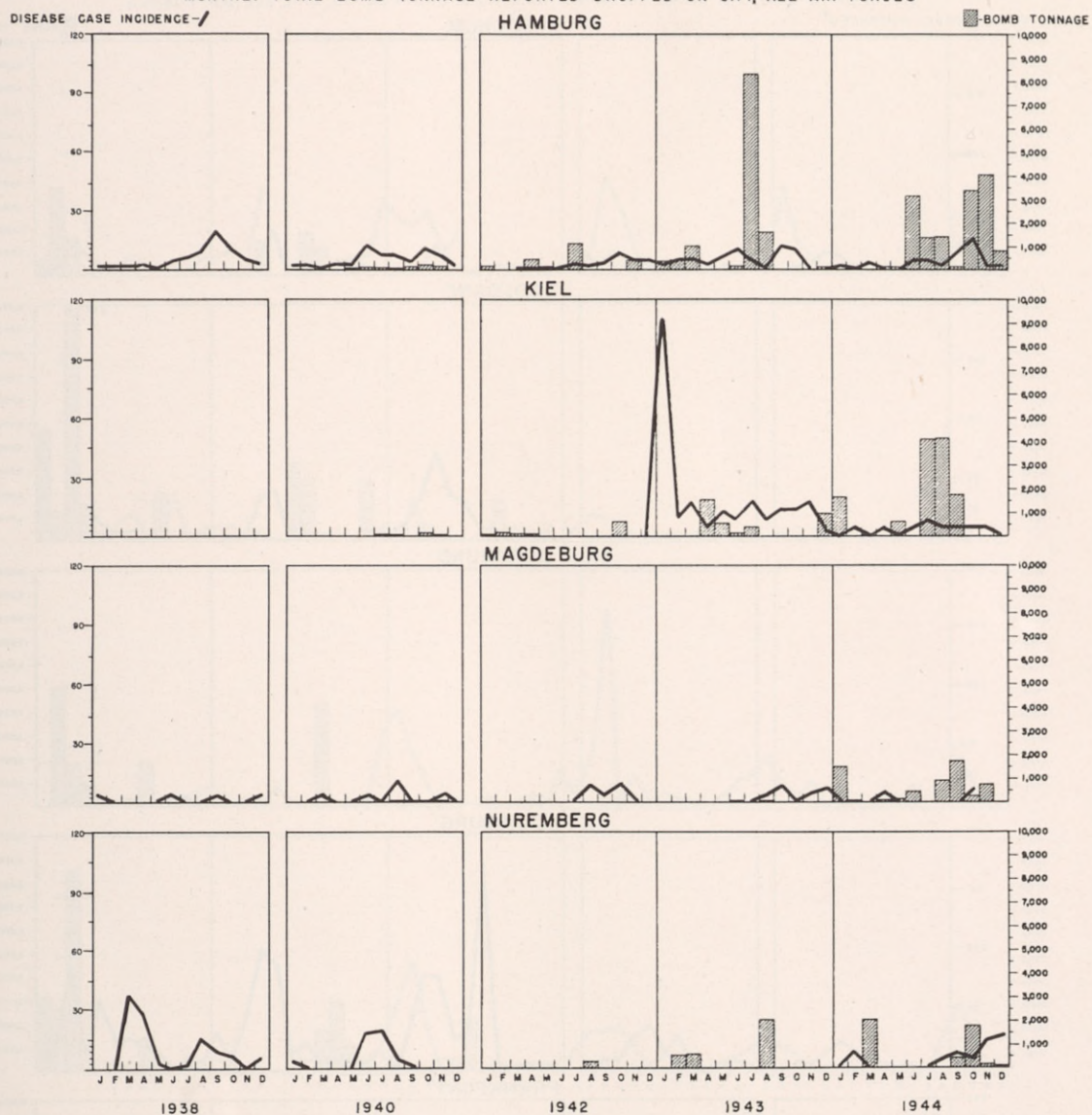


FIGURE 33

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
DYSENTERY
 IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

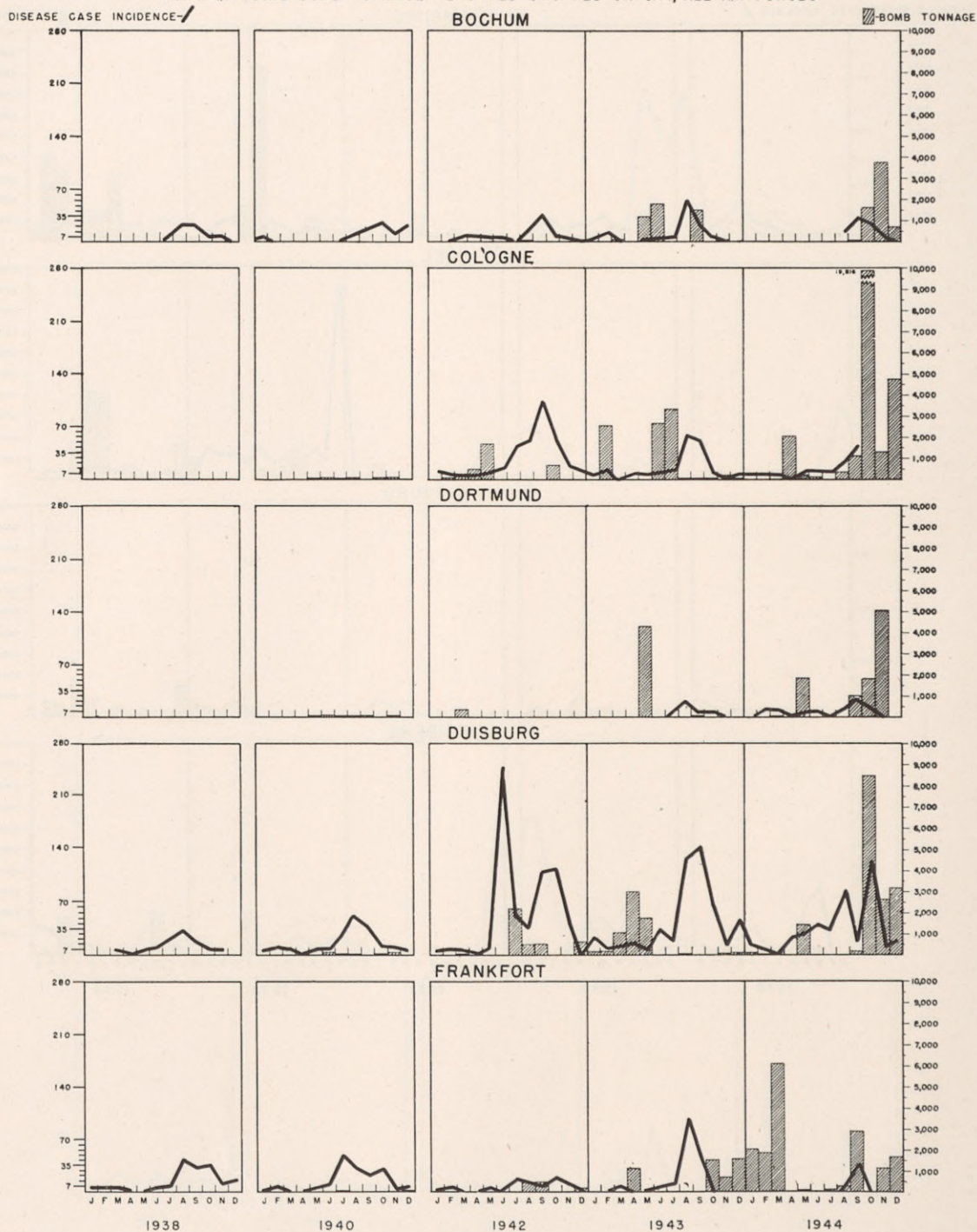


FIGURE 33 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
DYSENTERY
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

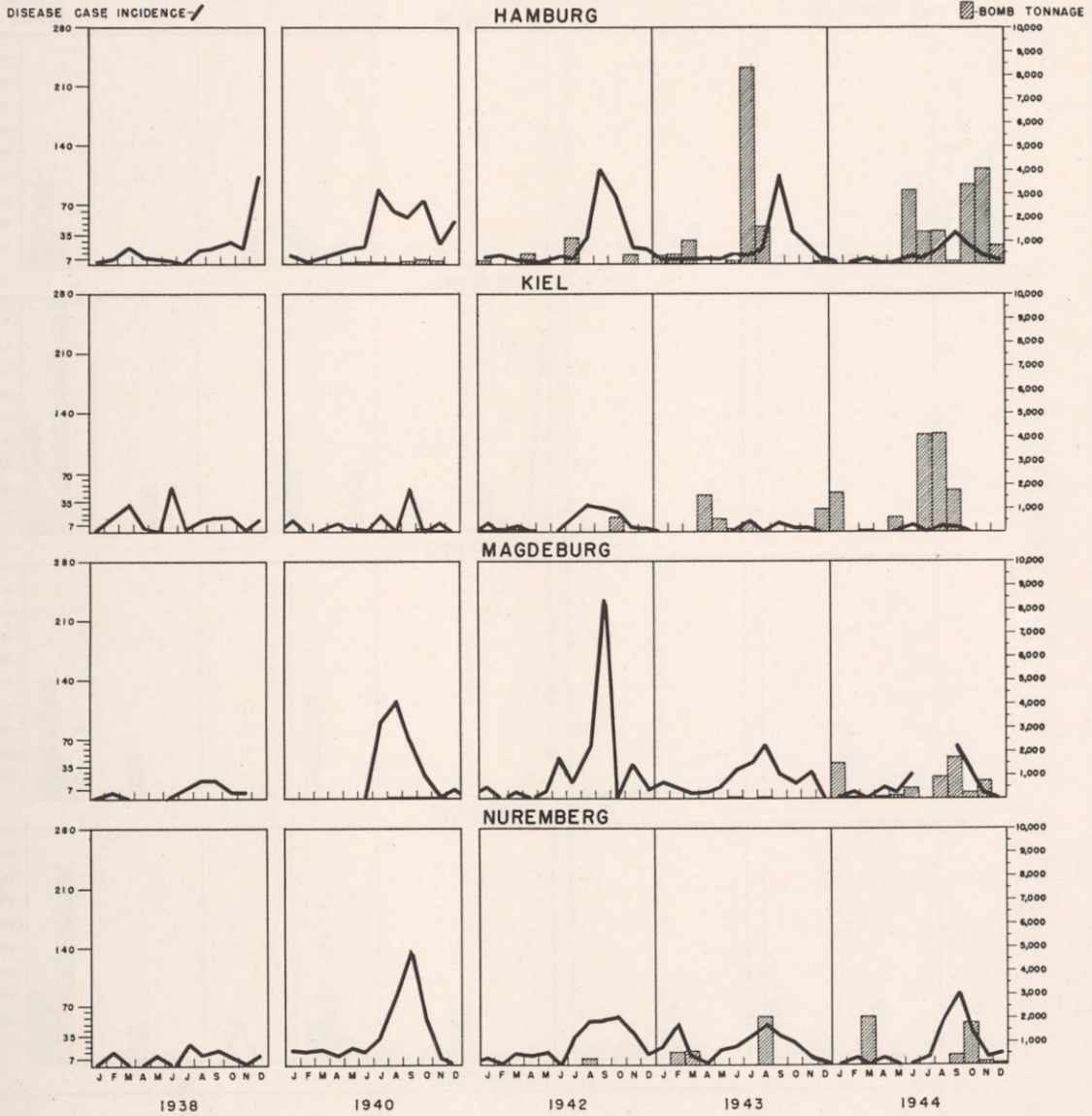


FIGURE 34

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
BACTERIAL FOOD POISONING
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

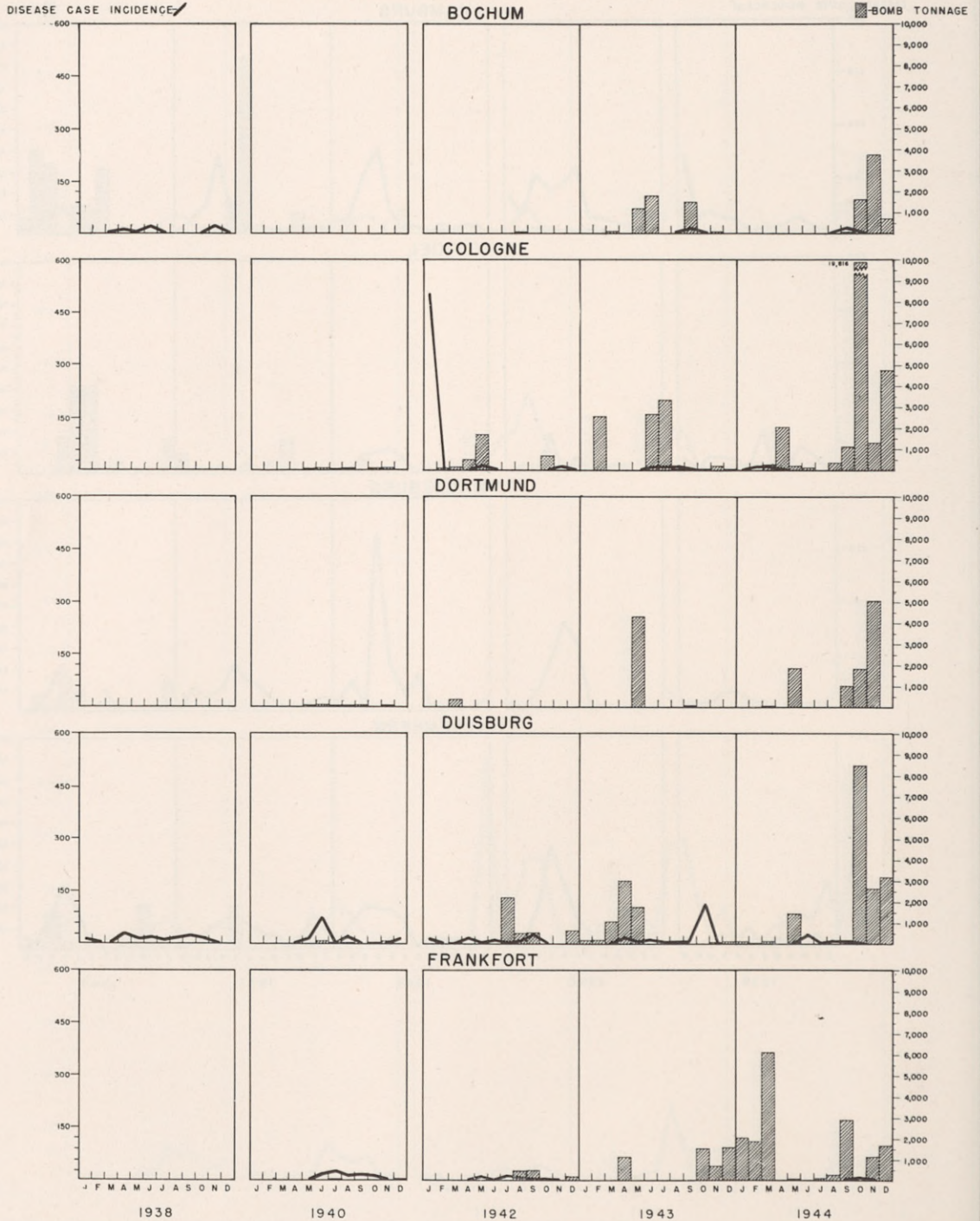
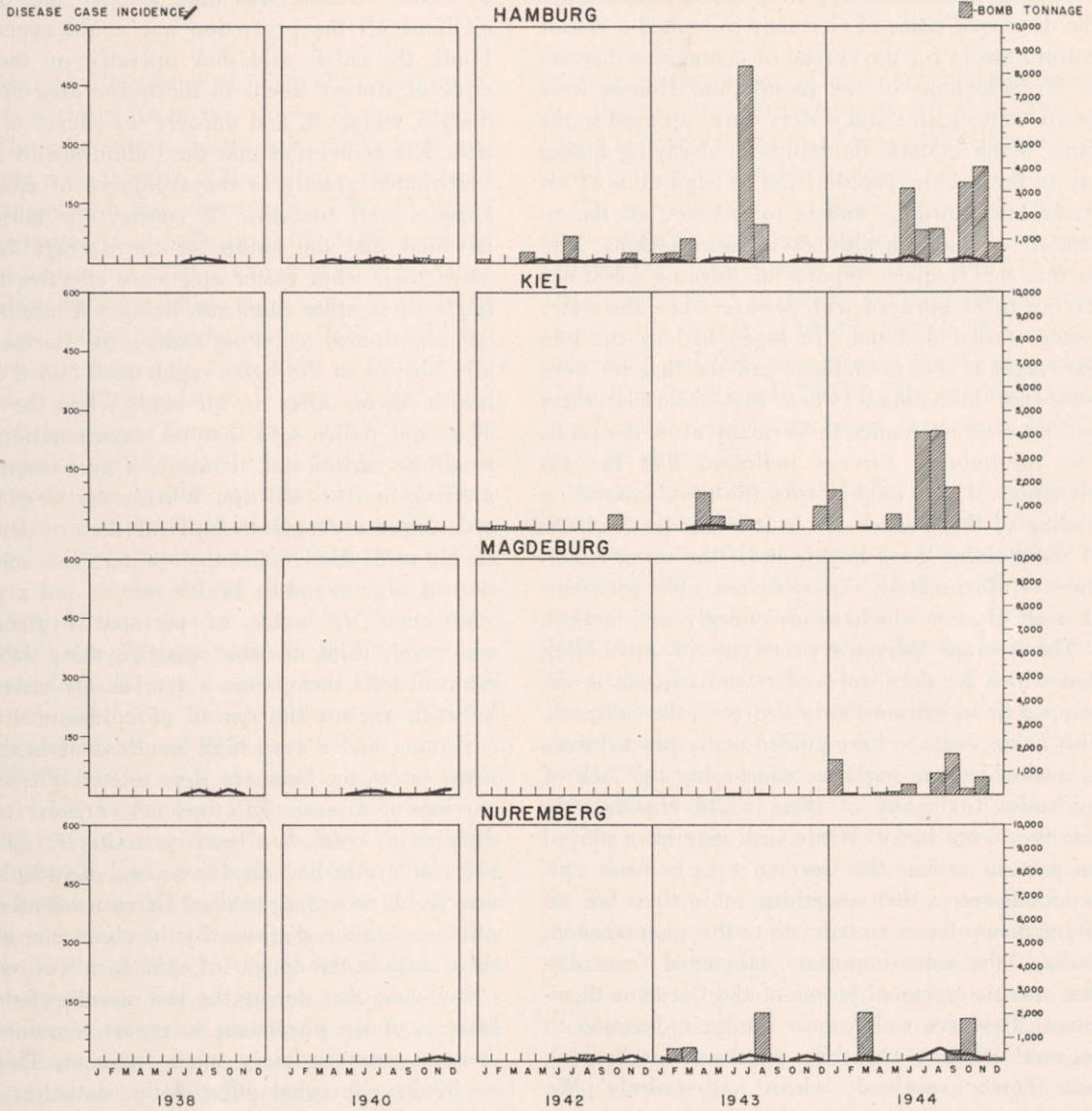


FIGURE 34 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
BACTERIAL FOOD POISONING
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



Why there were no epidemics

MAJOR C. F. ENLOE, JR.

Study of captured German documents and the bulletin of the public health service before going into Germany indicated that there had been no major epidemics in that country despite vast destruction. At first this appeared inconceivable since the destroyed cities of Germany presented a classic culture media for the spread of contagious diseases to large sections of the population. Houses were down, water mains and sewers were ruptured in the same bomb craters, thousands of decaying bodies lay in the rubble, people lived in conditions of extreme overcrowding, and in some cases, all the essentials of public health service were lacking. Add to this the frequent reports of burning buildings having to be sprayed with sewage when the water system failed and the fire hoses had to cut into the stagnant sewers and one can see that we were somewhat incredulous when first informed there had been no epidemics in Germany after the raids. The preliminary surveys indicated that the explanation of this might prove the most interesting finding of this Branch for in it might lie the basis of maintaining good health under the worst conditions. Unfortunately, we were not able to arrive at a conclusion which seems entirely satisfactory.

The average person's proclivity of attributing that which he does not understand to luck is developed to an extraordinary degree in the Germans. This habit seems to have guided many practitioners in answering our inquiries concerning the lack of epidemics for many of them could answer only that they were lucky. While luck may have played its part in saving the German people from epidemics it seems that something more than fate or divine benevolence contributed to this phenomenon. Perhaps the most important safeguard from disease was the personal habits of the Germans themselves. They are well-known for their devotion to personal hygiene and their penchant for keeping their homes spotlessly clean and orderly. We visited some of the hovels and cellars in which they lived. It was surprising to see how neat and clean these places were kept in the midst of the ruins.

The work of the *Luftschutzbund* (ARP) probably contributed greatly to the German civilians' ability to ward off contagious disease, for they made lectures on personal hygiene an important part of their training for civilians. Every civilian was required to attend a series of six lectures on first aid and personal hygiene once every three months.

These continued through the war and gave the individual a good idea of how to protect his health when all communal safeguards had broken down.

Germany had a large well-organized public health service. As explained in Chapter Seven, this organization was enlightened and powerful—and by virtue of this was able to give the German civilians all the protection one could expect. Dr. Conti, the chief, said they operated on the principle of Robert Koch: to locate the area breeding disease, isolate it, and uncover the source of infection. His contention that the public health service contributed greatly to the avoidance of epidemics appears well founded. Of course, one must keep in mind that the nature of the average German made their work easier and more effective than it might be in other countries. Being a docile individual accustomed to taking orders, the German usually obeyed to the letter regulations issued by the health officers after an air raid. When the health office and police said that rat extermination week would be carried out, it rarely, if ever occurred to a citizen not to conform. When signs were posted ordering the people to boil all their water after an air raid, they boiled their water. The combination of a good public health service and a people who knew the value of personal hygiene and who rarely think of questioning anything their government tells them, were a very nearly unbeatable bulwark against the spread of epidemic diseases.

Having had a very high standard of health for many years, the Germans were relatively free from carriers of disease. This was not entirely true for diphtheria which has been occurring in epidemic form at cyclic periods for several decades but it does hold, according to most German scientists, for other contagious diseases. By the absence or at least their scarcity the danger of epidemics was reduced.

It is true that during the last months of the war failures of the physicians to report communicable diseases were certainly more frequent. This has, no doubt, somewhat affected the statistics.

Nevertheless, the personal investigations by members of the Medical Branch failed to reveal any variation in the incidence of contagious diseases which might alter these conclusions. We believe that the air raids contributed somewhat to an increase in scarlet fever and other streptococcal infections and in paratyphoid fever, and they were largely responsible for the increase in the incidence of typhus fever, diphtheria, and scabies, and in the mortality from whooping cough.

TUBERCULOSIS

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LIEUTENANT COLONEL JOHN H. WATKINS, SANITARY CORPS, AUS

An increased incidence of tuberculosis and an increased mortality from this disease is not new in war. The tuberculosis death rate, which had been declining since the turn of the century, rose sharply in Germany with the second year of World War I and continued to a peak in 1918. After a second smaller increase in 1923 at a time of great economic instability, the tuberculosis death rate fell gradually to 60 per 100,000 population in 1939. Since that year the rate has again increased; in 1943 it was 74 per 100,000 population. Figure 35 shows the trend of the disease from 1925 to 1943. Figure 36 is a graph of the number of cases and the deaths in Germany for the period 1940 through 1943. Complete numbers of cases and deaths and reliable population data upon which to base 1944 rates for the country as a whole did not come into the possession of the Medical Branch; however, the information which was obtained indicates that the increase in tuberculosis did not continue into 1944. For example, the new cases of tuberculosis reported for the first nine months of 1944 were 98,300 compared with 98,800 new cases in the same period of 1943. Deaths from tuberculosis, however, continued to rise; 47,100 were reported in the first three quarters of 1944 as compared with 42,100 in 1943. The increase shown in the first four years of World War II was not as great as the increase in the similar period for World War I. During World War I, the influenza epidemic was in large part responsible for a large number of deaths recorded as resulting from tuberculosis, a fact which does not permit us to compare the proportional increase during World War I with that of World War II.

A distribution of the incidence and mortality of tuberculosis by age groups was not available for Germany as a whole, however Figure 37 shows the distribution by age groups for the combined districts of Frankfurt, Breslau, Stettin, Arnshagen, and Schwaben for October to January in the years 1941-1942, 1942-1943, 1943-1944. The charts show an increase at all ages in the number of cases of pulmonary tuberculosis. The proportional increase was

greatest for ages under 20 but a large and significant rise also occurred throughout the life span. The increase in deaths from other forms of the disease took place only at ages under 10 years.

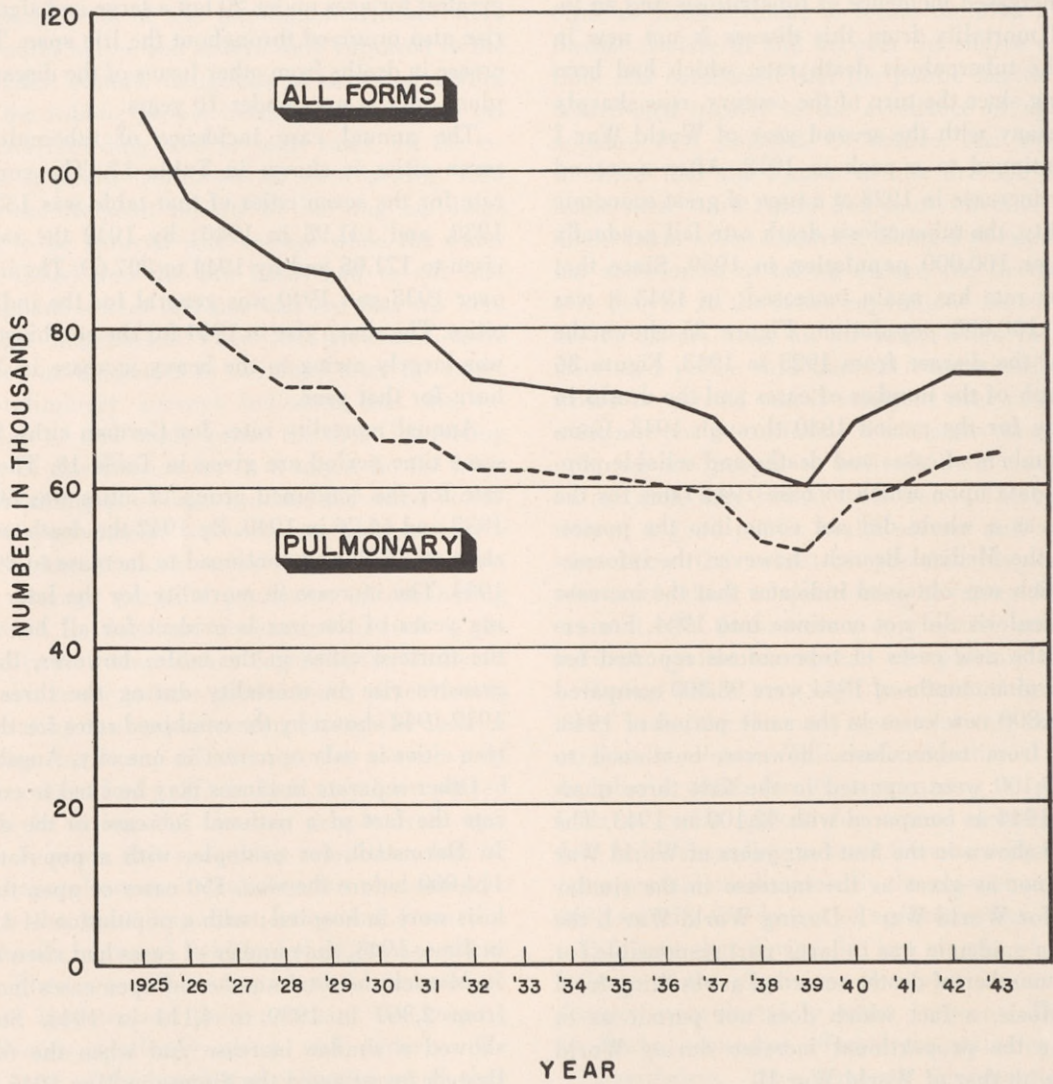
The annual case incidence of tuberculosis in seven cities is shown in Table 17. The combined rate for the seven cities of that table was 132.76 in 1938, and 141.98 in 1940; by 1942 the rate had risen to 171.05 and by 1944 to 207.60. The increase over 1938 and 1940 was general for the individual cities. The sharp rise in 1944 for the combined cities was largely owing to the heavy increase in Magdeburg for that year.

Annual mortality rates for German cities for the same time period are given in Table 18. The death rate for the combined group of cities was 60.39 in 1938 and 66.76 in 1940. By 1942 the death rate had risen to 76.22 and continued to increase to 80.57 in 1944. The increase in mortality for the later bombing years of the war is evident for all but two of the thirteen cities in the table; however, the progressive rise in mortality during the three years 1942-1944 shown by the combined rates for the thirteen cities is only apparent in one city, Augsburg.

Other separate instances may be cited to corroborate the fact of a national increase in the disease. In Darmstadt, for example, with a population of 114,000 before the war, 150 cases of open tuberculosis were in hospital; with a population of 110,000 in June, 1945, the number of cases had risen to 323. In Munich the total number of open cases increased from 2,367 in 1939 to 4,114 in 1944. Stuttgart showed a similar increase and when the Medical Branch investigated the disease in May 1945, it was reliably reported that the municipal tuberculosis clinics had under observation 2.16 per cent of all the inhabitants of that city. In communities where statistics were not available, interviews with doctors and officials in the public health departments had to be relied upon. Without exception, such authorities reported an observed increase in the morbidity and mortality of tuberculosis which was directly proportionate to the assembled data on the

FIGURE 35

THE MORTALITY RATE FROM
TUBERCULOSIS
IN GERMANY, 1925-1943



COMMUNICABLE DISEASES

Reich as a whole. In an interview with Dr. Leonardo Conti, chief of the German public health service, the over-all increase in tuberculosis was again stressed. He pointed out the return of the incidence of this disease to the high rate recorded in the economic depression of 1933 when the Nazis came into power.

Monthly trends of the case incidence and mortality of tuberculosis compared with the bombing patterns are shown in Figures 38 and 39. Little or no indication is given in Figure 38 that an immediate rise in tuberculosis followed a siege of heavy air attacks. The same is true for the charts of mortality (Figure 39). If the increase from tuberculosis throughout the country is definitely associated with the air attacks, the development of the disease must have occurred gradually and in association with other factors so that the particular effect of bombing on the cause of the disease is hidden. It is not surprising that the mortality rate of the disease fails to show a direct rise following periods of air activity, since the evacuation of tuberculosis patients to rural hospitals and sanatoriums, with no allocation of deaths back to the place of residence, prevented the inclusion of such deaths in the urban rates of tuberculosis mortality.

What were some of the factors responsible for the increase in tuberculosis during the war? The answers to this question, collected from interviews with the German health minister and with hospital and local health department doctors throughout Germany, are remarkably consistent.

One of the reasons is the fact that beginning in 1942 a national campaign under the auspices of the *Roentgen Abteilung der Waffen SS, Roentgen Sturmband* started a program for the fluoroscopic examination of every German citizen which turned up many new cases. According to Dr. Conti, some 15,000,000 people were examined. The system used was to fluoroscope whole communities at a time; inhabitants above preschool age reported to the examining station, usually a school, on several consecutive Sundays. For example, in Stuttgart, 98 per cent of the population were thus examined. In doubtful cases or in cases where there was obvious pathology, roentgenograms were made. Such a mass screening of course brought to light many inactive and open cases which had hitherto been undetected and which, when reported, swelled the statistical total, especially for the years 1942 and 1943. This procedure could pick up only the cases of pulmonary tuberculosis and since there was also a known increase in extrapulmonary tuberculosis, this mass fluoroscopy campaign is not the only factor which must be considered in evaluating the over-all picture.

The second most commonly voiced cause was the poor nutritional state of the people as manifested by almost universal weight loss. Although there was little evidence of actual malnutrition or starvation (see Chapter Eleven), the lack of fats in the diet, and in the later years of the war a diet barely adequate in the amount of other foodstuffs, with a consequent lowering of caloric intake, would

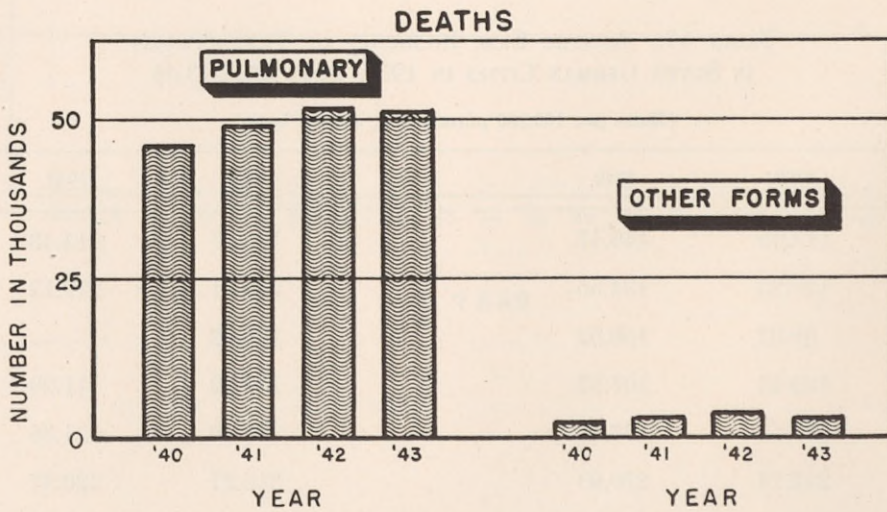
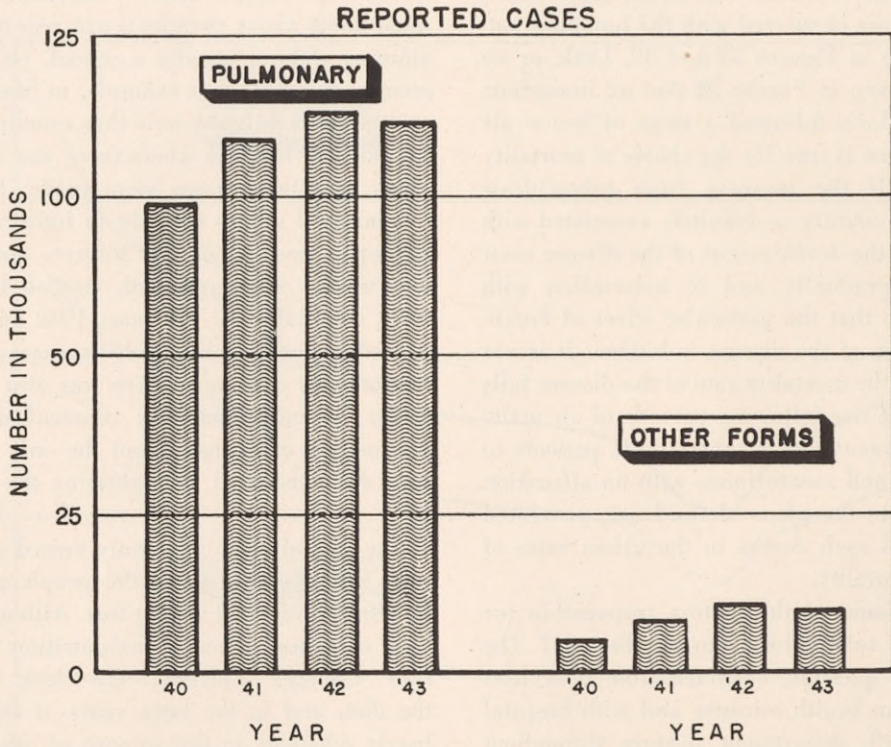
TABLE 17. ANNUAL CASE INCIDENCE OF TUBERCULOSIS
IN SEVEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

City	1938	1940	1942	1943	1944
Bochum	113.06	140.47	198.37	214.48	236.57
Duisburg	123.25	184.56	279.81	219.12	252.79
Frankfort	89.82	160.52	189.12	—	191.73
Hamburg	128.43	107.32	110.59	111.29	164.45
Kiel	207.62	173.46	218.59	331.36	260.31
Magdeburg	242.74	270.93	316.27	320.37	404.71
Nuremberg	100.18	86.07	114.13	105.25	111.53
Combined Cities	132.76	141.98	171.05	174.50	207.60

FIGURE 36

CASES AND DEATHS
DUE TO
TUBERCULOSIS
REPORTED IN GREATER GERMANY, 1940-1943



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TABLE 18. ANNUAL MORTALITY FROM TUBERCULOSIS
IN THIRTEEN GERMAN CITIES IN 1938, 1940, 1942-43-44

(Rates per 100,000 population; annual basis)

City	1938	1940	1942	1943	1944
Augsburg	47.59	54.12	53.94	58.94	76.66
Bochum	70.70	93.65	114.01	108.46	112.96
Bremen	69.90	79.05	82.09	83.25	81.14
Cologne	61.35	69.45	79.03	111.81	89.17
Dortmund	66.11	80.01	87.38	81.86	119.12
Duisburg	71.48	78.04	108.19	104.42	124.41
Duesseldorf	59.40	56.40	65.45	77.76	72.90
Hamburg	56.15	58.83	66.83	61.01	66.90
Kiel	53.31	48.83	39.84	39.72	26.56
Magdeburg	56.95	55.36	80.16	81.80	79.34
Mulheim	57.60	56.29	55.22	46.60	49.43
Nuremberg	61.50	80.29	87.21	81.34	81.06
Solingen	43.69	56.25	71.35	68.92	81.65
Combined Cities	60.39	66.76	76.22	77.17	80.57

tend toward a borderline nutritional state. This was especially true with young people who had to do harder work in factories and on farms than they were accustomed to. It is not surprising, therefore, to find it is in this group that the increase in tuberculosis is most noticeable. Quiescent cases were not infrequently activated from this cause. No supplements to the normal food ration were granted to persons exhibiting a predisposition to tuberculosis. Indeed, no added food allowance was granted unless a diagnosis of tuberculosis had actually been made and confirmed by the municipal tuberculosis clinic.

The increase in deaths from other than pulmonary forms of tuberculosis at ages under 10 years, shown in Figure 37, indicates that an increase in bovine tuberculosis occurred among children. This increase was brought about by a breakdown in the sanitary precautions for the production and distribution of milk.

Another factor frequently cited was the poor living conditions resulting from air raid damage: exposure to the elements, crowding in damaged houses




and cellars, and lack of facilities for the maintenance of good personal hygiene. The number of upper respiratory infections increased, and occasionally precipitated an active tuberculosis. The mental stress and strain of living under such circumstances and the lack of sufficient rest because of the persistent night raids and alarms were also frequently given as contributing factors.

The confusion caused by the disruption of civilian health controls following a heavy raid or a series of attacks made it extremely difficult for the authorities to exercise their tight control over the active cases of tuberculosis who were not hospitalized. There were both independent and mass migrations out of the cities, people moving from place to place within a city seeking shelter from bombed-out homes, and similar conditions which rendered it impossible for some time after an attack to trace down and locate again these dangerous carriers of disease. The most effective means of persuasion in bringing tuberculous individuals back to the tuberculosis clinics was the authority granted them to issue supplemental food rations each week to the

FIGURE 37

DEATHS FROM TUBERCULOSIS IN THE DISTRICTS OF
FRANKFORT, BRESLAU, STETTIN, ARNSBERG AND SCHABEN, BY AGE GROUPS
OCT. TO JAN. 1941-42, 1942-43 AND 1943-44

LEGEND

-  1941-42 OCT. TO JAN.
-  1942-43 OCT. TO JAN.
-  1943-44 OCT. TO JAN.

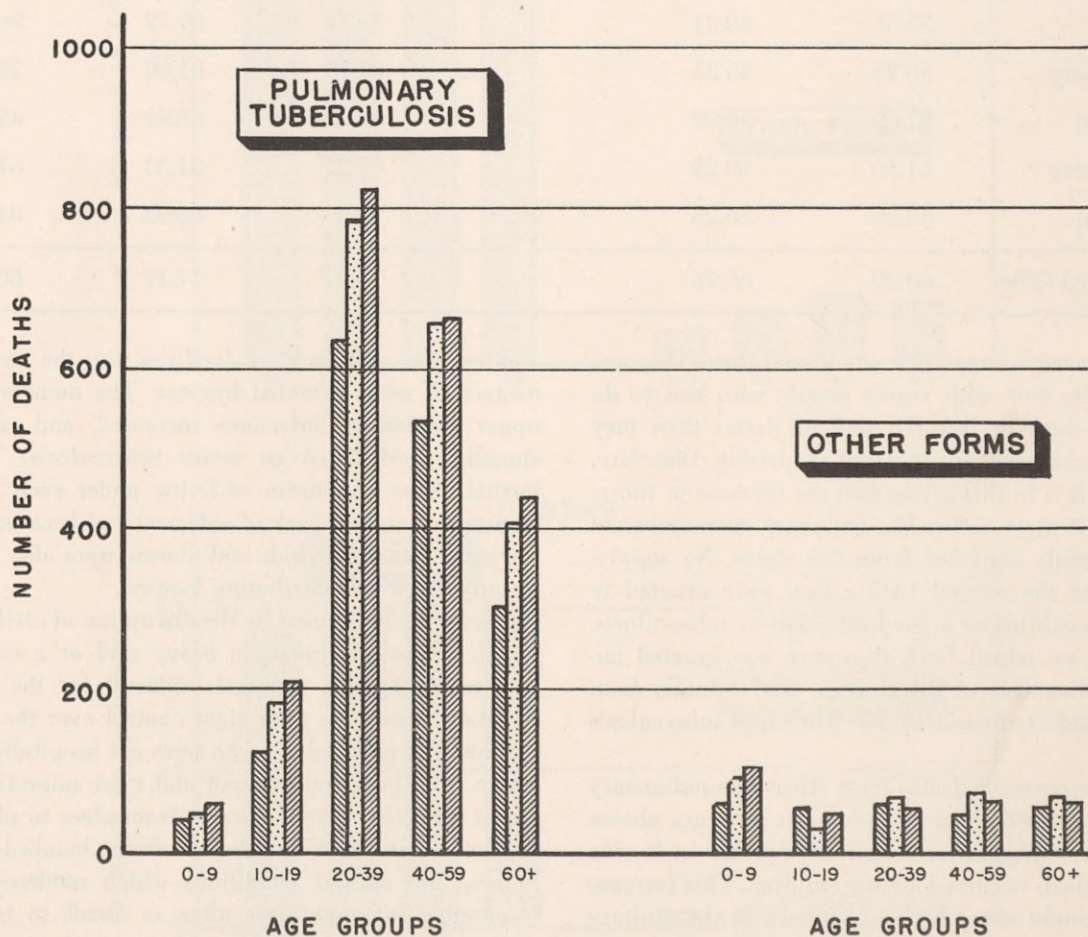


FIGURE 38

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
TUBERCULOSIS
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



FIGURE 38 (continued)

THE BOMBING EXPERIENCE AND CASE INCIDENCE OF
TUBERCULOSIS
IN NINE GERMAN CITIES

MONTHLY CASE RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

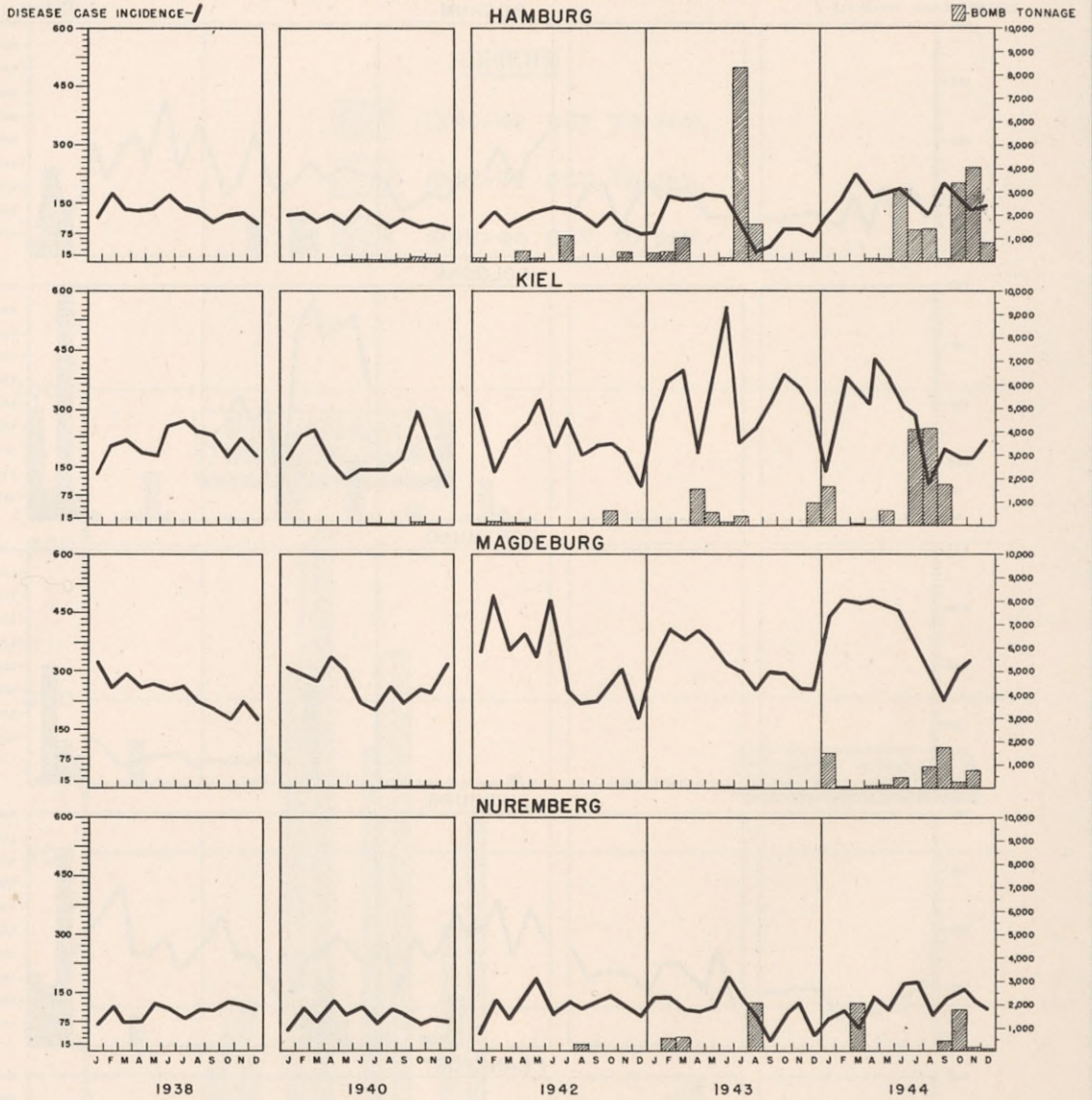


FIGURE 39

THE BOMBING EXPERIENCE AND MORTALITY FROM
TUBERCULOSIS
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

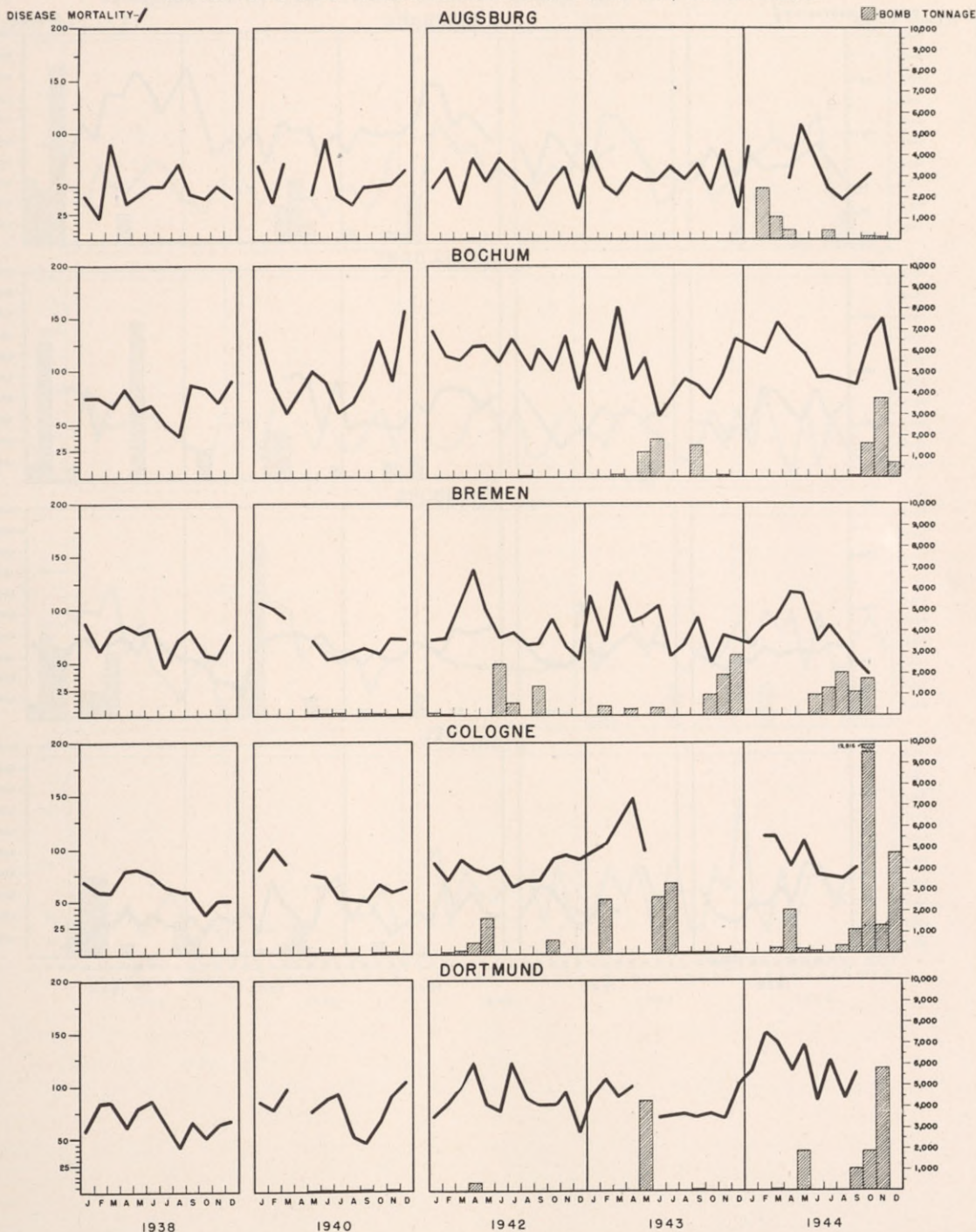


FIGURE 39 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
TUBERCULOSIS
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

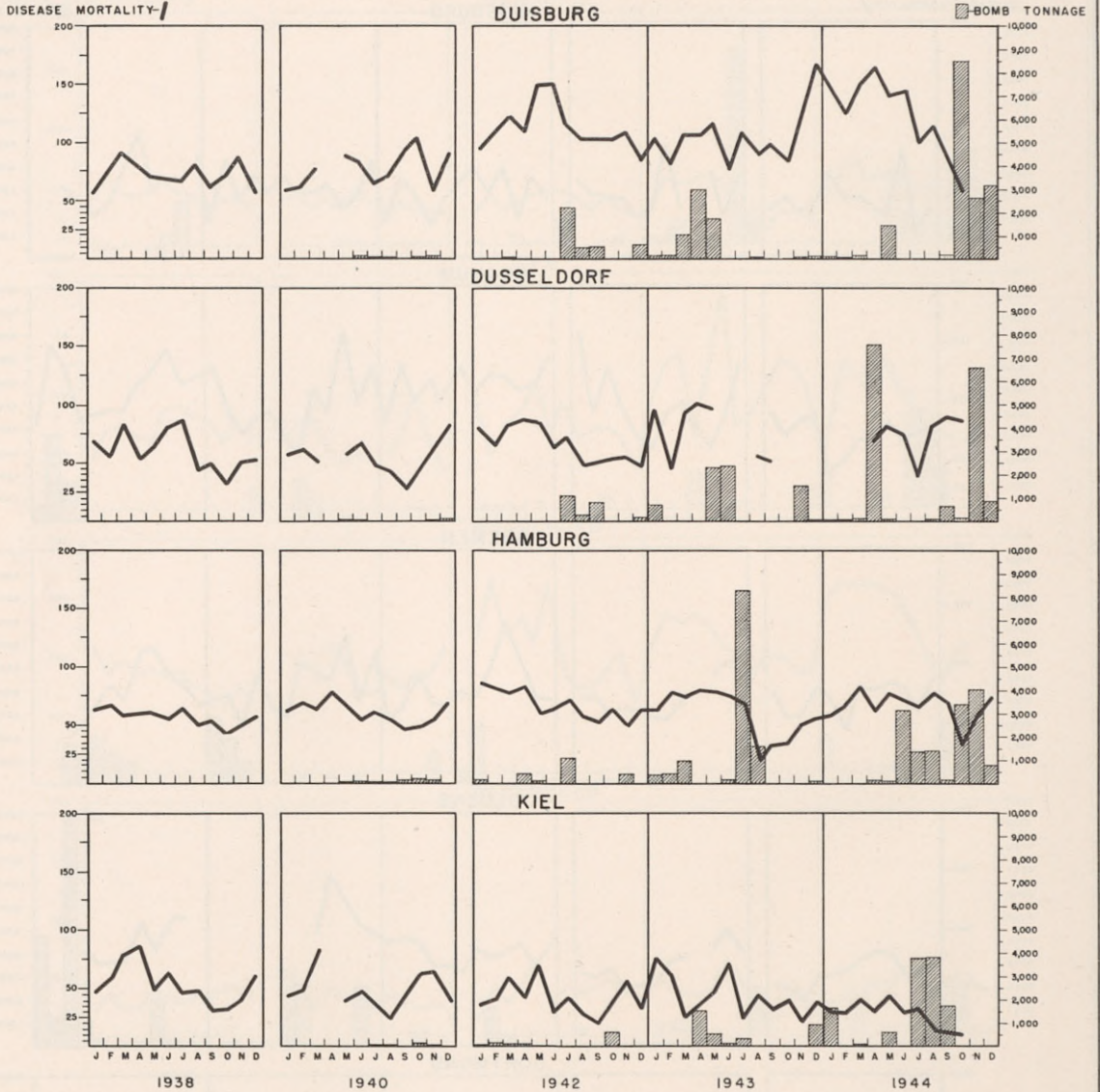
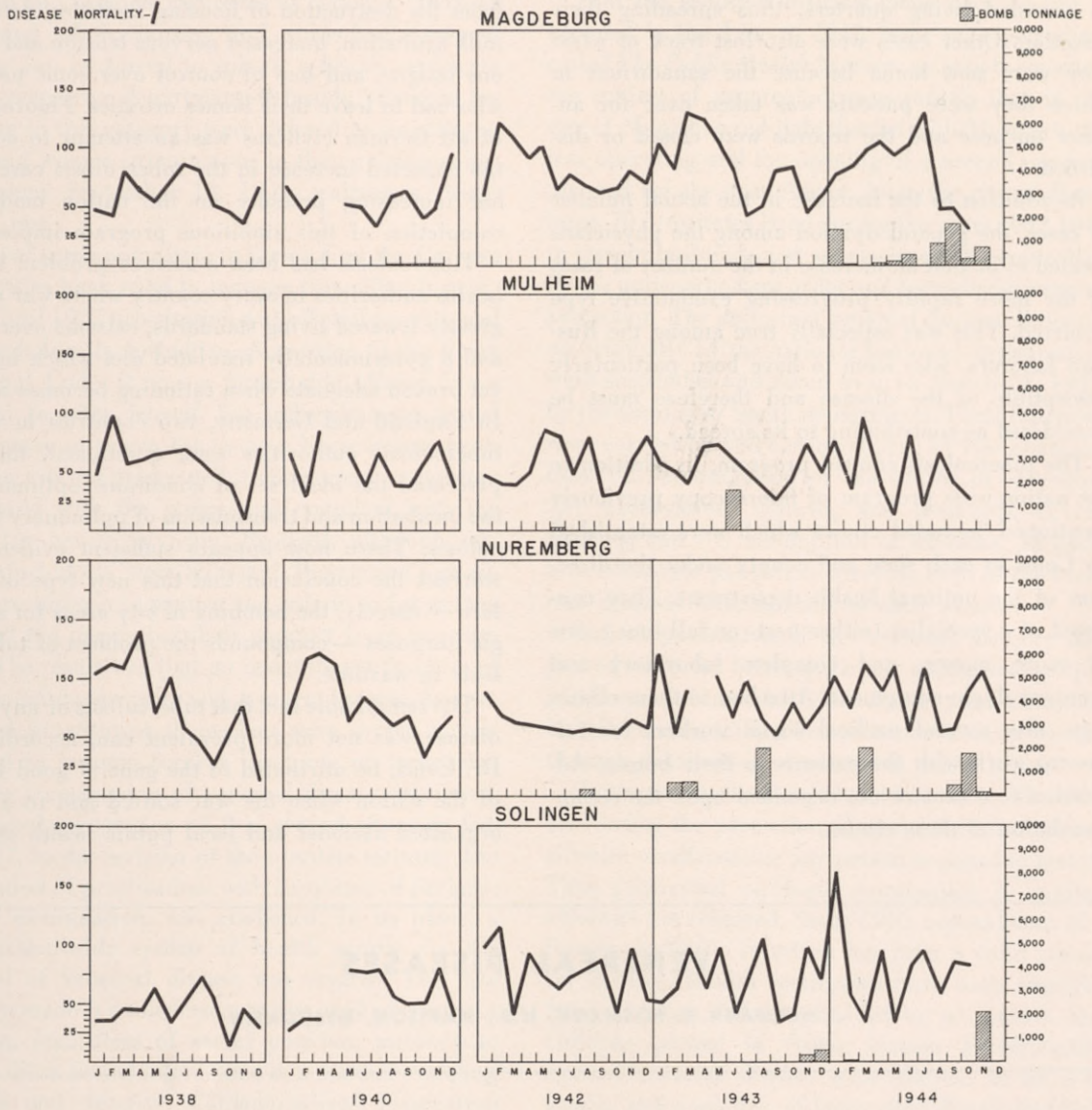


FIGURE 39 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
TUBERCULOSIS
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



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identified tuberculous patients. Another problem which the air raids imposed was that of how to protect the uninfected population in the crowded shelters. Theoretically, a person ill with open tuberculosis was prohibited from entering the public air raid shelters. Despite this they were often thrown into close contact with people in these shelters and in crowded living quarters, thus spreading their infection. Other cases were also lost track of when they were sent home because the sanatorium in which they were patients was taken over for another purpose and the records were closed or discarded.

In addition to the increase in the actual number of cases, the general opinion among the physicians seemed to be that an increase in the number of cases of the more rapidly progressing exudative type occurred. This was especially true among the Russian laborers, who seem to have been particularly susceptible to the disease and therefore must be considered as contributing to its spread.

The tuberculosis control program, in addition to the nation-wide program of fluoroscopy previously mentioned, included clinics which were established by Conti in each state and county under the direction of the national health department. They consisted of a specialist (either part- or full-time), one or more nurses, and complete laboratory and roentgenologic equipment. Attached to these clinics were also several medical social workers for follow-up work with the patients in their homes. Admission to a sanatorium depended upon the recommendation of these clinics.

Summary

An increase occurred in the number of cases of tuberculosis reported in Germany after the outbreak of the war. Some of the causes for the increase which can be attributed indirectly to aerial bombing are: crowding in air raid shelters, exposure to the elements, poor housing conditions resulting from the destruction of housing facilities, defective milk sanitation, increased nervous tension and nervous fatigue, and loss of control over some patients who had to leave their homes or cities. Fluoroscopy of all German civilians was an attempt to control the expected increase in the tuberculosis case rate, but increasing pressure on the nation made the completion of this ambitious program impossible.

Tuberculosis has been a serious problem to the health authorities in every country where war meant greatly lowered living standards, extreme overwork, and a governmentally regulated diet which has not yet proven adequate when rationing becomes severe. In England and Germany, two countries in which tuberculosis authorities were questioned, the war presented the ideal set of conditions optimum for the incubation and transmission of pulmonary tuberculosis. There now appears sufficient evidence to warrant the conclusion that this new type of warfare — namely, the bombing of city areas for strategic purposes — compounds the problem of tuberculosis in wartime.

The remarkable fact that tuberculosis or any other disease was not more prevalent can, according to Dr. Conti, be attributed to the general good health of the nation when the war started and to a well-organized national and local public health service.

VENEREAL DISEASES

HERMANN K. ROSMANN, M.D., MADISON, WISCONSIN

Throughout the German Reich communicable diseases, occupational diseases, crippling conditions, and abortions are reportable. Reporting of venereal diseases, however, was never required. Nevertheless, the national law of February 18, 1927, which concerned the control of venereal diseases, under certain circumstances obligated the physician to report to the health department patients who either discontinued venereal disease treatment or observation, or

who by reason of their occupation or personal conduct especially endanger other individuals.

To increase the efficiency of control, on September 18, 1939, the Minister of the Interior ordered that in each case of confirmed venereal disease the source of infection must be investigated immediately and thoroughly. Health departments, venereal disease clinics, and physicians were obligated to fill in a special form which enabled the authorities to find

the person in question. Professional secrecy had to be strictly observed. Destitute patients were entitled to free treatment provided for by public means. On the other hand, severe punishment was in store for an infected person who knowingly spread a venereal disease.

Paragraph 4 of the law refers to clandestine prostitution and brothels and reads as follows: "Persons suspected of harboring and spreading venereal disease can be forced to submit a health certificate to the respective department of health." Persons belonging to this category were defined as prostitutes, men and women promiscuous in their relationships, and, since September 18, 1939, waitresses, "taxi-girls," etc.

It is of some point here to review how the German authorities have tried to manage this difficult problem. Until 1927 prostitution was officially sanctioned although legally forbidden. According to the Reich Criminal Code, it was a punishable offense for a woman to offer herself for indiscriminate sexual intercourse in return for money. Nevertheless, prostitution was not prosecuted if the woman in question registered with the police and complied with the rules for her supervision. Brothels, although officially forbidden, were tolerated. Regulation was applied exclusively to women and only in so far as they derived the means for their support from prostitution. The result was that an insignificant fraction of the promiscuous men and women became known. Women prostituting themselves were driven underground to become forever the tools of racketeers, and the transmission of venereal disease continued.

General recognition of this absurd situation led, in 1927, to the revision of the obsolete statutes. The regulation of prostitution, with its system of periodic health examination, was abolished. In its place, a new nation-wide system of health service for the control of venereal disease was created. The new statutes made it a misdemeanor for anybody, man or woman, regardless of social position, publicly to solicit illicit sexual intercourse in a manner violating morals and decency. Commercialized fornication was prohibited in close proximity to schools and churches, in apartments where children were living, and in communities with fewer than 20,000 population. The operation of brothels and similar houses, such as the so-called "massage parlors," and of special streets and red-light districts was forbidden. Police assisted the official health departments in operating the health service, and in the protective custody of people without shelter and of youths in

danger of becoming delinquent. The Nazi regime, in the belief that these regulations contributed toward "immoral behavior," took countermeasures: they reintroduced weekly health examinations of known prostitutes and strengthened the powers of the police in supervising streets and restaurants for manifestations of immorality.

That the red-light districts came back to life is revealed in the June 5, 1942, issue of a periodical called *The Public Health Service*; an article covering the subject of venereal disease reveals that in the city of Munich, a red-light district with 54 prostitutes was operating and the opening of a second one was planned for the near future. As to the city of Hamburg, 70 prostitutes lived during the years 1942-1943 in certain buildings and streets especially controlled by the police who kept order and furnished necessary protection. The important venereal disease clinics set up originally by the national insurance organization were suspended and taken over on March 31, 1943, by the municipal health departments. Their functions were carried on and consisted of: (1) free examination, (2) investigation of the source of infection, (3) observation, control, and treatment of the patients, and (4) assumption of expenses. In addition, elaborate pamphlets covering each of the venereal diseases were handed to each patient.

But, as prevention of the venereal diseases still proved to be the better policy, a widespread propaganda was initiated by education in public schools, by talks and lectures given to women's societies, and through distribution of posters in public places.

Furthermore, the Reich law of October 18, 1935, concerning the protection of racial health, required a health certificate for any person engaged to marry. Thus premarital serologic examination is implied although not required. Since 1940, concealment of a former syphilitic infection has been a valid reason for divorce. Health certificates have been required for wet nurses, infants attended by wet nurses, and children placed in foster homes. Prophylactics against venereal disease were allowed to be sold legally and a number of large cities distributed prophylactics free of charge through their first aid stations.

Nation-wide surveys taken by the government in 1927, 1934, and 1940 revealed the prevalence of venereal disease. Based on the evaluation of the findings for the year 1927, a yearly admission rate of 400,000 newly infected cases was calculated, but by 1934 the number of fresh cases was reduced to 225,000, and at the end of the first war year, 1940,

COMMUNICABLE DISEASES

the number was further reduced to 170,000 despite the rampages of the war.² According to Conti, in the coming years it was planned to study the situation locally, including the cities of Munich, Frankfort, and Hamburg; later on a national survey was to complete the regional findings.

In the October 11, 1941, issue of *The Public Health Service*, a lecture published by Dr. Keim, a high official in the public health service, listed the most important conclusions about venereal disease as:

1. The results in discovering the sources of venereal diseases were still not too satisfactory despite the fact that compulsory reporting was resorted to. For instance, in Munich in the year 1940, 78 reported infection-spreading persons could not be found. In the year 1941, 99 such individuals could not be found.

2. In 1940, 90 persons were listed in Munich as possible infection carriers; in October, 1941, 471.

3. In October, 1941, 236 promiscuous individuals were under observation by the Munich health department. In the year 1940, in Munich, 1,414 persons were examined as venereal disease contacts; 204 or 14.4 per cent of the diagnoses were positive on the first examination.

4. A national census conducted in Germany in June, 1940, revealed these figures, given as rates per 10,000 inhabitants:

<i>Venereal Disease</i>	<i>New Cases in Germany</i>	<i>New Cases in Munich</i>
Syphilis in men	4.3	3.5
Syphilis in women	3.6	4.3
Gonorrhoea in men	25.1	19.0
Gonorrhoea in women	12.9	16.3
Soft chancre in men	0.5	0.6
Soft chancre in women	0.1	0.0

In Munich the rate of venereal disease in men was

20 per cent below the national average; the rate of venereal disease in women exceeded the national average by 20 per cent.

Valuable information regarding venereal disease during the war years was given by the city health department of Munich on May 31, 1945. The report reads: The city health department performed in the last years approximately 10,000 examinations for venereal disease. New cases of gonorrhoea stayed between the yearly average of 700 to 800. Even during the war, the number was kept at the same level. The situation differs in regard to syphilis. During the years 1939 to 1942, the number of new infections remained the same but in 1943 new infections increased by 110 per cent. In 1944, another 60 per cent increase above the 110 per cent was noted. Specialists in Munich interrogated by the city health department stated that all of them observed the sharp increase in syphilis.

The conditions existing in the city of Frankfort regarding venereal disease are disclosed by the study of the reports of the sick benefit insurance exchange which are shown in Table 19.

The figures for syphilis starting in the year 1940 show a tremendous increase of 200 per cent for the year 1942. Taking 1939 as a base, gonorrhoea and other venereal diseases went up approximately 88 per cent in 1940, increased 262 per cent by 1941, and dropped 154 per cent by 1942.

In Hamburg, the health department had to face the same difficulty as in other cities for there was no law requiring registration of persons with venereal disease. Data could be obtained only by inquiry of the practicing physicians and clinics. The last survey made in the summer of 1940 did not reveal any increase of venereal disease. In 1941, however, syphilis was on the march even though an increase

TABLE 19. CASES OF VENEREAL DISEASE IN FRANKFORT, 1939-1942

<i>Year</i>	<i>Members</i>	<i>Venereal Disease</i>	<i>Men</i>	<i>Women</i>	<i>Total</i>
1939	156,210	Gonorrhoea and others	61	34	95
		Syphilis	14	15	29
1940	157,906	Gonorrhoea and others	32	147	179
		Syphilis	16	17	33
1941	166,389	Gonorrhoea and others	59	285	344
		Syphilis	46	35	81
1942	161,058	Gonorrhoea and others	39	202	241
		Syphilis	41	49	90

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TABLE 20. VENEREAL DISEASE AMONG FEMALES IN HAMBURG 1939-43
From *Ortskrankenkasse* (municipal health insurance exchange).

Year	Average Female Members	Syphilis		Gonorrhea	
		Total	Annual Cases per 100,000 Members	Total	Annual Cases per 100,000 Members
1939	145,800	93	64	266	182
1940	150,500	102	68	282	187
1941	133,200	124	93	295	221
1942	147,600	181	123	293	199
1943 (1st quarter)	147,900	64	173	76	206

of 1.3 per cent was not alarming. Gonorrhea and other venereal diseases stayed at the same level. The year 1942 showed a further increase in syphilis and a further increase in gonorrhea and other venereal diseases. For 1943, the health department stated: The physicians agree that the venereal diseases are on the increase. Women suspected of venereal disease are more frequently found infected on examination. Through destruction of the houses in the red-light districts by bombing, the original number of prostitutes was reduced to about half (350); therefore, the frequency per day per prostitute increased from 20 to 30. Prices were low, ranging from 2.50 to 10 Reichsmarks. Visitors had plenty of money and the motive in many cases was the result of the "escape mechanism." The restriction in the supply of condoms meant a further increase in venereal disease. The figures tabulated by the Hamburg health department (Table 20) confirm the presumption that a positive connection exists between the number of frequentations and the number of infections by prostitutes. Indications were that syphilis is on the increase; gonorrhea and the other venereal diseases also have increased, but only on a slighter scale.

Unfortunately, the municipal health insurance exchange stopped the assembling of statistics at the end of 1943. Statistics for the second and third quarters of 1943 are incomplete since the major attacks upon the city fell in this period, and therefore they were left out in the table.

Dr. Conti, chief of the public health service, was eager to collect information on all of Germany for the year 1942. As the general practitioners and specialists whom he asked for reports prior to this year were so overworked he approached this time the

health departments, 70 per cent of which had observed an increase in venereal disease. The investigation of rural districts made it clear that neither foreign labor nor Germans evacuated from bombed areas played any important role in spreading venereal infections. The main sources of venereal disease in remote agricultural regions were the soldiers on furlough and the convalescent members of the armed services. Dr. Conti was confident that the control of venereal disease carried out by civilian and military authorities would be effective in controlling this spread. Unfortunately, Dr. Conti was unable to cite definite figures to support his statement. Of several physicians interviewed, Dr. Voight, chief of the health department, stated that venereal disease increased considerably in the last years despite the fact that statistical reports do not show higher figures in comparison to former years (venereal disease was not reportable).

The marked difference between the increase in syphilis and the increase in gonorrhea can be explained by the fact that gonorrhea still was considered by a number of patients as a relatively harmless disease and they resorted to self medication with sulfa drugs. Prostitutes and other promiscuous individuals used sulfa medication as well.

Treatment with arsphenamine was preferred for syphilis. Physicians in charge of health insurance found that their patients showed certain minor reactions, but the doctors of a large institution which took care of sailors could not confirm this observation. Penicillin was not used for gonorrhea. The sulfonamides were used alone or in combination with artificial fever.

COMMUNICABLE DISEASES

Summary

Statistical information on the prevalence and trend of venereal disease in Germany and its relationship to the effect of bombing is scant and fails to give an adequate picture of the situation. Although the diseases appear to have increased in incidence, many factors are at work to account for the increase aside from air attacks. In common with other countries, the state of the German population during wartime, with disrupted families, a desire for release and excitement with money no longer a restrictive factor is conducive to greater sexual promiscuity with its consequent toll in increased venereal diseases. Conditions created by air attacks may have played a part in this scheme but alone can hardly be held to account for an

above-the-average incidence of these diseases.

To control clandestine prostitution with its inherent possibility of infection, even the totalitarian system was forced to reverse its original opinion and to sanction red-light districts in the larger towns.

Beginning in 1941, syphilis increased alarmingly over the level of the year 1939, by 170 per cent in Munich, by 200 per cent in Frankfurt, and by 100 per cent in Hamburg.

In Munich gonorrhoea and the other venereal diseases stayed at the same level during the war years. Frankfurt reported an increase of 262 per cent and a slight increase was reported in Hamburg over the 1939 level.

PSYCHOSOMATIC DISORDERS

CAPTAIN ASHER S. CHAPMAN, MEDICAL CORPS, AUS

Certain functional and organic diseases considered in this section derive totally or in part from conditions which are generally considered to be an important factor in their production or aggravation and which exert a psychic effect upon the individual. Disorders such as bronchial asthma and hay fever, in which allergic factors play an important role, will not be included in this discussion. Diseases of purely neuropsychiatric nature are presented in the final section of this chapter.

There are several sources of information which form a basis for the subject under discussion. Statistical data concerning psychosomatic diseases among the civilian population of Germany are meager because these diseases are not reportable. Furthermore, diagnostic errors inherent in the classification of these diseases are great, and statistics compiled from the usual sources are therefore liable to error.

The most important and reliable information was obtained from interviews with specialists in the particular fields considered. Their opinions were formed on a basis of clinical observation in the hospitals, in the universities, and in private practice before the war and during the period of war and aerial bombing. For the most part, these informants are outstanding in their fields and internationally known in medical circles.

Certain statistical material regarding the incidence of the diseases under discussion was obtained from the records of the local offices of the governmental insurance exchanges (*Ortskrankenkasse*). Diagnostic error incurred in the compilation of these data is no doubt considerable; however, the outstanding variation in the incidence of diseases before and during the war about which this report is concerned, in many instances far outweighs the inherent error in the compilation of the data. These data correlated with and reinforced the expressed opinion of the medical specialists and other medical personnel who were interviewed.

Circumstances of war and especially those conditions directly or indirectly existent incident to aerial bombardment produced a psychological environment which can be considered ideally conducive to the production of psychosomatic disorders and for the aggravation of diseases which are influenced by emotional factors.

Thus the German civilian was subjected to intermittent or almost constant threat of danger by air raids, not only a threat to himself but to his family and loved ones as well. If he escaped bodily injury or death he might find his home in ruins and the material gain of a lifetime lost. He often found it necessary to alter the accustomed pattern of his life. New and difficult problems confronted him and his

family. Frustration faced him at every turn. Fear, terror, anxiety, and grief beset him. Hope often was lost; resentment and undischarged hostility replaced the healthful course of productive enterprise as the reward of his efforts. It is evident the German civilian was placed in an environment considered ideal for the production of psychosomatic diseases. The disorders found or those which one would expect to occur under these conditions are discussed in the following paragraphs.

Gastrointestinal disorders

There was a marked increase in the incidence of peptic ulcer among the German civilian population during the war years. It was noted particularly among young people, and the incidence was greater among women than is customarily encountered.

The factor mainly responsible for this increase, according to Dr. Wilhelm Stepp, professor of internal medicine at the University of Munich, was the tension and nervousness brought on by frequent air raids. Another factor considered to be operative, according to Professor Alfred Schittenhelm of the University of Munich was a decrease in the protein and fat content in the diet. However, most authorities interviewed agreed that the anxiety, tension, and uncertainty brought about by the bombings were the greatest factors in the increase of peptic ulcer. That such was the case was evident from the few cases of ulcer formation found in areas not subjected to air raids.

The characteristic history given by patients with peptic ulcer during wartime has been described by Dr. Victor Hoffman:¹ the onset often occurred suddenly during an air raid alarm or the air raid itself in individuals who had not experienced any previous gastrointestinal symptoms. A sense of pressure or burning in the epigastrium or left hypochondrium occurred. Radiation of pain to the back or shoulder was often present; abdominal pain occurred spasmodically, recurrently, or almost constantly. Nausea, belching, and vomiting were frequent. Intermeal pain, typical of peptic ulcer, may or may not have been present; however, food usually gave relief. The course continued acutely for a period of eight days to three weeks at which time roentgenologic evidence of peptic ulcer usually could be demonstrated. From this evidence, it was apparent that these ulcers were very rapidly formed. Surgical and roentgenologic findings in these cases have been described by Professor G. E. Konjetzny of Hamburg and by Dr. Victor Hoff-

mann of Cologne. Ulcer formations described, which were seen frequently since the onset of aerial bombardment, were characteristically, although not always, located in the stomach and usually in the cardia. Often there was acute ulceration of the duodenum on the anterior or posterior wall. The acute ulcers of the stomach were penetrating in type and extended deep into the muscular wall. They were large (frequently thumbnail in size or larger), and there was little or no scar tissue formation about them, indicating the acute nature of the lesion.

Although some variance of opinion existed regarding the incidence of complications in peptic ulcer during the war years, it is probably true, according to the opinion of competent surgeons, that there was an increase in perforation and hemorrhage of peptic ulcers. These complications have been reported to occur frequently during air raids.

Analysis of cases suffering from the acute type of ulcer formation showed that gastric hyperacidity, such as is frequently found among patients suffering from chronic duodenal ulcer, usually was not present.

Analysis of data from governmental insurance groups demonstrates an unmistakable increase in the incidence of ulcer patients during the war years and especially during periods in which the particular areas were subjected to bombing. Furthermore, the areas which received little or no bombing showed little or no increase in the incidence of peptic ulcer. It is evident that the conditions brought about by war and especially by bombing contributed a psychologic factor to this increased incidence.

Gastritis was considered by many to have increased during the years of war and especially during the periods of bombing. However, the term gastritis is used rather loosely and a diagnosis of gastritis is frequently difficult. No definite statement regarding this disease is warranted from the evidence at hand.

Interrogation of German physicians concerning the incidence of ulcerative colitis was likewise inconclusive. Again the question of a proper differential diagnosis arose. No good evidence was gathered which would indicate that there was an increase in this disease during the war years.

Endocrinologic disorders

Diseases of the thyroid gland, as the exophthalmic type of goiter or Graves' disease, come first to mind in the consideration of endocrinologic diseases with

a probable psychologic etiology. It is commonly considered that emotional and psychologic factors are at least a precipitating cause for this disease. The accumulation of data on this subject was of particular interest. The incidence of this disease is far less under normal conditions than that of peptic ulcer and coronary heart disease. Consequently, variations in the incidence are of small magnitude.

The clinical experience of Professor Schittenhelm has led him to the opinion that there was a definite and considerable increase in the incidence of Graves' disease during the war years. Professor Stepp is in concurrence with this opinion, stating that the disease increased threefold since 1939. Both are of the opinion that the environmental circumstances brought about by aerial bombardment were the outstanding precipitating factors, and the poor nutritional state of the population was a secondary factor. Frequently cases of acute crisis were precipitated during the air raids. The course of the disease during the war years was extremely malignant.

Analysis of the statistical data of the governmental insurance groups concerning the incidence of thyroid diseases is not conclusive. In most, but not all areas, the incidence was increased; but because of the relatively low occurrence of this disease the increase was less spectacular than occurred in peptic ulcer. However, it was probable that a definite, moderate increase of Graves' disease occurred during the war and that aerial bombardment was a primary factor in its production.

Disorders of menstruation were extremely frequent. Dysmenorrhea, amenorrhea, and intermenstrual bleeding presented a major problem to the gynecologic clinics of Germany during the war years. Menarche (initial onset of menstruation) occurred later in life in girls during wartime. The marked increase in painful menstruation, amenorrhea, and intermenstrual bleeding was associated particularly with bombing attacks, with the evacuation of patients to outlying areas, and with various types of heavy work to which many women were unaccustomed. Dr. Linzenmeier of Karlsruhe, Professor Eymer of Munich, Professor W. Heinemann of Hamburg, and others stated that the origin of these disorders was primarily and definitely psychic; and second, that they believed that certain nutritional factors contributed to their production.

Psychic impotency among men was rare. On the contrary, increased sexual desire was present, as evidenced by a rise in prostitution and in the venereal

real disease rate. The relationship of these disorders to wartime conditions is not clear-cut. (See the section on venereal diseases in this chapter.)

Cardiovascular disorders

Psychologic factors exert an important influence on the precipitation or aggravation of certain cardiovascular diseases; because of this it was of interest to determine the effect of warfare and bombing upon the incidence of these diseases in Germany during a period when the population was under great psychologic and emotional stress.

Functional arrhythmias were not greatly increased during the war years; neither was the so-called neurocirculatory asthenia syndrome reported to have been seen with any great frequency.

The outstanding effect on the cardiovascular system resulting from wartime conditions and especially bombing was a distinct rise in the incidence of coronary heart disease. Internists uniformly reported that this disorder increased during the war years and that it was associated with the situations brought on by bombing or by the threat of bombing. The incidence of anginal pain among individuals who had previously suffered became greater during periods of air raids; likewise, anginal symptoms occurred with greater frequency among people not previously affected. Many of these patients had no electrocardiographic evidence of coronary disease. Severe anginal attacks were frequently precipitated by air attacks.

Coronary thrombosis occurred with increased frequency during periods of bombing, especially a fatal coronary thrombosis among men in their 30's and older. This occurred so frequently it was called "the shelter death of the aged." Professor Stepp of the University of Munich reported that many patients, and especially those in the younger age group, who had died a cardiac death that was particularly associated with coronary symptoms, were found to have no morphologic evidence of arteriosclerosis of the coronary arteries. Before the war, coronary insufficiency among younger men occurred infrequently; since the war it was frequently seen. Medical authorities concurred that circumstances brought about by air raids were a major factor in the production of coronary heart disease. Secondary factors which were considered to influence the incidence of this disease were an increase in the use of tobacco, prolongation of the hours of work, and the everyday annoyances of life in a war-torn country.

COMMUNICABLE DISEASES

Statistical data from the records of the local insurance exchanges showed definitely that the incidence of angina and other coronary disease increased during the periods when an area was subjected to heavy air attacks.

Little or no increase in the incidence of hypertension or hypertensive heart disease was noted. However, several informants reported that a greater number of cases of hypotension were seen during the war. Hypotension tended to occur in patients 50 years of age or older. Possible causes were thought to be a nutritional deficiency or the excitement caused by air attacks.

The incidence of cerebral hemorrhage was reported by some to have increased during periods of air raids, frequently occurring during an attack; however, this increase was not noted by all authorities who were interviewed.

Peripheral vascular disorders were not commonly noted to have increased during the war. In some instances it was felt that there was some increase in the incidence of Raynaud's disease, or in its aggravation, which could be associated with bombing attacks.

Dermatologic diseases

Neurodermatitis was rather commonly seen in the skin clinics of Germany and its increase during the war was reported definitely to be associated with the tension and strain brought on by air raids. Urticaria and exzema also were said to increase in incidence or severity in association with air raids.

Vegetative symptomatology

Symptoms ordinarily associated with the autonomic nervous system were remarkably infrequent in their occurrence. It was reported that only occasionally did patients complain of excessive sweating. Over prolonged periods of aerial bombardment some patients suffered from extreme fatigue-ability and "chronic nervous exhaustion"; likewise,

there was a moderate amount of insomnia. Anorexia was not an uncommon complaint. More frequently, patients suffered from diarrhea of neurogenic origin often requiring hospitalization. Dr. Meissner of the University Eye Clinic at Munich reported a definite increase in the incidence of glaucoma during the war, which he attributed to the nervous tension and excitement resulting from air raids. This statement was likewise corroborated in several large eye clinics in Germany and is furthermore reflected in the statistics of the governmental insurance exchanges.

Summary

The circumstances associated with total war and especially the effects of aerial bombardment were influential factors in the increase of psychosomatic diseases in Germany. This was evidenced most by the greater number of cases of peptic ulcer, and more specifically, by the production of a characteristic ulcer, usually of the stomach rather than of the duodenum, with the clinical onset rather acute and the ulcer large and penetrating in type. The increase in the incidence of coronary heart disease was particularly noticed among younger patients in whom arteriosclerosis was absent.

However, in view of the tremendous exogenous stimuli which offered a fertile ground for the development of psychosomatic complaints, the relative infrequency of the development of these disorders among the population is striking. Causes for the relative stability of the civilian population to psychological trauma were not apparent to Medical Branch investigators. Constant indoctrination with propaganda may have been a factor. The initial and sweeping military successes evidenced by the appearance of foreign goods and of slave laborers for work in factory and home, their expectation of winning the war, and the maintenance of a high level of morale may have been contributing factors.

PSYCHIATRIC DISORDERS

HANS H. REESE, M.D., MADISON, WISCONSIN

The objectives were to ascertain the effects of air warfare on Germany's psychiatric institutions and on her facilities for diagnosing, treating, and committing individuals with neuropsychiatric disorders

and diseases. If possible, it was hoped to compute data on the mental health of Germany prior, during, and after the bombing attacks. To attain these objectives, psychiatric hospitals and clinics were visited,

and medical authorities, physicians in general practice, and air raid protection police were interrogated on the problems that arose during the air attacks. To incorporate all these data into a condensed report is impossible and not desired, but a short introduction may be helpful to familiarize the reader with the subject.

University professors and superintendents of institutions estimated that the war reduced the number of cases in mental institutions between 32 to 54 per cent. It is not possible to compute accurate data because, late in 1944, the German government ordered the burning of all records relating to enforced sterilization, to mercy killings, and to population figures of psychiatric institutions. The Nazi government considered that the chronic mentally ill, those with heritable physical and mental disorders and the incapacitated senile population, were a liability to the nation. Therefore, by official regulation, institutions were deprived of enough physicians, food, drugs, and mechanical facilities for active therapy. Various stories were reported to the Medical Branch about the *mercy* killings, and the following paragraph is a synthesis of these stories.

If in the psychiatric section of a city hospital or a university clinic a diagnosis of incurable mental disease was made, the afflicted person was reported to the regional health office (*Amtsarzt*), which in turn requested a governmental commission to examine the official report, and, if necessary, ordered commitment of the patient to an institution of its selection. His transport was conducted by SS police troops. Then the family was notified that, because of incurable mental disease, its member had been transferred to such-and-such a place for care. After several days, however, the family received another notice, that the patient was seriously ill, and that an operation was imperative and he might die. Mercy killings were carried out in gas chambers by the use of carbon monoxide. On a specified date the family could call for the body or for the ashes in an urn and for their relative's clothing. If the family did not keep this appointment, the urn was interred in the hospital cemetery, and the clothing was given to a public agency for distribution. In a final letter, the government expressed regrets, and an incorporated death certificate related the cause of death. (Very often erroneous diagnoses were given, such as that the patient had died from a ruptured appendix or gallbladder, when in reality surgery had removed that organ years ago.)

From the Medical Branch investigation of six uni-

versity psychiatric clinics and eight state institutions and from discussion with a large number of urban and rural physicians, it is concluded that the air raids did not interfere directly with the management of the state institutions for mental diseases, for these reasons: they were located in rural areas or in sheltered regions and thus escaped damage or destruction; they were self-supporting units from the standpoint of food, water, and lighting; and they suffered only indirectly from disruption of their transport system.

The university psychiatric clinic and smaller hospitals of course suffered in proportion to the damage inflicted on the city in which they were located. If the university with its medical school was destroyed, the clinics for the care of nervous and mental diseases also suffered, as demonstrated by the illustrations accompanying the chapter on medical education.

It is amazing indeed to hear that even in a completely bombed-out psychiatric hospital, where in normal times little if any co-operation from the mentally ill patients could be expected, no death or severe injuries occurred as the direct effect of the bombings.

The known fact, that a psychiatric clinic or hospital staff always encountered difficulties in the management of disturbed or excitable patients, suggested inquiries at psychiatric clinics as to the effect of air raids on that difficult patient group. When the alarm signal was received in a psychiatric hospital sedation was ordered for all patients. The universal routine was that the excitable and uncontrollable patients received morphine and scopolamine and often slept through air raids unless physical damage to their wards necessitated moving them; the quiet and demented ones were guided to safety by the so-called herd instinct. No university psychiatric clinic had encountered insurmountable difficulties in rescuing its charges. The difficulties encountered depended upon the severity of the bomb damage inflicted and the number of patients to be removed.

Verbal statements by leading psychiatrists to some important questions relating to mental disease are reported here. The questions were:

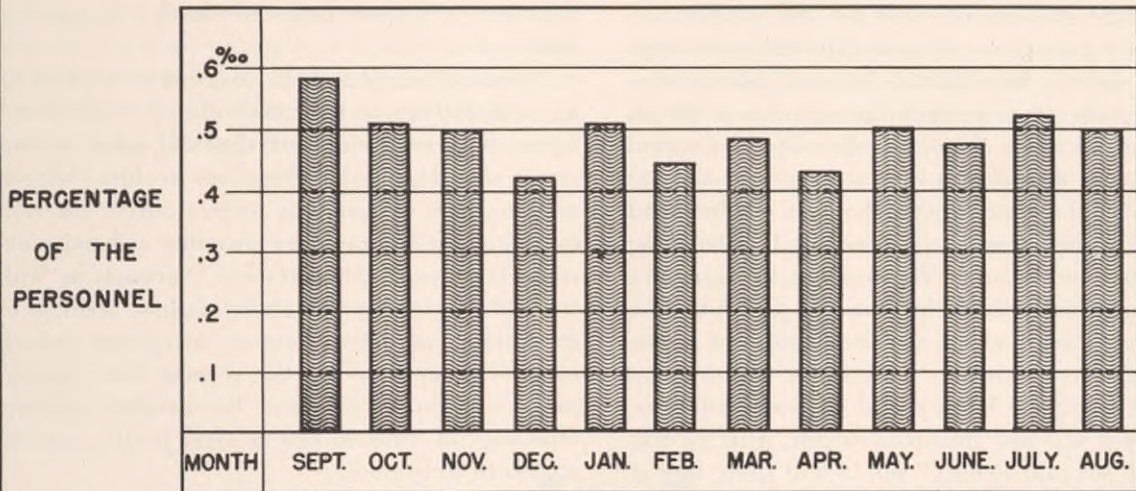
What was the influence of the Allied bombings upon the mental health of the German population?

Did air raids increase the number of psychiatric diseases?

What was the most damaging effect of bombing attacks upon the population in the field of mental health and diseases?

FIGURE 40

MONTHLY RATE OF ADMISSION FOR NERVOUS & MENTAL DISEASES AMONG THE GERMAN AIR FORCE (1942-1943)



Did you observe an increase of psychiatric cases during the years 1940 to 1945?

Professor Mueller of Leipzig voiced (May 16, 1945) the universal reply to a questionnaire that had been sent to specialists in the nervous and mental diseases, to universities, and to the medical directors of psychiatric institutions, that neither organic neurologic diseases nor psychiatric disorders can be attributed to, nor are they conditioned by, the air attacks. Fleeting reaction symptoms in the sense of neurohysteria were not uncommon after severe damaging attacks. There was no increase of psychiatric cases, he declared.

Professor F. Knigge of Hamburg answered that there was no increase in psychoses or in acute psychotic episodes. Air raids were no longer a surprise to people, and therefore no panics nor so-called *Katastrophenschocks* were caused after the experiences of August, 1943.

Professor M. Buerger-Prinz of Hamburg said that, in his experience, severe air raids will provoke endogenous depressions, either as a recurrent phase or as the initial clinical symptom complex of manic depressive psychoses in older people. It is debatable

if the psychotic manifestations which occurred in the change of life period are provoked by air raids. In five instances he observed that the severe depressions cleared up in the course of heavy bombings and that these people did a man's job during the rescue work but relapsed into deep depressions after four to six weeks of apparently normal health. The majority of the depressed and melancholic patients remained in their stupor even with the greatest dangers from fire and crashing buildings about them. The increase of hysterical reaction types was minimal in the cities and almost absent in the Army.

The shaker, the stuporous, the deaf-mute, the "shell shock patient" of World War I had not been seen as yet. Exogenous psychotic disorders as an accompaniment of intoxication in infectious diseases were common; malaria often precipitated subclinical psychotic tendencies into a long lasting psychosis.

The leading authority in the field of psychiatry, Professor Bumke of Munich, had the following answer to the four questions:

The university clinic with its 200 psychiatric and 100 neurologic patients had no air raid protection until in August, 1943, a provisory basement shelter

was constructed. The air raids of 1943 destroyed the serologic and neuropathologic laboratories and since 1943 paralyzed all work in these important departments. A direct bomb hit damaged the men's building and collapsed the women's chapel, but no lives were lost and no confusion or panic were encountered. Sedation for the patients depended entirely upon the degree of mental disturbances. It was not necessary to use morphine and scopolamine for everybody. No entertainment for the patients was necessary during air raids, or while they were waiting in shelters. It is Bumke's opinion, that air warfare or even severe air raids did not increase the admission rate to his clinic, that air raids did not provoke latent dispositions into acute psychoses, that air raids did not increase psychoses in children, and that no manic phases as the direct result of bombing had been encountered. The increase in depressive states, especially in the involitional period of life, was negligible. However, a greater number of people suffering from nervous exhaustion, concomitant apathy, emotional lability, and depressed attitudes, and those who had attempted suicide, must be considered "air raid victims," and lack of sleep, lack of food, and never-ending worries about new raids contributed to the development of this more somatic than psychic fatigue syndrome with its weight loss and undernourishment.

Bumke replied to a final question, "What was the most damaging effect of bombing upon your clinic and your patients?" with the following answers:

1. The physical destruction of the clinic with disruption of water, lighting, gas, and plumbing services interfered with medical supervision and treatment.

2. The disruption of all transportation facilities for physicians, for patients and their relatives, and a shortage of food and drugs created irritations and complaints.

3. The inability to repair the physical damages, and the tension caused by the never-ending but constantly altered emergency planning, taxed the patience of the staff.

Bumke's statements concerning nervous-mental diseases during the air raid years implies a rather stable incidence rate in the civilian population which equals the normal expectancy of peacetime.

Figure 40, showing the percentage of the German Air Corps admitted to mental institutions in the years 1942 and 1943, is presented for the sole purpose of demonstrating a similar rather stable incidence rate in a large military group.

Major hysterical disorders were a rarity in the Army as well as in the civilian population during the war years, according to Stockert, Villinger, Pette, Roeper, and Mikorey. They were not observed during air raids, nor did the wishful fixation neurosis to be evacuated to the country after a raid appear. The complicated and resistive psychoneuroses were much less frequent in the service groups and in civilians, in sharp contrast to the frequency of these disorders in prewar times among the German intellectuals.

Hysterical manifestations in front of bunkers or air raid shelters or upon returning to bombed-out homes have been rare, but they did occur during severe air raids. Phobic obsessions in older children and in young women were present during the rush to air raid cellars or when crowding and noisy excitement blocked the entrances. Nervousness with irritability, steadily increasing fatigue leading to exhaustion, vegetative neurotic symptoms (which may be grouped under the generic term psychosomatic disturbances), and the aviation anxiety, especially in children and in older people, may be attributed to bombing.

In the collective psychiatric reports of 1942, the German Army sanitary inspector's office challenges the opening of a special department for psychogenic disorders at the University of Munich and discourages other hospitals to follow what was believed to be an unnecessary and unwarranted separation of patients. This office stipulates directives for hysteria, for simulation, and for psychologic aggravation of organic diseases and requests that immediate therapy be given in qualified hospitals and states that under no circumstances should soldiers with hysterical signs be discharged from service. Diagnoses such as war neurosis, shell shock, or psychoneurosis should be avoided, to be replaced by adding the prefix psychogenic to the outstanding symptom (as psychogenic gait disturbance). A short personality evaluation should follow the description of the causative factors which produced the disorder.

Addiction to alcohol, to sedations, to pick-up drugs, or to narcotics did not increase. People smoked more, some excessively. However, the sense of moral responsibility was lessened, and tendencies toward petty criminality in people with excellent character records increased. Simulation and aggravation of illnesses were of no significance in the armed forces or in the home population. Juvenile delinquency with all the implications of that term, was a great concern to city and parental authority.

COMMUNICABLE DISEASES

The formation of gangs and stealing by youngsters, especially after air raids, were severely punished, but according to police records, delinquency and looting never reached alarming proportions during the war years or after destructive air attacks.

Psychopathic personalities, which caused severe disturbances as an effect of the ever-increasing air raids, will not be touched on, since there was no uniformity in the use of the term *psychopathic personality*, and since no definite statements could be obtained. It is interesting to note that in a country so brutally ruled and crushed by the Gestapo, so frustrated by political accusators and defamers, so torn and demoralized from loyalty to its govern-

ment, its leaders, and even to family members, not more systematized paranoid states with ideas of persecution were registered.

Summary

Air raids did not aggravate illness or the loss of life in German neuropsychiatric hospitals.

Air raids did not contribute directly to an increase in psychiatric disorders.

Air raids only slightly influenced the course of affective emotional disorders.

Air raids, however, did increase tension states, anxieties, and exhaustive states among the people, but not to an alarming degree.



CHAPTER FIVE

INDUSTRIAL HEALTH

CAPTAIN FRANZ K. BAUER, MEDICAL CORPS, AUS

During the exploitation of targets by the Medical Branch team it was possible to devote some attention to the problem of industrial health. In a country as highly industrialized as Germany, the health of industrial workers even in peacetime is of importance for the evaluation of the health state of a nation as a whole. If one, furthermore, takes into account the degree of industrialization during a total war when it was necessary to call on every available source of manpower and even to import foreign labor despite the obvious danger which such a measure carries with it from a political as well as sanitary standpoint, it can be seen that the health of the worker will reflect on the health of the nation. It is also of importance to note that Germany has had a widespread organization for the safeguarding of industrial health ever since the end of the last century. Statistics and pertinent information were compiled and kept by German authorities in view of evaluating the state of health in industry.

Although the main problem of the team was the study of German health as a whole, as many industrial plants were visited as possible whenever they were in the vicinity of the city targets exploited. It was attempted to obtain information from statistics and records kept by the plants and during interviews with managers and plant physicians. It must be stressed, however, that the heavy air attacks had destroyed many industrial plants and with them their recorded health statistics. Furthermore, the Germans had attempted to decentralize their industries and to evacuate whatever possible into areas comparatively safe from aerial attack. These areas were not visited by the Medical Branch team.

This chapter is based on information obtained in several of the largest plants, such as the Krupp Industries in Essen, the M. A. N. Industries in Augsburg, the Messerschmitt aircraft factories in Augsburg, the I. G. chemical plants in Hoechst, Leverkusen, Ludwigshafen, and Elberfeld, and the Robert Bosch electrical works in Stuttgart. In ad-

dition to these large establishments, a number of small plants were visited in or near the sample cities.

Germany attempted to safeguard her industrial workers' health by countless laws, decrees, and ordinances referable to industrial hygiene and health. Insurance against sickness and accidents applied virtually to every German worker and salaried employee. The latter's income was not to exceed 3,600 RM. Family dependents of the insured were covered automatically although they did not qualify for the full services and benefits available to the insured.

Legal responsibility for health services was divided between public agencies and social insurance organizations. In addition, voluntary health organizations were given a definite place in this structure, and party organizations exerted powerful influence over administration of health service.

With precautions against air raids and evacuation of victims exclusively in the hands of the government, the voluntary organizations lost their influence to a large extent during the period of aerial warfare against Germany.

The public agencies vested with administrative powers and functions in the field of health service operated on a local, intermediate and a central level. In the local level, administrative responsibility was concentrated in the health departments which co-operated with public agencies active in related fields. Intermediate agencies were set up in government districts, provinces, or larger states, and were under medical administrators (*Regierungsmedizinräte*). These men had supervisory powers over all local health activities.

There was a division of the central government for sharing of responsibility for the health of the working population. The Ministry of Labor administered the social insurance or workers' compensation and supervised the conduct of industrial hygiene. The compilation of statistics which is so important in detecting health trends among large working groups was prepared by the Reichs Sta-

tistical Office, a division of the Ministry of Economics which, among all other statistics, was in charge of the vital statistics for the entire Reich.

The social insurance organizations played a most important role in the administrative structure. Social insurance was administered by special bodies locally as well as centrally. Compulsory social insurance had developed legally since the 1880's and provided compensation for sickness, maternity care, accidents including permanent and temporary disability, old age, and death of the bread-winner due to sickness or accident. Sickness insurance was administered by local statutory bodies called *Krankenkassen* consisting of state operated *Ortskrankenkassen*, *Betriebskrankenkassen* (operated by the individual plants), and *Innungskrankenkassen* (operated by trade unions). In all cases the insured had free choice of a doctor.

Voluntary health organizations including church and nondenominational organizations were integrated into the pattern of public agencies.

The national socialist regime added a fourth to the three types of agencies previously described (local, intermediate, and central or national level): the Main Party Office for National Health (*Hauptamt fuer Volksgesundheit*) which was under the direction of the leader of German physicians (Dr. Leonardo Conti) and which had subdivisions at intermediate and local levels (*Gauaemter und Kreisaemter*), and the Main Party Office for National Welfare (*Hauptamt fuer Volkswohlfahrt*).

Industry was covered by air raid protection insurance as much as the civilian population. No major changes in the extremely detailed national plan were made. The socialization of health insurance had been so thoroughly developed that the system was able to withstand the impact of the consequences of the aerial attacks on Germany.

It was up to the factories and plants to procure shelters and other air raid protection measures through the co-operation of local and central agencies. In vital industries this was relatively easily accomplished through a priority system. Cities throughout Germany were given different numbers in this system. They were mostly dependent for their priority on vital industries in or near the cities. With high priority the cities (and industries) were able to procure material and personnel from the Todt organization to construct shelters and bunkers (concrete tower shelters). For industries less vital to the war effort, the construction program for air raid shelters lagged due to lack

of manpower and increasing disruption of the transportation system subsequent to aerial attacks. As late as 1945 many factories had no, or inadequate, shelters. Such factories were, among others, makers of surgical instruments, bandages, and other products not immediately connected with armaments and munitions industries.

Deaths and injuries due to aerial bombings

Casualties in war plants were about as frequent as they were for the population at large. The Germans had expected more casualties in industry, particularly in the armament and munitions industry, by virtue of the fact that in aerial attacks on German cities these industrial plants constituted prime targets. According to information obtained, fewer and fewer people were killed at work as the aerial attacks on Germany increased in number and severity. Thus, at the Krupp industries in Essen 305 men were killed in 1943, against 291 in 1944 and 107 in 1945 up to the occupation of Essen by Allied Forces, although the attacks on these factories became so intense that they were forced to shut down most of their operations in late 1944. It should be kept in mind that there were more attacks on Essen as the war progressed, and that this decrease in the number of casualties was due to better air raid precautions, such as sending workers into air raid shelters as soon as plane formations were known to approach the area, which was contrary to the policy of 1943 of waiting until it was certain that the respective cities were the target (Robert Bosch Industries—Stuttgart; Messerschmitt Aircraft Industries—Augsburg).

According to the statements of managers and plant physicians interviewed, the number of dead and injured through aerial attack in industrial plants was not serious enough to stop production at any given time. This held true as long as key personnel was not killed or injured. The serious effect of such an incident is obvious as, for example, when at the pharmaceutical plant of E. Merck in Darmstadt one direct hit killed the entire biologic research staff (see Chapter Twelve). This plant from then on dispersed the workers in order to forestall a similar occurrence and to avoid crowding of members of one department into one air raid shelter. Other plants, according to the information available to the Survey had no such provisions.

The types of injuries due to direct violence en-

countered in bombed industrial establishments were similar to those seen among the population at large (see Chapter Three).

Numerous instances occurred of irritation of the eyes through liberation of chemical gases such as aldehydes and akrolein, which were set free in the bombings of the respective plants. Such injuries were not noted among the population at large. No cases of permanent disability from gas effect were reported in the literature or in personal interviews.

The care of casualties was undertaken in a similar manner as for the general population: The plant physician usually acted as air raid physician, with a staff of nurses and lay attendants under him. The number of first aid posts distributed throughout the plants was usually increased as the air war against Germany progressed. At least one first aid post was designated in each plant for medical personnel. As soon as the alarm sounded, the medical personnel proceeded to the designated first aid post. The injured were evacuated as speedily as possible to either the plant hospital, if available, or to municipal hospitals in the cities nearby.

Industrial establishments with high priority working for the war effort had no difficulty in retaining their physicians. Armaments industries were able to maintain the same doctor-patient ratio as in peacetime. This practice held true for all units working under directives of the Speer organization. The same industries received priority for the purchase of medicaments. It was up to them to purchase drugs and bandages necessary for the care of the industrial workers.

The sick rate

Most insurance companies (*Krankenkassen*) compiled statistics of diseases causing disability and requiring compensation, as well as data showing the duration of patient days. The majority of insurance companies discontinued this practice during the war because of the shortage of clerical help. Statistics from different insurance organizations throughout Germany were compared and discussed with managers, plant physicians, public health men and expert consultants, and the findings and conclusions reached are thought to be valid for the entire industrial population of Germany. Other divisions of the Survey have gathered data on personnel matters, including absenteeism and illness, in their examination of the war industries of Ger-

many which will give a more detailed picture of this phase.

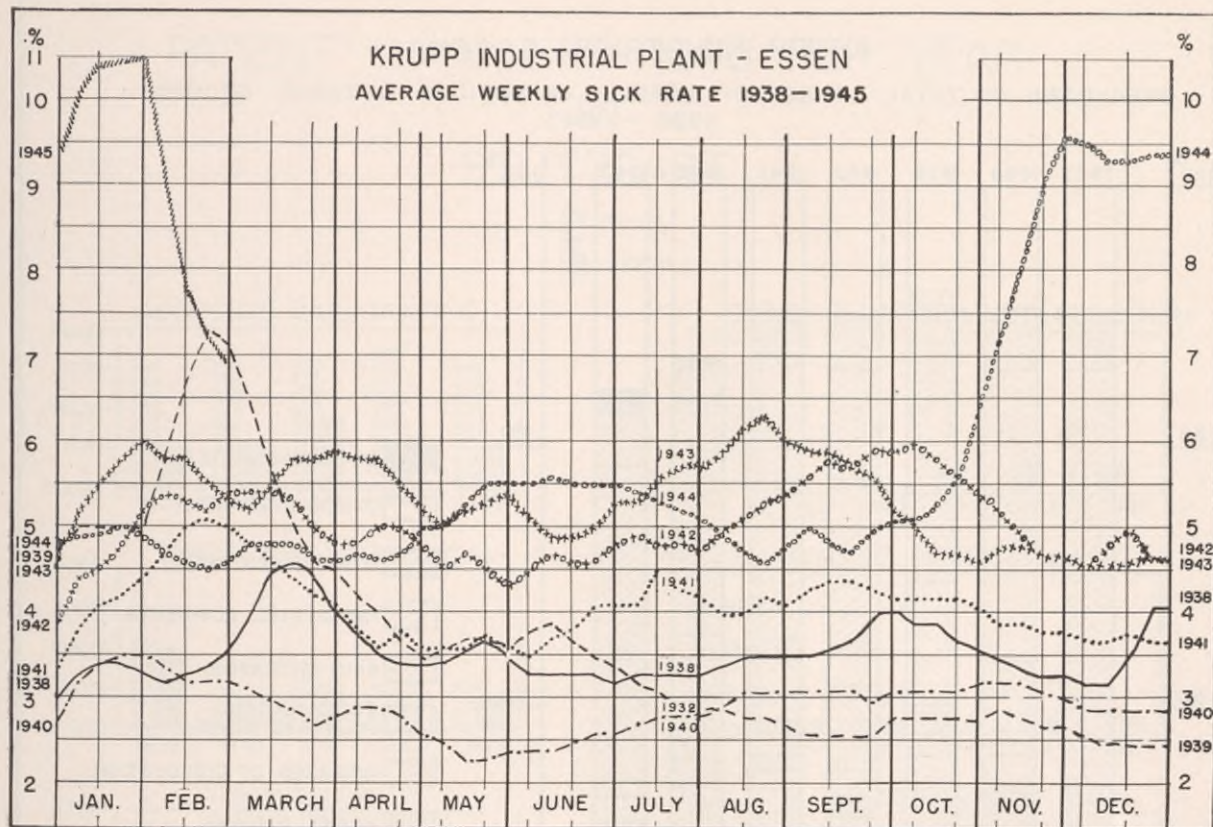
All Germans who were associated with industrial medicine emphasized that air raids caused sick rates to rise. In Hamburg the Blohm and Voss Company complained in their 1943 report that air raids had pushed their sick rate up to 5 per cent in August, September and October, and to 5.7 per cent in November. Reasons for this were "disturbances of health, shock and undisciplined behavior of our employees. Inclement weather is a contributory factor." The charts of the Krupp Industries in Essen show (Figure 41) how illness among the workers advanced to 9.5 per cent in 1944 after the heavy raids on that city. Officials of the Krupp Industries and of the public health department in Essen attributed this to an increase in the over-all emotional strain with heightened irritability and decrease in physical and emotional resistance; the resultant effect is demonstrable in the increase of the incidence of all illnesses and the prolongation of the period of treatment and recovery. The National Insurance Company's reports of Augsburg show graphically that after aerial bombardments the sick rate advanced as high as 9 per cent in 1944, raising the expected annual seasonal peaks from 5 to 6 per cent; here, too, "shock, fright, neurogenic heart and stomach disorders and undisciplined and unpatriotic conduct" were given as reasons.

Industrial accidents were the main contributors to high percentage of compensation paid out (Figures 42 and 43). At Krupp the total number of accidents decreased, and it was stated that the ratio between traffic and industrial accidents proper had changed; traffic accidents—to and from work, that is—showed an increase, whereas industrial accidents during work decreased due to better accident precautions and a vigorous educational program. In the statistics of other industrial establishments this differentiation between traffic and industrial accidents was rarely made.

The National Socialist Party Office for National Health stated in its quarterly reports that accidents constituted the main cause of industrial illness. The shortage of manpower led to widespread employment of foreign workers who were mostly untrained in the work to be done and in the principles of industrial hygiene and personal safety. Language difficulties were also an important factor in this respect. Although working hours were lengthened and as the younger age groups were drafted for mili-

INDUSTRIAL HEALTH

FIGURE 41



tary service or compulsory labor service (women) the average age of the industrial employees became higher, the accident rate did not rise among German nationals due to the above mentioned precautionary measures. It became higher among foreigners before it was possible to acquaint them with the principles of industrial hygiene and personal safety.

Upper respiratory infections closely followed accidents in the compensation data. The increase here was due to crowding in air raid shelters, in street cars and other public conveyances and in the homes. It should be kept in mind that not factories alone but entire cities which were large industrial centers were also principal targets of the attacks so that hundreds of thousands were made homeless. Whole families were forced to move in with other people and through this overcrowding the transmission of droplet infections was enhanced. Added to this was the constant exposure during fire fighting and rescue work. Then, too, it was routine to start work in bombed plants as soon as possible even if the roof of such a plant had been shattered and repairs not begun. Workers were frequently exposed

to rain and wind for days at their place of work and it is natural to expect an increase in upper respiratory infections.

Armament plants reported a steady increase in gastro-intestinal disorders in all age groups. They were of a functional nature for the most part, a fact for which emotional irritability and poor nutrition were held largely responsible. Emotional instability following raids in which transportation facilities, water, gas and light service were affected, without which personal discomfort and hardship become acute, was always said to be the underlying factor for functional disorders involving the gastro-intestinal tract and cardiovascular system.

Cardiovascular disorders increased throughout Germany during the war years and took an important place in the statistics of insurance companies. From Figure 42 it can be observed that heart disease constituted 1.6 per cent of all disease groups in 1942 and 3.1 per cent in 1943 in one of Germany's most important industries. From physicians it was learned that the increase was in functional disorders rather than organic disease, although the latter was more prevalent in the industrial worker as the war

FIGURE 42

KRUPP INDUSTRIES - ESSEN

BREAKDOWN OF TOTAL NUMBER OF DISABLED IN VARIOUS DISEASE GROUPS
1937 - 1943

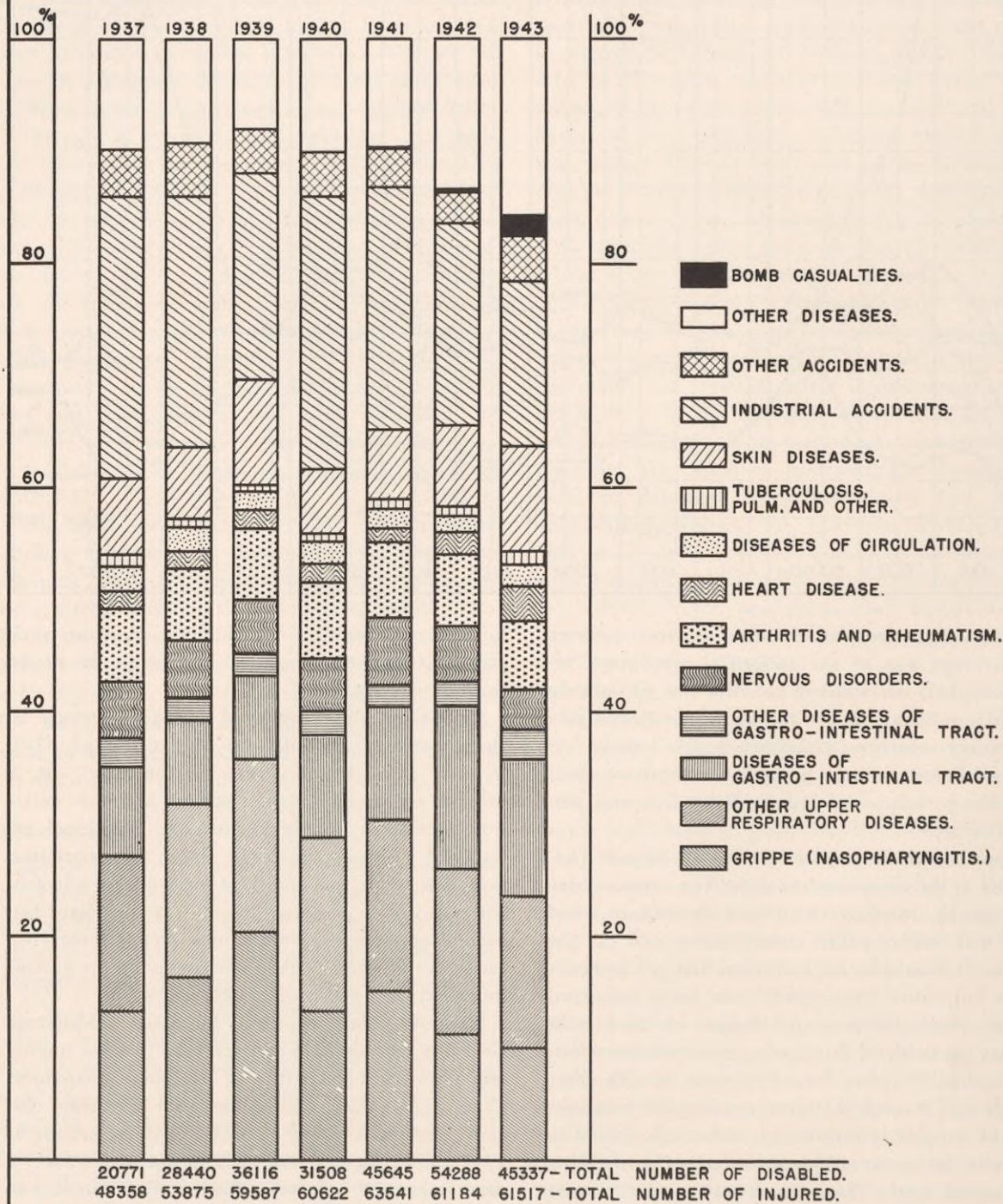
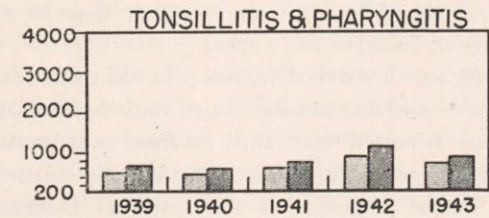
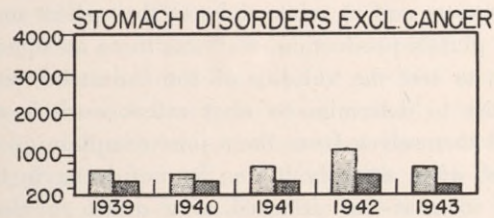
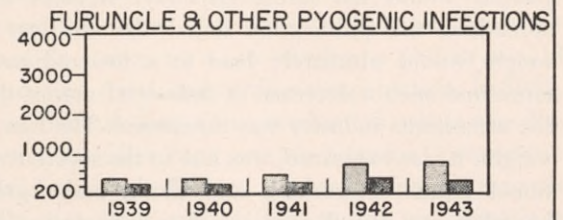
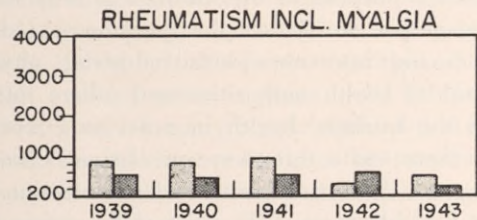
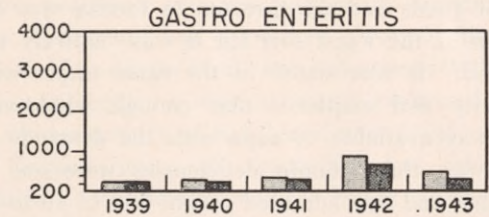
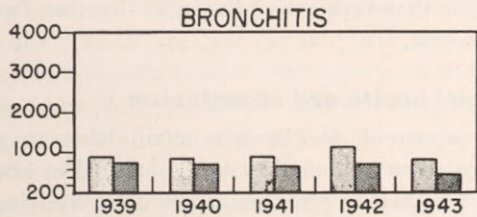
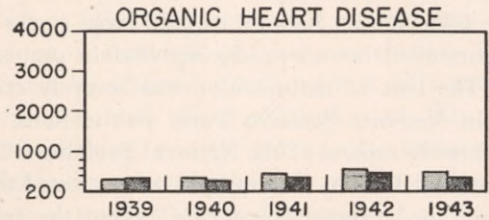
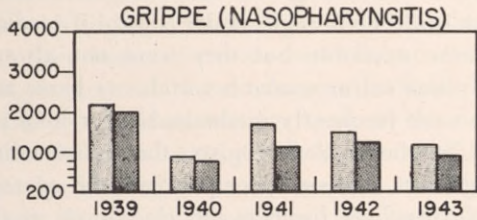
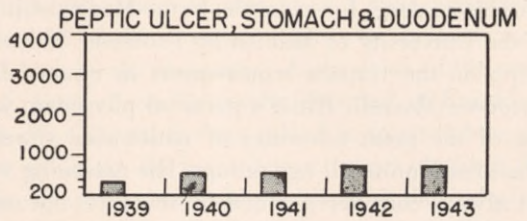
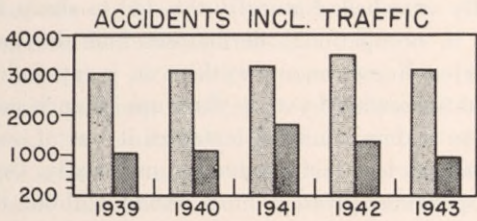


FIGURE 43

PATIENT DAYS PER 1000 PER YEAR IN STUTT GART

- MALE
 - FEMALE



progressed in Germany by virtue of the fact that more and more physically fit persons were drafted into the armed services; thus the state of health of the German worker was worse.

The part played by the nutritional status of the worker was the subject of much controversy among those interested in industrial health. There was much ado on the nationwide use of vitamin concentrates for laborers and persons whose output was of prime importance to the total war effort. Research was done, for example, in the Medical Clinic of the University of Munich by Professor Wilhelm Stepp on the vitamin requirements in miners. Dr. Theodore Morrell, Hitler's personal physician, was one of the great advocates of nationwide vitamin administration to all age groups. His reasoning was not always considered sound by scientists not only because he was, perhaps, the Fuehrer's most intimate associate but because he held large stocks in pharmaceutical houses producing vitamin preparations. The fear of malnutrition was severely criticized in National Socialist Party publications. In the quarterly reports of the National Socialist Office for National Health, for example, it was stated that the continued "rumor-mongering" about the scarcity of foods and the threatening famine was defeatism of the worst sort for it was "entirely unfounded." It was stated in the same organ with authority and emphasis that enough wholesome food was available to cope with the demands of total war, that vitamin deficiencies were out of question, and that admitted weight loss of 10 to 15 pounds would not affect anybody. Rumors had spread, so this publication stated, that the loss of weight would ultimately lead to a lowered resistance and such a decrease in industrial output that the armaments industry was threatened. The loss of weight, it was explained, was due to the severe emotional strain of working and living under great hardship and the disruption of transportation because of the Allied air raids rather than to any shortage of food for the worker.

There was a marked increase in skin disorders. Interviews and an examination of statistics and publications revealed that this increase was mainly due to pyogenic infections, particularly furunculosis. In the statistics of the National Insurance Company of Augsburg (*Ortskrankenkasse*), furunculosis advanced in the list of disabling diseases from seventh place for men and seventeenth place for women in 1939, to fourth and sixth places, respectively, in 1943. At Krupp skin diseases con-

stituted 6 per cent of all diseases listed in the plants' chart of disabling conditions in 1941, whereas they constituted 9.6 per cent in 1943. The authorities with whom this subject was discussed stated that the lack of soap, which has never been the cheap and easy to get item in Europe that it is in the United States, contributed greatly to the prevalence of skin conditions. It was a vicious circle for it was repeatedly stated that as the working conditions deteriorated soaps and wetting agents gradually vanished. Naturally this led to sharp increases in occupational dermatoses and the general uncleanness among workers in many industries was succeeded by acute flare-ups of such conditions as scabies. In some instances it was of such magnitude as to affect production materially. Generally speaking, given a long period without the necessity for crowding into air raid shelters, an outbreak could be brought under control if medications were available but they were not always. Not only was sulfur scarce but ointment bases and vehicles were frequently unobtainable for long periods. Like the epidemiologists, the industrialists and hygienists repeatedly emphasized the average German's penchant for personal cleanliness as the one factor that kept a bad hygienic situation from getting worse.

Industrial health and absenteeism

The causes of absenteeism attributable to air raids are given here as they were obtained in interviews with German plant managers and physicians. It is not the purpose of this chapter to deal with absenteeism per se. Rather the question was discussed during interviews with industrial physicians, public health authorities and others interested in the workers' health in order to discover whether there was a three-way correlation between bombing and industrial health and absenteeism. It was not possible to compile a list of the causes of absenteeism and to relate them to their effect on a given plant's production. Nor was there an opportunity to test the validity of the industrial vital statistics to determine to what extent workers absented themselves from their jobs complaining of illness, when actually it was fear of being in the plant when it was attacked or a desire to clean up the rubble of their own homes. These are questions of morale and of many other ingredients of industrial absenteeism and they have been adequately explored in other reports by the Survey.

Fear of bombings was experienced by everyone,

according to the persons interviewed. Numerous German citizens sought admission to hospitals for insignificant ailments in order to be evacuated to auxiliary hospitals in the country. Although evacuation was governed by the policies established by the government, a large number of workers attempted to go to the country either with their families or to join their evacuated children. The control was rigid, but many succeeded in finding ways and means to spend days and even weeks away from the endangered cities and justify their absence on the basis of illness.

A general irritability was evident soon after the bombings; loss of sleep due to alarms and rescue work, transportation difficulties, and stricter food rationing were all factors which induced people to absent themselves from work. Transportation became a major problem. At the Robert Bosch Industries in Stuttgart, to take one example, during the very heavy air raids in 1943 and 1944, only 30 per cent of the employees—both officials and laborers—were present for work in the first week after the raids. At the end of one week approximately 50 per cent were present, and after four weeks 70 per cent to 80 per cent. In these figures are included the sick who contributed 15 per cent to the rate (5 per cent for the male, and about 20 per cent for the female employees). In most cases, transportation difficulties and preoccupation with personal affairs subsequent to bombings were given as reasons but the personnel director believed that very minor illnesses were used as excuses and may, therefore, render the statistics unreliable.

Absenteeism was by no means widespread up to 1942. Living at that time was bearable, morale was high and the war was going well. By the end of 1942, however, many people decided that they had made enough money to buy the necessary commodities which rationing permitted them, and that they were due a rest. They were resolved to take a rest either in their homes or in the country, and the only way to do this with compensation was to go to their plant doctor and be certified as to their need for sick leave. It was repeatedly stated that industrial physicians were rather lax in certifying workers who were not really sick, and that this practice spread rapidly despite warnings by the Government and the National Socialist Party to the workers that absenteeism meant defeatism, and defeatism was not far from treason.

According to statements and publications from some insurance companies, the number of workers

receiving sick leave with compensation soon reached the point where the insurance firms were no longer able to meet their financial obligations. At Frankfort on the Main the practice of granting these sick leaves became so widespread and the abuses so flagrant that the state authorities had to step in. Considerable correspondence developed between the Gauleiter of Hessen, Sprenger, and the directors of the Frankfort branch of the National Insurance Company and other Frankfort insurance companies. The sick rate at that time exceeded 5 per cent of all workers, which was declared much too high by the companies. A physician of the medical clinic of the University Hospital of Frankfort, Dr. W. Gutermuth, was called in to straighten out the situation. In his solution it was decided that the university hospital would assist the industrial physicians with all their diagnostic facilities in order to eliminate preventable absenteeism. By requiring a thorough physical examination supplemented by laboratory tests many a malingerer and employees with minor ailments were discouraged from seeking a sick leave with compensation. Within three months the sick rate was below 3 per cent—a result considered spectacular at that time. This procedure attracted nationwide attention and Dr. Gutermuth was appointed plenipotentiary for medical problems in all war industries for the purpose of requiring more thorough examination and a stricter control of sick leave among war workers.

German insurance companies had what was called a confidential medical expert service (*Vertrauensärztlicher Dienst*). Physicians, occasionally specialists, were appointed to pass on the plant doctor's judgment as to whether a patient should be declared sick and receive compensation. In 1933, this Service had been overhauled when the National Socialists took over the German Government. Dr. Gutermuth directed his reorganization towards this consultant service. His reasons as given in a personal interview in 1945 were that most of these expert consultants had been appointed to their positions through political connections and were more or less corrupt (in the summer of 1945 a favorite explanation of most German authorities for everything). At the same time they were badly trained by virtue of the fact that they had been active in party organization and activities and "the two don't go together."

In the beginning of Dr. Gutermuth's period of term as plenipotentiary for medical problems in the war industry, the Expert Medical Consultant

Service prided itself on its success in reducing the sick rate and returning large percentages of "disabled" persons to work. The procedure followed was to call in those persons who had been declared sick and were about to receive compensation and examine them very carefully as to their state of health. However, Dr. Conti wrote a letter (July 7, 1943) to Dr. Walter, the Chief of the Expert Medical Consultant Service, and pointed out that according to the reports of the Service 62 per cent of all persons declared sick by the plant physicians in 1939 were called in; in 1940, 75 per cent; in 1941, 76 per cent, and in 1942, 80 per cent. Yet the "disabled" returned to work include: in 1939, 14.2 per cent of the number considered unable to work by the industrial physicians; in 1940, 16.6 per cent; in 1941, 14.6 per cent; in 1942, 14.4 per cent. This means that, although the Expert Medical Consultant Service called in more and more employees declared sick by the plant physicians, approximately the same percentage of those who were sick were returned to work. It was deduced from this by Dr. Conti that it was neither malingering nor was it laxity on the part of the physicians that the sick rate was high, for if it were the expert medical consultant service would have had more success in returning people to work. Dr. Conti in this letter attempted to explain the rise in the sick rate by "biologic" factors: During the war the healthiest and most resistant men were drafted, which led to a decrease in the general state of health among industrial workers as more and more older people and those with diseases of a chronic nature were employed or even made to work.

Morbidity rates changed in many districts of Germany and for many disease. Thus, in Berlin, an epidemic of bacillary dysentery occurred in October, 1942, and there was an increase of infectious hepatitis. These are only examples listed by Dr. Conti in his attempt to explain the rise of the sick rate among war workers and to protect the German physicians from the attack which Dr. Gutermuth had made on them. Gutermuth's program was described to a member of the Medical Branch Team in a personal interview in 1945. He had planned to recruit well-trained consultants for the insurance organizations and to make the diagnostic facilities of all state institutions, such as university clinics, available to the industrial physicians. Compulsory sickness insurance would have been broadened to include earners making up to 7,200 RM yearly. No plant or industrial insurance companies were to

have less than 5,000 members. Physicians from the Armed Forces were to be assigned to war industries as plant or expert physicians on a full-time basis for a limited period of time or part-time to relieve the burden the bombing of war plants had placed upon industrial physicians.

In brief, it can be stated that aerial attacks on Germany caused the sick rate in industrial establishments to rise. General irritability subsequent to bombings with disruption of public utilities and transportation facilities, overexertion due to rescue work and longer working hours with increase of dirt led not only to a decrease in the resistance of the individual to various diseases but also to a tendency to stay away from work without actual organic disease. The deterioration in workers' health is directly related to bombing but the statistical up-swing of illness following raids is in part due to malingering and psychologic factors, which was soon recognized by the Germans.

Improved and more thorough diagnostic procedures were not the only steps taken to combat absenteeism. Expert medical consultants were required to make house calls, somewhat like a truant officer, to check on whether a person receiving illness compensation was actually following instructions. When the doctor found the "sick" worker in a picture show or working in his garden instead of following the regime prescribed, the worker could be fined by a loss of wages. Rigid Nazi control was exercised through representatives of the Party in the various plants. These representatives were supplied with propaganda and with slogans and attempted to impress on workers through personal contact and distribution of pamphlets that they should be as brave and as willing to carry on, despite hardship and minor sickness, the same as the front-line soldier.

Numerous inducements were offered to keep workers on the job. They consisted of food, liquor, tobacco, clothing, toys for their children, costume jewelry, free excursions and even vacations. This was handled through the Ministry of Munitions and War Industry and its Department of Social Care (*Sozialbetreuung*). The prerequisite was to meet the set individual production quota. The plant then was eligible to file application for bonuses in the form of the articles mentioned, if they were available.

It was stated that the output of foreign workers could be raised by 100 per cent by such items as three cigarettes for men and one comb for women.

This increased output did not last very long and most managers and supervisors *promised* cigarettes and toilet articles beforehand to lax workers in order to prolong the effect of the gift.

The German Workers Front was instrumental in the distribution of vitamin concentrates, candy and similar items of inducement. They made it known to the industries that a certain amount of candy or vitamin concentrates was available. The plants then had to pay the makers of these items for the quantities received by the German Workers Front and distribute the items free of charge to the employees. Thus, the employees gained the impression that the German Workers Front was the one to which they owed these benefits.

The foreign worker

Although no separate study was made on the efficiency and state of health of the foreign worker in comparison with the German national, the question was always brought up in interviews with managers, public health authorities and physicians when problems of industrial health and hygiene were discussed. The matter was given much attention in the publications of the National Socialist Party Office for National Health in its quarterly reports. The statements made in this chapter were based on these publications and information obtained in numerous interviews from men who had close contact with foreign workers.

It was stated almost unanimously that with proper inducements and threats the output of the foreign worker, particularly the Russian, Ukrainian and Pole, could be raised over the output of most German workers. It was explained in this connection that foreign workers were in better physical condition than most German industrial workers by 1942 and 1943 because the Germans working in industrial plants were mostly replacements for healthy men and women who had been drafted for armed service or compulsory labor service. Yet the sick rate and the number of patient days lost from work were much higher among foreigners than among Germans, being double at times (Party Office for National Health, Robert Bosch Industries—Stuttgart, M.A.N. Industries—Augsburg and Nuremberg). Foreign workers took advantage of the social insurance organization and were eligible for sickness and accident insurance. They could go to physicians just like any German worker. They capitalized on every minor ailment and attempted to stay away from work as often as they could.

Language difficulties were an important factor in keeping them at work as they were easily able to exaggerate their complaints and ailments.

In the opinion of seemingly responsible Germans, they were fairly easy to manage, particularly the Russians, Poles and Ukrainians. They were given instruction in the principles of industrial hygiene and health which occasionally included orientation in the vagaries of modern plumbing. As a result, no major epidemics developed among foreign workers.

Naturally the Germans were careful to import only those slaves who were in robust physical condition. In order to retain the health status as high as possible—and to keep the foreign workers from being a burden to the already over-taxed physician—the foreigner who became permanently crippled or acquired some serious chronic disease was immediately returned to his home country. Thus foreigners who developed tuberculosis or became pregnant were immediately returned to their homelands and replacements procured.

The notoriously clean Germans complained that foreign workers had no feeling for cleanliness; the workers of the East could be excused, but it is of interest to note that the Dutch were considered the worst in this respect. They sabotaged the program of personal hygiene in their barracks and permitted vermin to develop. Their behavior was considered a serious health hazard in an effort to complicate life for the Germans as much as possible.

An effort was made to bring foreign physicians to Germany to care for their own nationals in the capacities of industrial physicians. Numerous inducements were offered such as private practice, nice homes and automobiles. This program met with partial success only in occasional instances. There were several hundred Ukrainian physicians in Germany but they were considered poorly trained. Some French, Dutch, Belgian and Italian physicians went to Germany to practice, as did an occasional South American and Spanish physician, but the scheme soon collapsed of its own weight.

Foreign laborers very frequently went to several physicians at the same time for the same ailment and drew food rations, drugs and compensation in a multiple of the permitted amount. This happened in several German cities and was given official publicity in the reports of various insurance companies and party publications.

Self-mutilation was encountered occasionally in foreign workers and in some instances in Germans. Accurate figures are not available, but the matter

was deemed important enough to be brought up repeatedly in publications of the National Socialist Office for National Health. Thus, in the quarterly report of October, 1941, for Stuttgart it was stated that many men from the East had injected the juice of radishes into their urethras and produced a gonorrhea-like discharge. Several Polish women had treated their external genitalia with strong acids in order to simulate venereal disease in the hope of being sent back to their home countries.

It was emphasized that the foreign worker capitalized on any disease with which he was afflicted much more than the German in whom patriotism and national pride were still important factors.

Summary

Aerial bombardments had a direct effect on the health of the industrial worker in Germany. They were responsible for (1) irritability, fright and lack

of concentration which accounted for a high accident rate, traffic as well as industrial, and functional disorders; (2) production of unsanitary conditions of work which accounted for an increase in upper respiratory infections; (3) an increased need of soap due to longer working hours under poor hygienic conditions which accounted for an increase in pyogenic infections and scabies.

Absenteeism because of ill health was on the increase subsequent to air raids, and measures were instituted to combat it. These measures were very rigorous and were partially successful.

Although the physical condition and health of the foreign worker were better than those of the German industrial worker, the sick rate of the foreigners was higher than that of the Germans. Minor ailments were given the utmost attention by the foreigners and every attempt was made to be absent from work whenever possible.



CHAPTER SIX

VITAL STATISTICS

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Through statistical analysis we have endeavored to show the trends of various health conditions in Germany and to discover their relation, if any, to the bombing of that country. Much of our work has been included in the study of communicable diseases and tuberculosis shown in Chapter Four. The present chapter, in addition to describing the methods employed, examines the birth rate, infant mortality, and mortality rates of death from all causes, suicides, diabetes, heart disease, cerebral hemorrhage, old age, and all types of accidents.

It was obvious that a complete report of the effect of Allied bombing, as reflected in the vital statistics of Germany, was impossible; the time limit imposed on the activities of the Survey was alone sufficient to limit the study. The initial assumption that many record offices were destroyed with the records in them, which led the Medical Section to plan to collect only the bare essentials of population and mortality data, was confirmed during the later field work. It was recognized that all data collected had to be validated to assure that false reports had not been rendered by the Germans with the hope of concealing the effects of Allied air attacks.

Since the primary object of the study was concerned with the effects of air attacks, the major efforts of the Medical Branch in the collection of medical statistics were confined to individual cities in Germany rather than to the country as a whole. Case incidence and mortality rates for the entire country consists of data combined for all regions, bombed and unbombed, and were controlled by a variety of influences other than air attacks. Data for individual cities, consequently, were essential in order that variations in mortality or case rates could be examined in direct comparison with the specific bombing attacks which may have effected them.

Allied air attacks on German cities over the period of air activity were not continuous, but each large city was subjected to raids, which must be considered from the present point of view as spo-

radic in time. A city was attacked at one time for the purpose of eliminating a certain type of industry, again to destroy another industry, and still at other times to destroy the city as a whole. Repeated attacks occurred with no relation in time to the previous ones. Because of this, the effects of bombings were only shown by weekly or monthly data so that an increase in mortality rates, for example, after a period of bombing could be compared with rates reported previous to the bombing.

Selection of cities

The selection of cities to be visited for collection of data on vital statistics was accomplished through the use of information on Allied air attacks, available in the Morale Division. A chart was prepared for each city showing the number of planes designating the city as a target, and the total tonnage of bombs dropped for each week through the period 1942 to April 1945. The resulting time pattern of attacks was studied for the intensity and duration of attacks, and for the number of attacks which were followed by a non-bombing period of several weeks. Approximately 25 cities were selected for which bombing attacks were sufficiently dispersed to reflect the influence of bombing on the community vital statistics, if such occurred.

The list of cities selected for field work was decreased by the practical aspects of a field study of a country as large as Germany in the time allotted. Some of the cities originally selected, Berlin and Dresden, for example, were situated in Russian occupied territory, to which the American teams were forbidden entry at the time the field study was made. It was soon learned that in most towns a complete compilation of the material desired would not be forthcoming. "Alles verbrannt" and "Alles kaput" were all too familiar expressions. In some cities no information was available, or if so, could not be secured within a reasonable period of time. In other cities information on population data was lacking, which precluded the use of any mortality or morbidity information which had been obtained.

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On the whole, the data on mortality submitted by the local officials checked with that published in the tables of the *Reichsgesundheitsblatt*. The population figures, however, seldom checked, so that it was impossible to use the *Reichsgesundheitsblatt* tables unless local data on population were secured to replace the population figures shown in the table.

Upon completion of the field work, during which 23 cities were visited, selection of the cities began for which the information secured either from the local officials or from the *Reichsgesundheitsblatt* tabulations could be accepted. This examination was primarily for the purpose of securing reliable population bases from which rates of mortality and morbidity could be computed. Graphs were made of all population data submitted for each city. The births, deaths, number of attacking planes and the bomb tonnage were plotted on each graph, which were then examined for a consistent picture in the curves. All cases in which a population drop was shown were checked to ascertain first, if such a decrease was reflected in the total number of births and deaths, and second, if the air attacks indicated that it could reasonably have occurred through an exodus from the city. If such a consistent picture was not secured, the city was rejected for further analysis. If no local information on mortality was available, the city was also rejected, since the tabulations in the *Reichsgesundheitsblatt* for that city could not be checked. The result of this procedure was to leave 13 cities for which acceptable population and mortality data were at hand:

	<i>Population census of 1939</i>
Augsburg	180,039
Bochum	305,469
Bremen	419,226
Cologne	768,352
Dortmund	537,865
Duisburg	433,530
Duesseldorf	535,753
Hamburg	1,698,388
Kiel	261,298
Magdeburg	329,824
Mulheim	136,828
Nuremberg	420,349
Solingen	140,453
Combined Cities	6,167,374

These cities were representative of all cities in the southern, western and northern parts of Germany. Augsburg and Nuremberg are situated in southern and central Germany, while Bremen, Hamburg, Kiel, and Magdeburg are representative of northern Germany. Bremen, Hamburg, and Kiel were subject to heavy attacks because of their harbors. The remaining cities, Bochum, Cologne, Dortmund, Duisburg, Mulheim, and Solingen, are located in western Germany in the region of the Ruhr.

Acceptable tabulations of the incidence of infectious disease were available for 8 of the 13 cities for which mortality data were utilized. These were: Bochum, Cologne, Dortmund, Duisburg, Hamburg, Kiel, Magdeburg, and Nuremberg. In addition, Frankfurt was included in tabulations of infectious disease since acceptable population figures were available in the absence of complete mortality data.

Collection of data

An examination of medical statistical reports available for the pre-war period showed that a comprehensive weekly tabulation of mortality statistics was available in the weekly *Reichsgesundheitsblatt*. This table covered all cities over 100,000 in population, and gave immediate data on population, marriages, births, total deaths, and deaths by cause. Almost complete files of the *Reichsgesundheitsblatt* up through the first month of 1945 existed in London. As a preliminary move the mortality tables were transferred to punch cards, and the data tabulated for each town. A major portion of the task of collecting mortality information was accomplished by this means, providing the tables could be validated. These tabulations by cities were taken to Germany for checking with data secured from local sources.

In addition to mortality data, it was also planned to secure from local sources monthly tabulations on the incidence of infectious diseases, and of other important diseases.

Monthly information on population was desired and as originally planned consisted in tabulations by sex and age groups. Early experience showed, however, that population data by such intimate sub-divisions could be secured rarely or not at all. Consequently, requests for population data were limited to monthly tabulations of the total resident population and all foreigners, Jews, and non-residents. In order to clearly define the nature of the data, local officials were asked to submit popula-

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tion figures: (1) as estimated from births, deaths, and migration, and (2) as given by the count of the local ration cards.

Four blank forms were prepared in German for distribution to local city officials with instructions as to how the forms should be filled out. These were tables on: (1) population, (2) births and deaths, (3) infectious disease, (4) other diseases. The data requested were:

1. *Population.* Monthly population of residents and foreigners, Jews, and non-residents, estimated (a) by the customary procedure of adjusting the previous estimate by means of births, deaths, and migration, and (b) by counts of food ration cards.

2. *Birth and deaths.* The monthly number of live births, total deaths exclusive of air raid casualties, deaths under one year, deaths from tuberculosis, pneumonia, diarrhea and enteritis under one year, typhoid fever, suicide, and air attacks.

3. *Infectious disease.* Monthly case incidence of diphtheria, scarlet fever, whooping cough, tuberculosis, epidemic meningitis, epidemic encephalitis, poliomyelitis, trachoma, typhoid fever, paratyphoid fever, anthrax, rabies, psittacosis, undulant fever, typhus fever, syphilis and gonorrhoea.

4. *Other diseases.* Monthly case incidence of wounded from air attacks, cancer, rheumatism, diabetes, disease of the thyroid and parathyroid, neurosis, psychosis, addiction, glaucoma, heart disease, arterial disease, influenza, pneumonia and bronchitis, stomach and duodenal ulcers, and kidney disease.

The city officials were instructed to fill out one of the monthly tables for each of the years, 1938, 1940, 1942-1944, inclusive. The year 1938 was taken as the most recent pre-war year and 1940 as a war year during which air attacks on German cities were minimal. The list of infectious diseases requested in Form 3 was a standard one used in Germany for the transmission of periodic information to the Reichsgesundheitsamt. It was not expected that Form 4 could be filled out completely, but instructions were given that as much of the table be prepared as possible.

Forms 2, 3 and 4 were limited to statistics for German non-Jewish residents only, since preliminary study had shown that only these data were adequately collected. Occasional records of mortality and case incidence for non-residents, foreigners and Jews were encountered, but these were not considered reliable.

The general plan of the field work was to have a member of the medical team surveying the city leave the forms with a responsible member of the civil government, either the Burgomeister, the Health Officer or the head of the Statistische Amt. This official was given several days in which to conform with the request, after which the team member called for the forms and discussed them with the official in charge. The plan was modified somewhat after the work began, in that the statistical team was held responsible for the collection of statistical information in each city. This change was made in order that a more thorough discussion of the submitted material could be made with the local officials, and first-hand conclusions regarding the validity of the information and of the tabulations from the *Reichsgesundheitsblatt* determined by those responsible for further analysis.

Methods of analysis and presentation

The monthly population data secured from each city consisted in local estimates for the first few years of the war, and of data compiled from the food ration cards for the later years. Where monthly population figures computed by both methods were available, a large discrepancy was usually shown, the data from food cards being lower than that from the estimates made from births, deaths, and migration. It was believed that in the initial years of the war the estimates were accurate, but as air attacks occurred with greater frequency the migration from the city was too great to be approximated, and no means was available to correct the factor with any precision. Consequently, in the later years of the war, the food ration cards had to be relied upon to yield population data representing the number of persons in the city. A transition period thus occurred after bombing took place for which the population data could only be estimated. During these periods, usually of several months duration, a straight line interpolation was made between the previous level of estimated population and the new level of food ration card population. The interpolations were checked against the population movement as reflected in the tabulation of births and deaths.

The monthly population figures thus secured were used for the determination of computing factors by which monthly numbers of deaths and cases of disease were multiplied to give monthly rates of natality and mortality on an annual basis. The birth rate and the death rates from all causes were

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computed per thousand population. Specific death rates by cause and case incidence rates were computed per 100,000 population. Monthly figures on infant mortality were divided by the number of live births to yield an infant mortality rate per thousand live births. It was realized that this rate was inaccurate since the deaths of infants occurring within a given month were not all derived from the live births registered for that month. However, this is the most accurate figure obtainable since sufficient data were not available to compute rates by any other means.

The results of these analyses on the acute communicable diseases have been incorporated in the study of communicable disease. Data on tuberculosis are included in the study of that disease. The analysis of births, all causes of deaths, infant mortality, mortality rates of non-communicable disease, suicide and accidents are given in the present chapter. The general sequence of presentation has been a discussion of the annual case incidence and mortality rates, followed by the charts on monthly case or death rates as related to the air raids. The

charts show individual mortality trends for thirteen cities and case incidence trends for nine. The tables of annual mortality rates present those of the thirteen cities. However, for case incidence the cities comprising the table and its total show only six or seven of the nine presented in the monthly charts; two, Cologne and Dortmund, and occasionally a third were eliminated because the available rates did not cover the five years for which data were available for the other cities of the original nine.

Annual rates have been considered in the present study as revealing changes which reflect all wartime influences taken together (air raids being but one of them) and year by year, their cumulative effect. The monthly charts, with the tonnage of bombs reported dropped on the city, show the rates in relation to the bombing, hence some idea of the bombing effect alone may be deduced from them.

It will be noted that many gaps occur in the monthly rates; these in most instances follow an air raid, and are due to the destruction or disruption of the local statistical office. After several

TABLE 21. ANNUAL BIRTH RATES
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44
(Rates per 1,000 population, annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	15.87	16.46	14.11	14.31	10.38(10)
Bochum	16.74	17.39	13.88	10.95	9.97(10)
Bremen	18.56	19.66	13.94	12.28	11.18(10)
Cologne	16.21	17.84	11.79	15.69(5)	8.20(8)
Dortmund	18.03	18.73	14.57	11.48	13.87(9)
Duisburg	19.52	20.20	15.17	13.09	16.23(10)
Duesseldorf	17.00	18.87	12.78	9.85(9)	8.43(7)
Hamburg	16.26	17.54	14.34	12.65	12.64(10)
Kiel	19.49	21.39	15.37	12.98	5.14(10)
Magdeburg	16.13	17.15	14.57	14.72	13.03(10)
Mulheim	15.68	17.11	13.48	9.67	12.07(10)
Nuremberg	15.02	18.22	13.85	12.44	13.82(10)
Solingen	11.27	13.61	11.78	10.70	12.47(10)
Combined Cities	16.77	18.19	13.87	12.68	11.42(10)

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TABLE 22. ANNUAL MORTALITY FROM ALL CAUSES OF DEATH (Except Air Raids)
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 1,000 population, annual basis)

City	1938	1940	1942	1943	1944
Ausburg	11.63	12.16	11.36	10.98	11.65(10)
Bochum	10.11	10.73	10.37	11.29	12.93(10)
Bremen	10.26	11.43	11.31	11.70	11.37(10)
Cologne	11.15	12.73	11.91	14.84(5)	11.51(8)
Dortmund	10.56	11.54	11.01	11.21	14.26(9)
Duisburg	10.34	11.87	13.75	14.33	14.60(10)
Duesseldorf	10.97	12.42	11.90	11.10(9)	11.87(7)
Hamburg	11.64	13.36	12.29	11.09	13.10(10)
Kiel	10.22	10.31	8.46	8.05	6.86(10)
Magdeburg	11.92	12.13	11.68	11.83	15.47(10)
Mulheim	9.61	10.51	13.49	12.77	10.24(10)
Nuremberg	10.80	12.04	12.64	12.54	12.45(10)
Solingen	10.74	12.17	12.63	12.79	13.45(10)
Combined Cities	11.00	12.26	11.83	11.80	12.43(10)

weeks reports were resumed, but the data for the city during the bombing period were not made available in the *Reichsgesundheitsblatt*. The locally collected data on disease were more complete, and in most instances figures were rendered for all weeks, including those of the bombing. It is undoubtedly true that the data for raid periods are defective, collected as it was by staffs of destroyed offices during a period when diagnosis and reporting was unusually difficult.

Births

The birth rate in Germany began to rise in 1933 following the Nazi directed campaign for increased fertility. The upward swing continued until 1939, after which the rate declined. In 1941 the birth rate for the country as a whole was 18.6 per 1,000 population, compared with 20.4 at the peak year of 1939.

Table 21 shows the annual birth rate for thirteen German Cities. The 1940 rate for all cities, 18.19 per 1,000 population, was higher than in 1938 when it was 16.77, the decline from the peak

of 1939 being less abrupt than the increase for 1939 over 1938. The rate for the combined cities in 1942 was 13.87. It fell to 12.68 in 1943 and to 11.42 in 1944. In general the rates for the individual cities follow the same course. The exceptions are largely those in which the rate for 1944 was higher than that for 1943, a condition brought about in large part because of evacuations from the cities following the air attacks of 1943.

Programs of evacuation from large cities featured the initial removal of pregnant mothers and those with babies and small children. The effect of this is clearly shown in Figure 44, where many of the monthly trends of birth rates are seen to drop sharply after periods of air attack. Properly, of course, the evacuation factor should have been taken care of by population adjustment, but this was not always possible.

A second factor to be considered in the trend of the birth rate as effected by bombing is the frequency of miscarriages and abortions. Some evidence has come to hand that these mishaps of pregnancy increased during the period of heavy

FIGURE 44 (continued)

THE BOMBING EXPERIENCE AND
BIRTH RATE
IN THIRTEEN GERMAN CITIES

MONTHLY BIRTH RATES PER 1,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

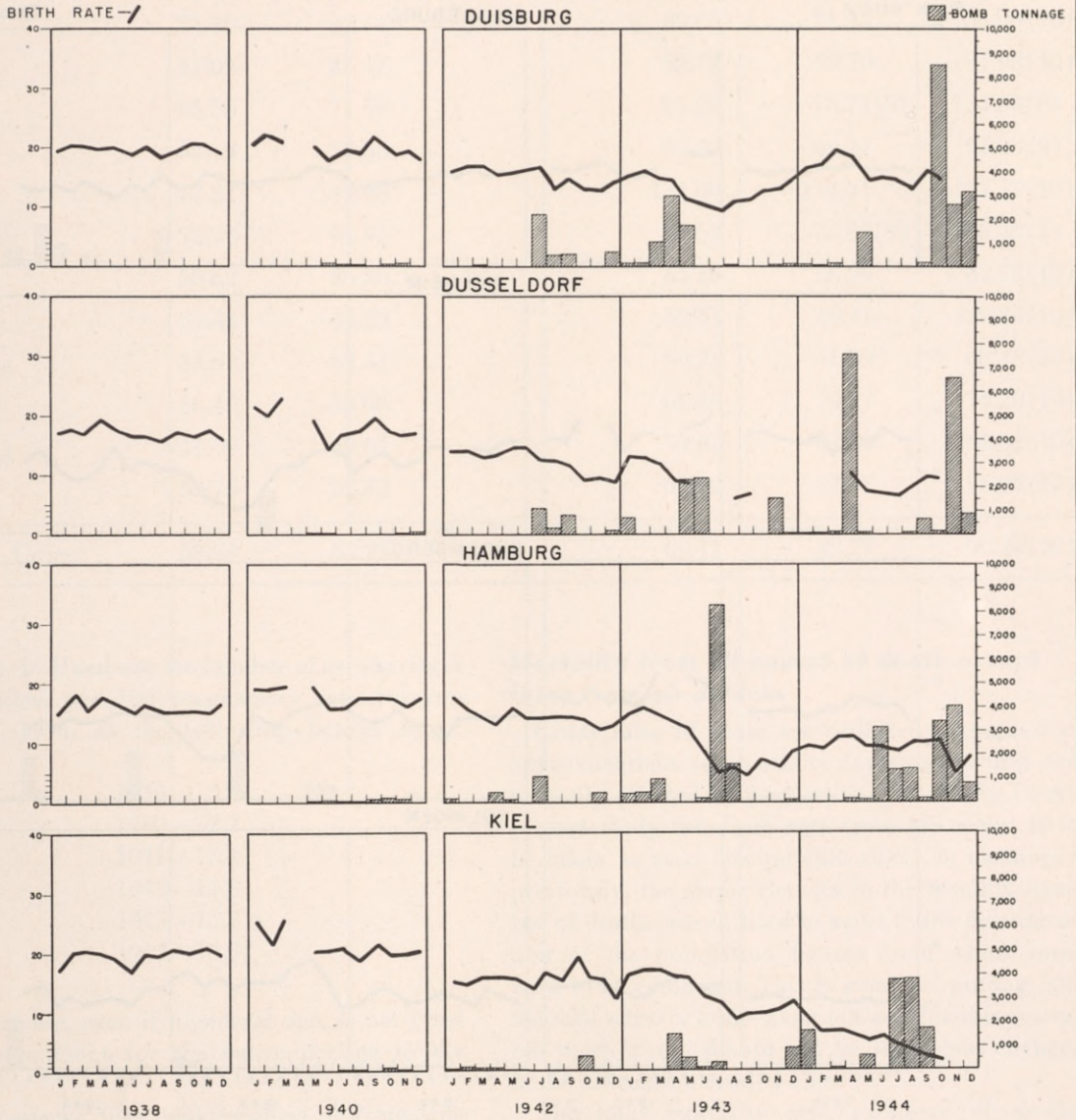
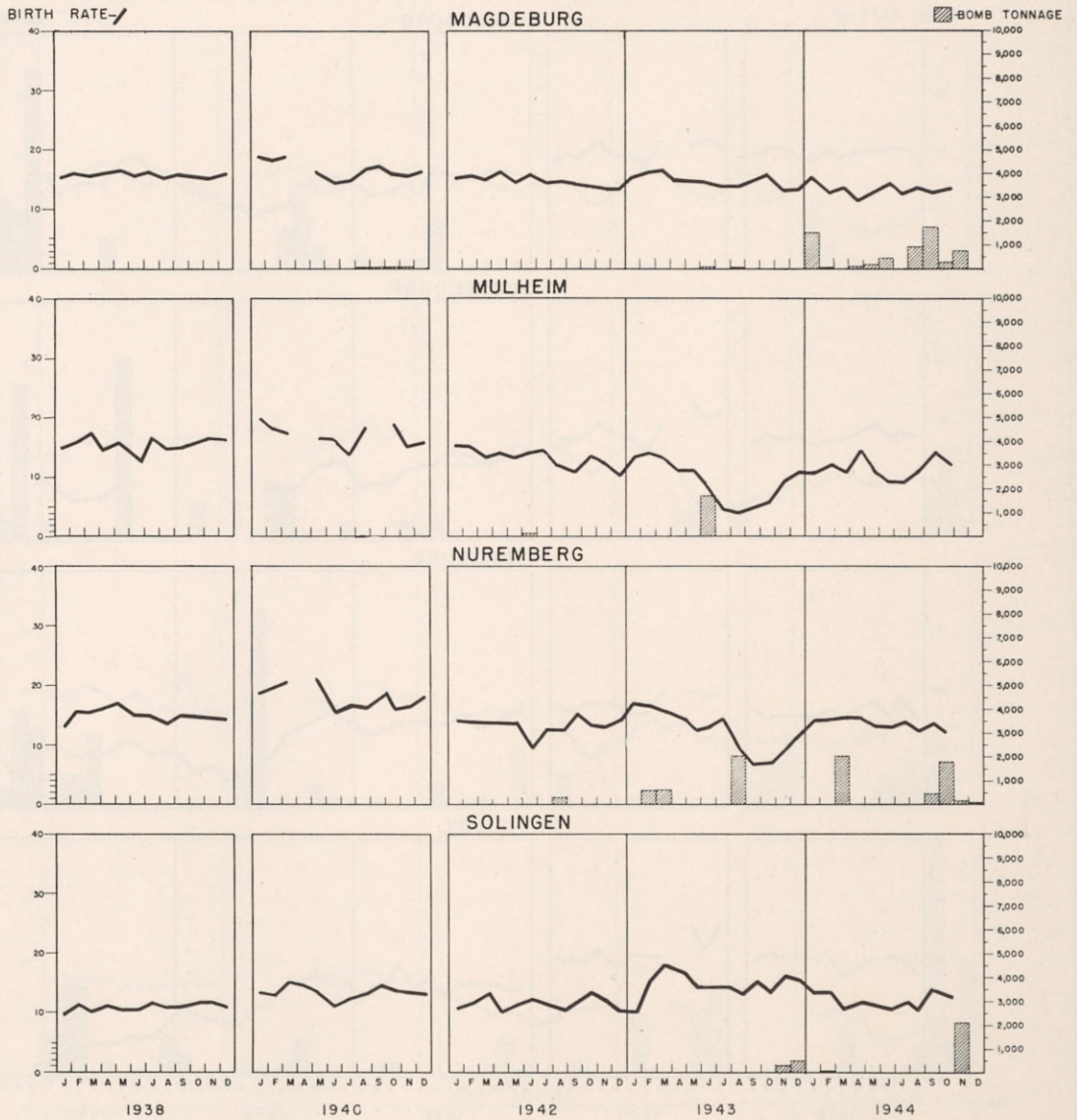


FIGURE 44 (concluded)

THE BOMBING EXPERIENCE AND
BIRTH RATE
IN THIRTEEN GERMAN CITIES

MONTHLY BIRTH RATES PER 1,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES.



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TABLE 23. ANNUAL INFANT MORTALITY
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 1,000 population, annual basis)

City	1938	1940	1942	1943	1944
Augsburg	60.65	78.41	80.97	89.19	89.96(10)
Bochum	71.36	82.44	89.63	81.56	134.00(10)
Bremen	47.05	47.37	52.72	59.76	97.98(10)
Cologne	65.56	71.59	85.28	76.71(5)	134.84(8)
Dortmund	64.19	57.53	67.58	82.44	97.03(9)
Duisburg	77.21	89.90	134.00	114.41	137.17(10)
Duesseldorf	72.74	94.91	68.60	74.87(9)	135.48(7)
Hamburg	50.62	55.36	54.10	56.99	82.78(10)
Kiel	54.48	44.29	59.51	49.41	120.24(10)
Magdeburg	53.07	62.51	60.21	61.59	68.48(10)
Mulheim	50.40	48.08	61.46	70.57	74.29(10)
Nuremberg	41.09	48.61	59.65	67.24	68.02(10)
Solingen	53.75	52.37	68.82	57.17	56.85(10)
Combined Cities	58.83	64.29	69.12	68.79	96.79(10)

air attacks. In Hamburg the number of miscarriages and abortions per 100 pregnancies rose between 1939 and 1944, as the following figures show:

1939—13.8
1940—12.2
1941—13.4
1942—14.8
1943—15.7
1944—16.9

This increase, even if a general one, is not great enough to account for the entire decline in the birth rate.

The air attacks, then, had the effect of decreasing the birth rate in German cities largely through the evacuation of pregnant mothers to regions of greater safety. It is a statistical decrease, and signifies nothing as to the actual decrease in pregnancies throughout the country. Rural birth rates were not available to demonstrate an increase commensurate with the decline in the urban birth rate. Little doubt exists, however, that an actual decrease occurred in the rate for Germany as a whole.

Mortality from all causes of death except those from air attacks

Crude rates of death are ordinarily regarded as approximations of mortality forces since they are so easily effected by population differences. In the present study the death rate from all causes is to be taken as even less reliable since, as mentioned previously, the major changes in the monthly number of deaths was utilized to assist in the determination of the population figures from which rates were to be computed. This is a case of putting into the mill what is to be taken out and for this reason too much stress should not be laid upon changes in the all-cause mortality rate.

The total mortality rate, exclusive of deaths from air raids, combined for the thirteen German cities is shown in Table 22. The table indicates that the crude death rate had risen during the war years, but that relatively little effect was demonstrated in increased mortality for the heavy bombing years of 1942 to 1944 over that of 1940. The rate for 1944 was 12.43 per thousand which is only slightly above that for 1940, 12.26. The rates for 1942 and 1943 are both less than that for 1940.

The picture shown for the combined group is borne out by the data for individual cities. Pre-war year 1938 shows the lowest death rate, while those for 1942 to 1944, for the most part, show no marked deviation from the rates for 1940. A consistent increase during 1942-44 occurred in only five of the thirteen cities, four of which were located in the Ruhr, an area of exceptionally heavy bombing. The fifth city, Magdeburg, received only light air attacks until 1944.

The monthly crude death rates for each of the thirteen cities, with the tonnage of bombs dropped, are shown in Figure 45. These curves clearly show that no substantial change in the level and trend of mortality occurred during 1942-43, as expressed by the data at our command. Inspection of the curves for the year 1943 does show that in several cities, Bochum, Dortmund, Duesseldorf, Hamburg, Mulheim, and Nuremberg, the mortality rate increased following months in which air attacks occurred. However comparison of the curves for 1943 with those for 1938 and 1940 indicates that the apparent increase is along the line of normal seasonal expectation. A later section of this chapter presents the results secured after the seasonal effect has been adjusted, and demonstrates that an actual increase occurred as an effect of the air attacks.

Infant mortality

Annual infant mortality rates are shown in Table 23. The rate for the thirteen cities combined was 58.83 in 1938. It rose to 64.29 in 1940 and a little higher, 69.12 and 68.79 in 1942 and 1943. In 1944 the rate was 96.79. Except in Solingen the rate in 1944 was substantially increased over the previous years for all cities. Study of the monthly charts, Figure 46, shows that a gradual increase in the infant mortality rate may be detected except for the four cities Magdeburg, Mulheim, Nuremberg and Solingen on the third page of the figure. These are cities which were not attacked by air raids with the intensity devoted to other cities, especially in the earlier years of bombing. It appears, then, that increases in infant mortality were brought about more by the cumulative hardships of war-time than directly by air attacks.

It should again be emphasized that the infant mortality rates are here subject to errors which may impair their accuracy and reliability. As mentioned above, these rates were computed per 1,000 live births occurring in the same month. But only

a proportion of the infant deaths can properly be charged to the births occurring in that month. An evacuation of pregnant mothers and infants will effect the infant mortality rate in a manner governed by the unknown ratio of pregnant mothers to infants for the previous months. Such an evacuation occurred in the cities under discussion here and its effects on the infant mortality rates cannot be judged.

Diseases of adult life

Diabetes: Annual mortality rates for diabetes in thirteen German cities are given in Table 24. In 1938 and 1940 rates for the cities combined are 23.32 and 21.51 respectively. Compared with these, the corresponding rates for the later years are low, being 16.84 in 1942 and 15.54 in 1944. In general, rates for the individual cities show a decreased mortality from this disease during the heavy bombing years.

The monthly trend of mortality from diabetes is shown in Figure 47 for the same cities. Little evidence is given that heavy air attacks had any effect on mortality from this disease. Occasional sharp increases following heavy bombings are shown as in Duisburg in 1942, for example, but these do not consistently occur to an extent that the level of mortality is raised significantly above that of the pre-bombing period. The effect of the breakdown in insulin supply discussed in Chapter Twelve which will probably make itself felt on the mortality rates of diabetes was not apparent when these data were collected.

Heart Disease: In 1938 and 1940 the mortality rates per 100,000 for heart disease were 149.76 and 161.80 respectively for the combined group of thirteen German cities, Table 25. The corresponding rate for 1942 was 138.72; which rose to 145.10 in 1943 and to 164.49 in 1944. In spite of the fact that the level of mortality for the heavy bombing years was less than for 1938 and 1940, the progressive increase between 1940 and 1942 points to a definite increase in the later years of the war. This finding is consistent with the results shown in Table 25 for eight of the individual cities.

The periods of heavy air attacks appear to have an accelerating effect on mortality from heart disease, as indicated by the charts of Figure 48. In Bochum, for example, mortality rose shortly after the bombing periods in 1943. In Duisburg, the mortality rates rose after the raids of 1942 and again after those of 1943, and in Magdeburg immediately

FIGURE 45

THE BOMBING EXPERIENCE AND MORTALITY FROM ALL CAUSES OF DEATH (EXCEPT AIR ATTACKS) IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 1,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

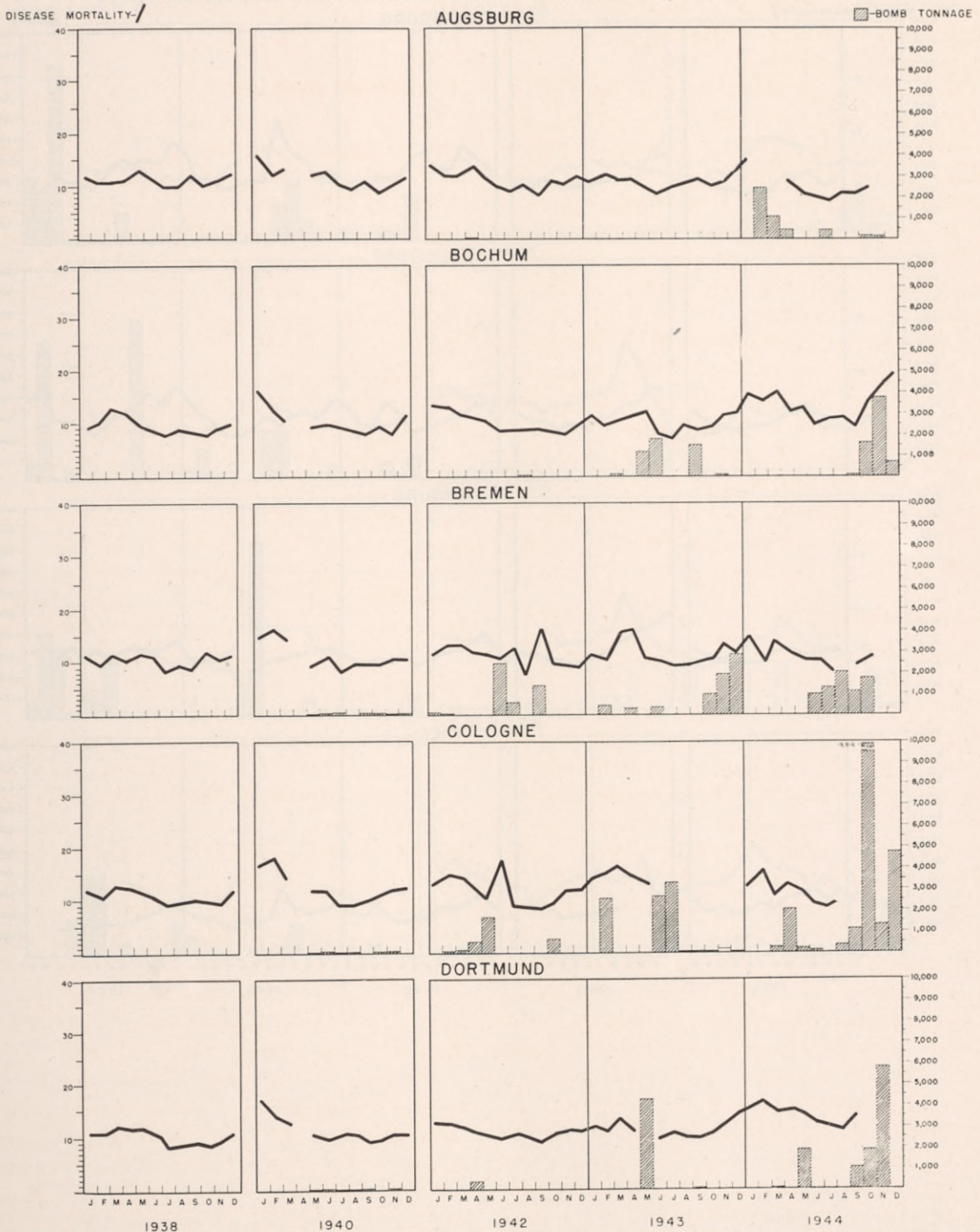


FIGURE 45 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM ALL CAUSES OF DEATH (EXCEPT AIR ATTACKS) IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 1,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

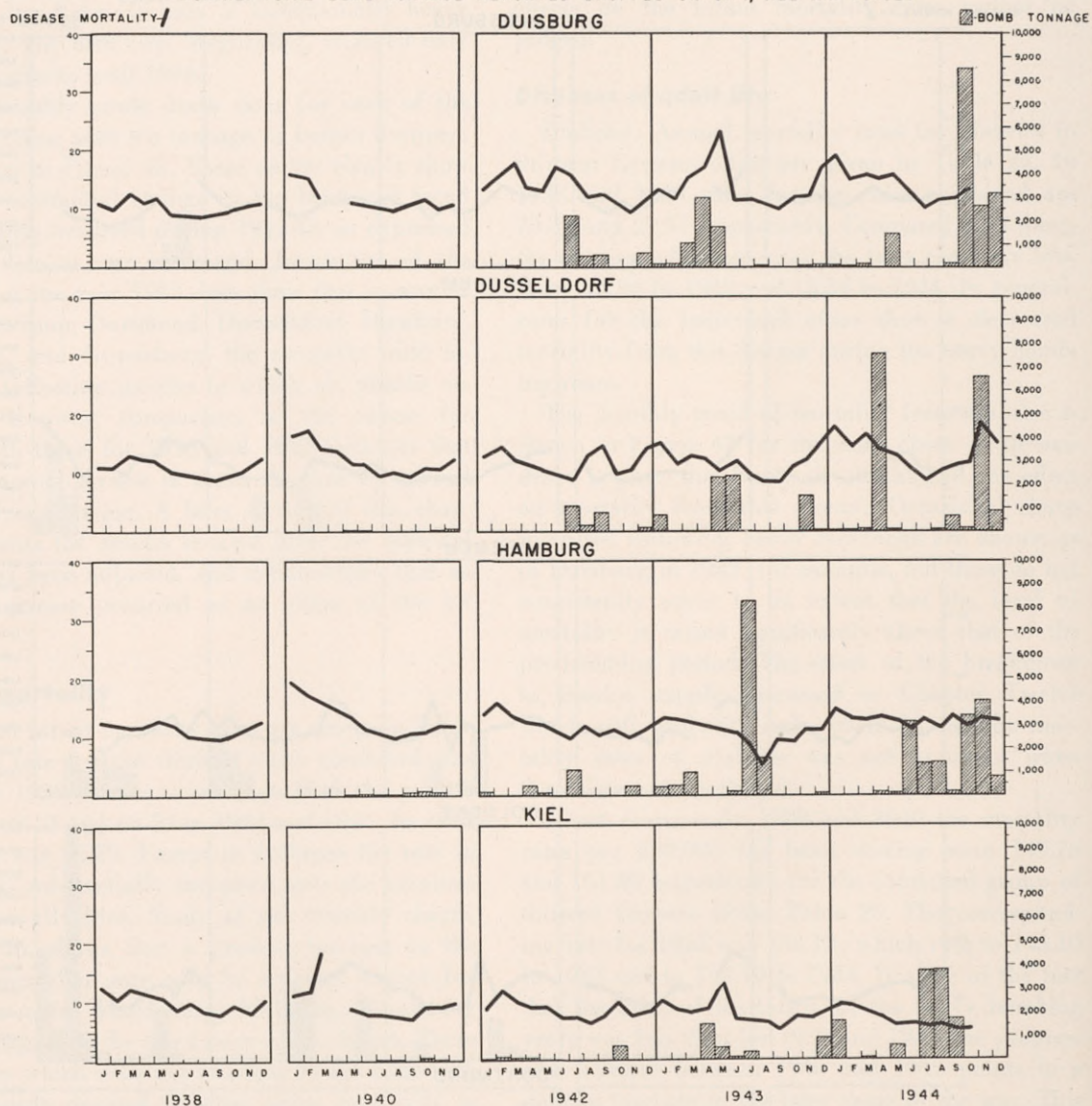


FIGURE 45 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM ALL CAUSES OF DEATH (EXCEPT AIR ATTACKS) IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 1,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

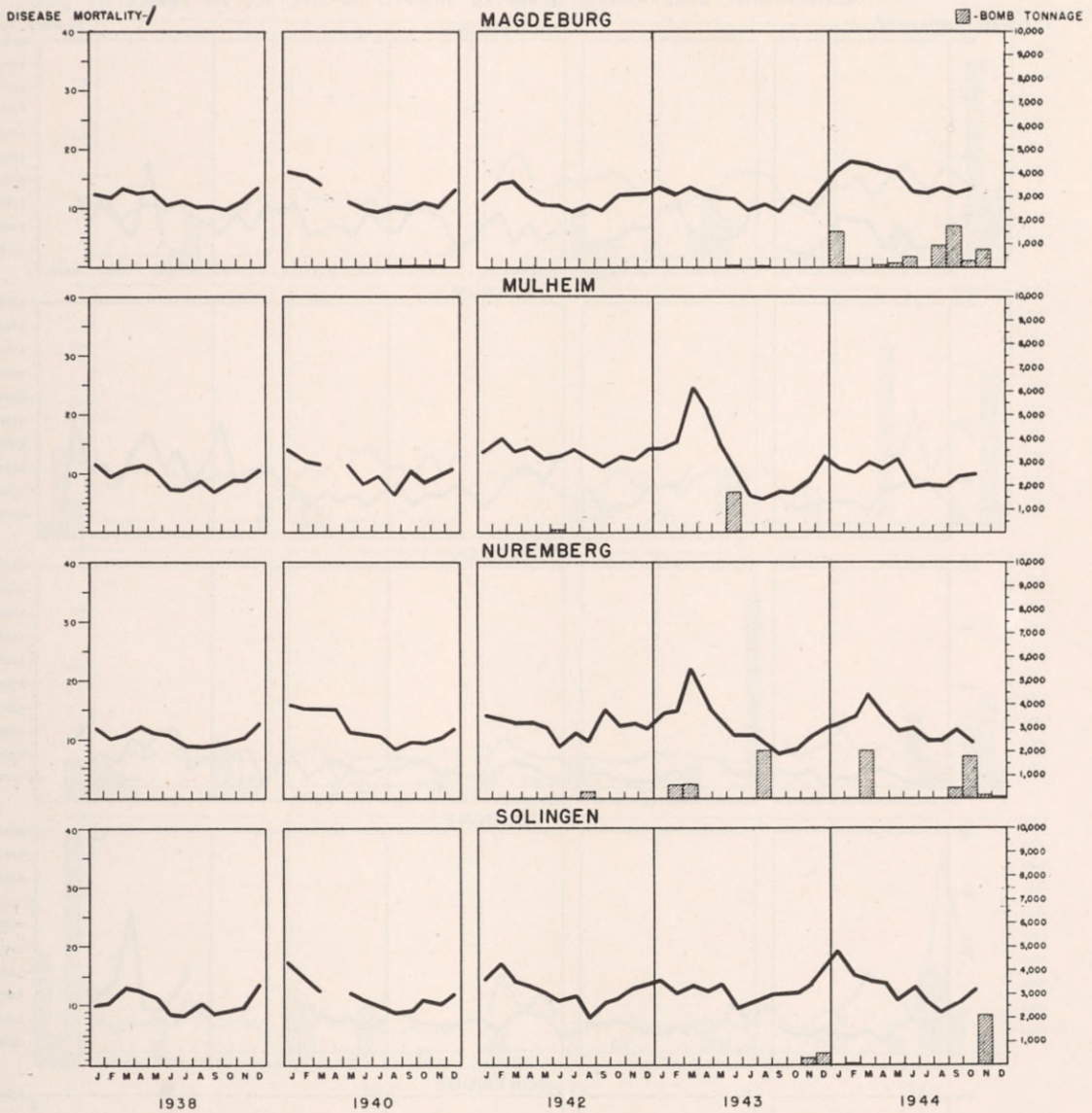


FIGURE 46

THE BOMBING EXPERIENCE AND
INFANT MORTALITY
 IN THIRTEEN GERMAN CITIES

MONTHLY INFANT MORTALITY RATES PER 1000 LIVE BIRTHS, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

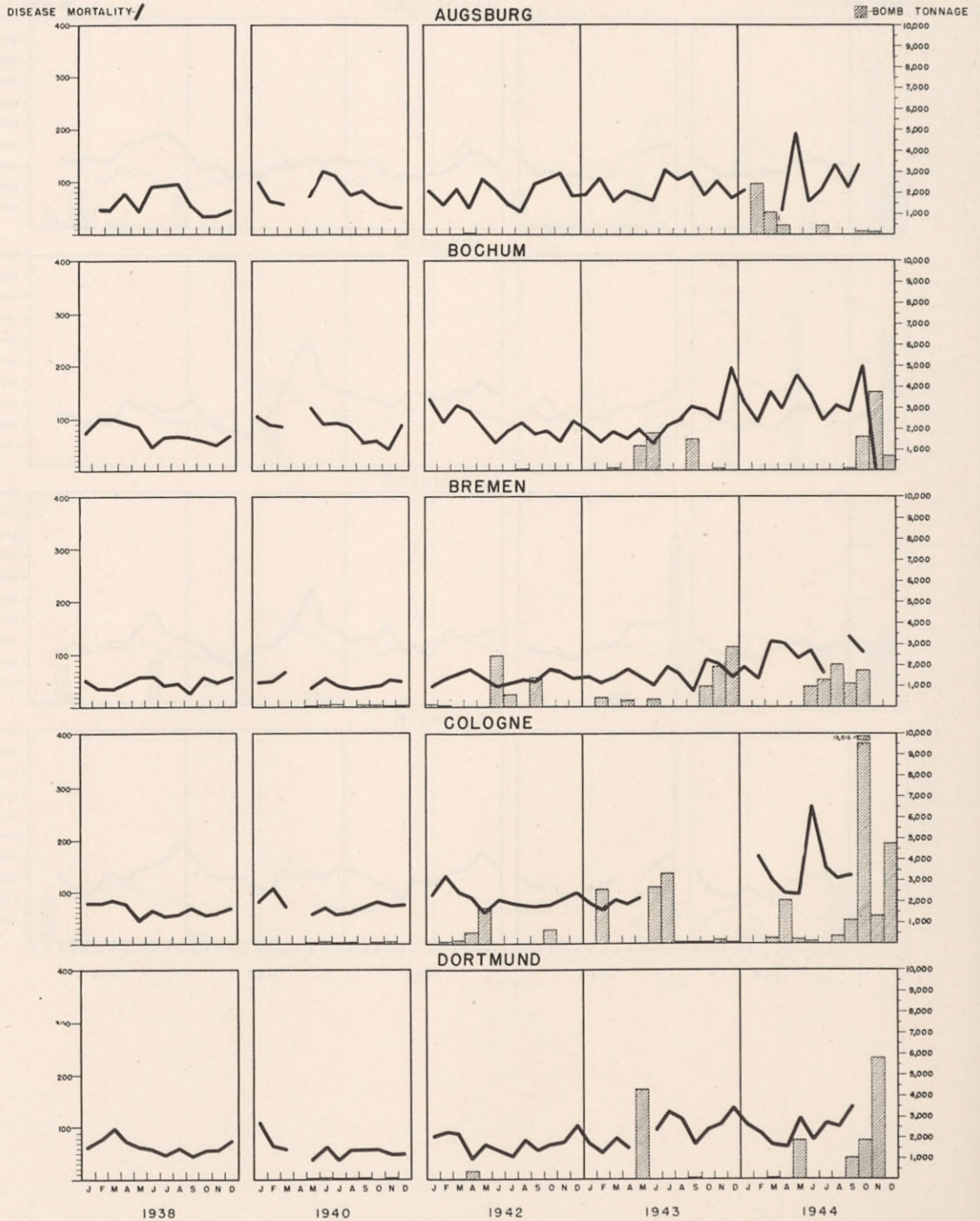


FIGURE 46 (continued)

THE BOMBING EXPERIENCE AND
INFANT MORTALITY
IN THIRTEEN GERMAN CITIES

MONTHLY INFANT MORTALITY RATES PER 1000 LIVE BIRTHS ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

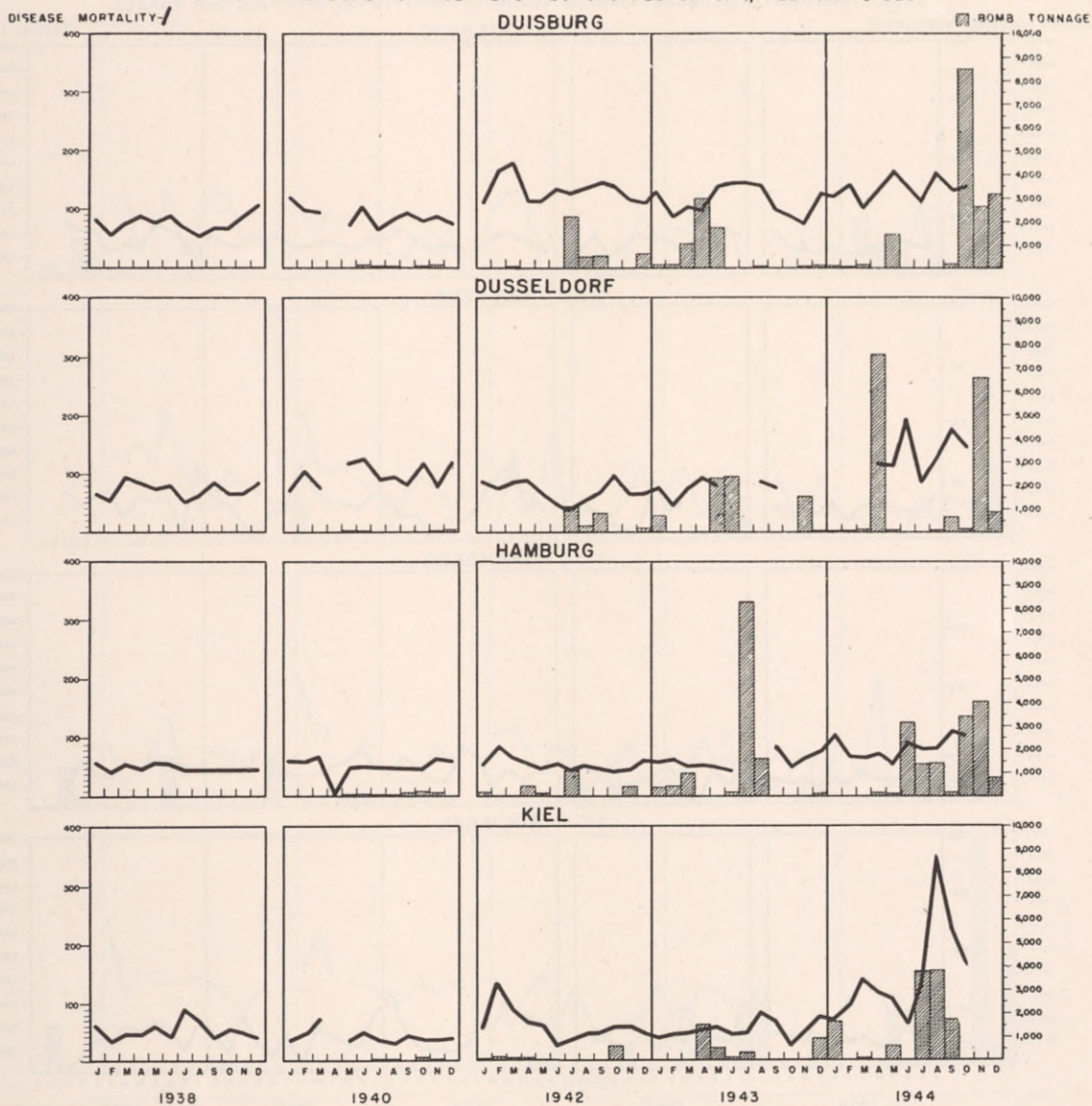


FIGURE 46 (concluded)

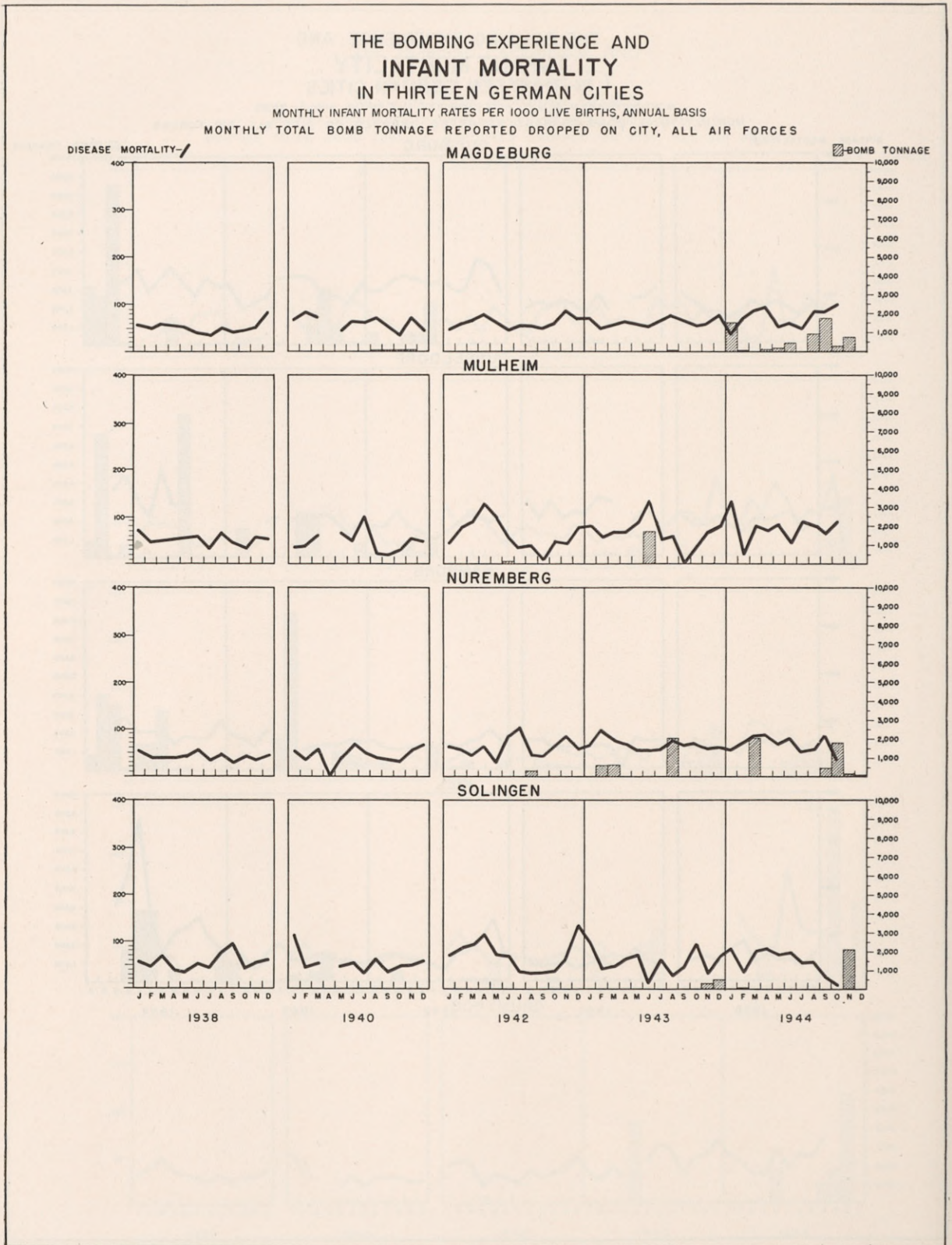


FIGURE 47

THE BOMBING EXPERIENCE AND MORTALITY FROM
DIABETES
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

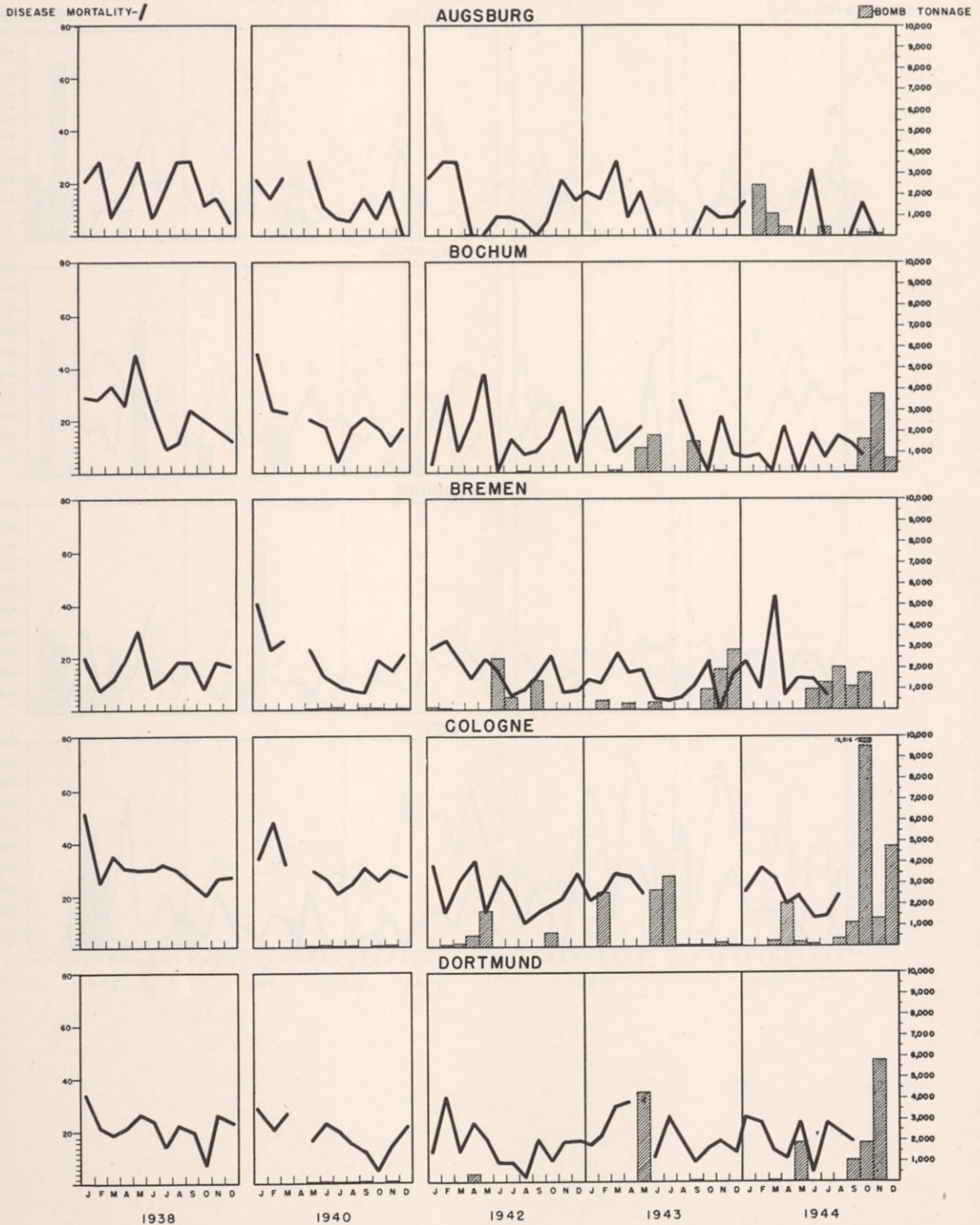


FIGURE 47 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
DIABETES
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

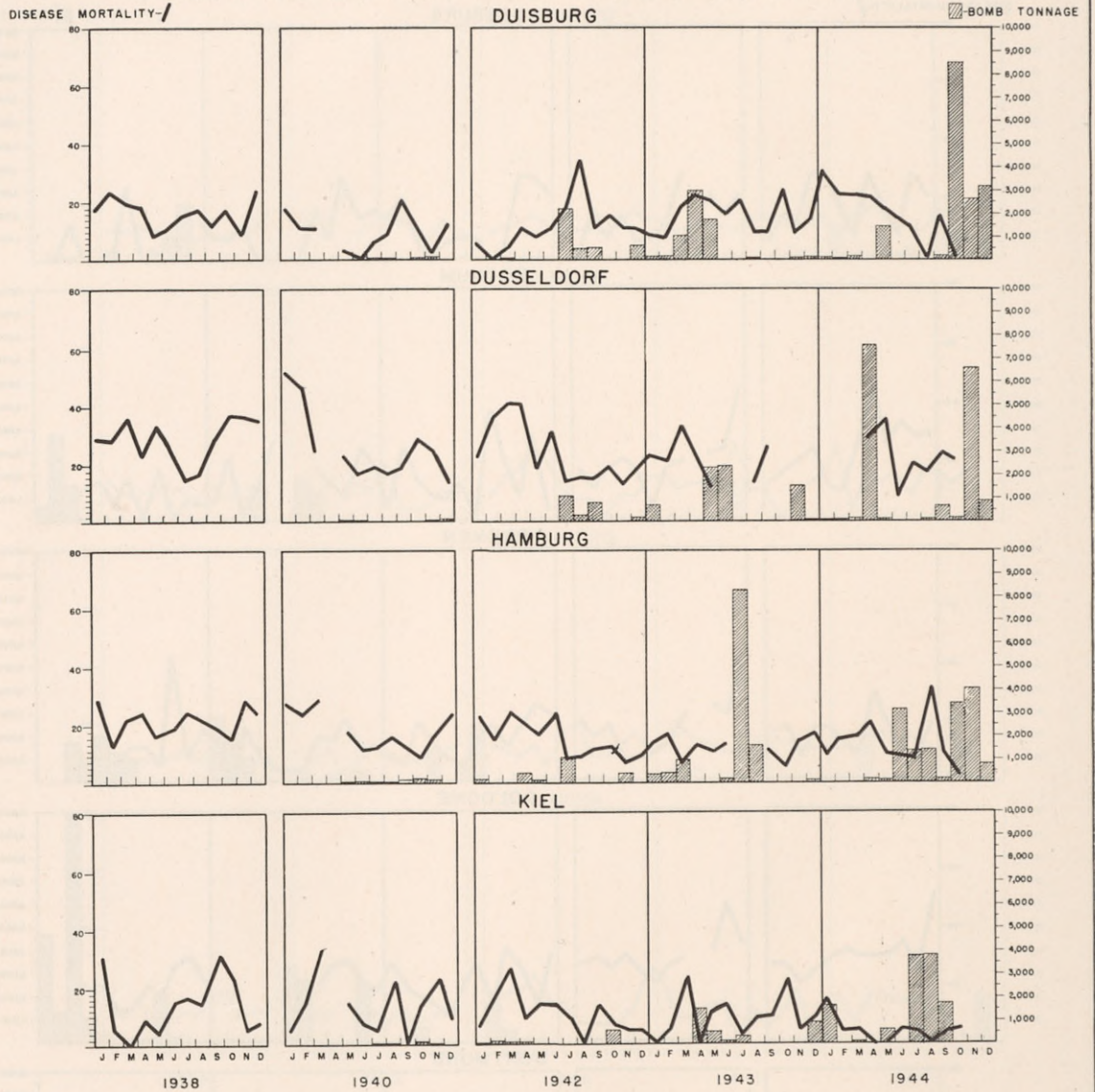
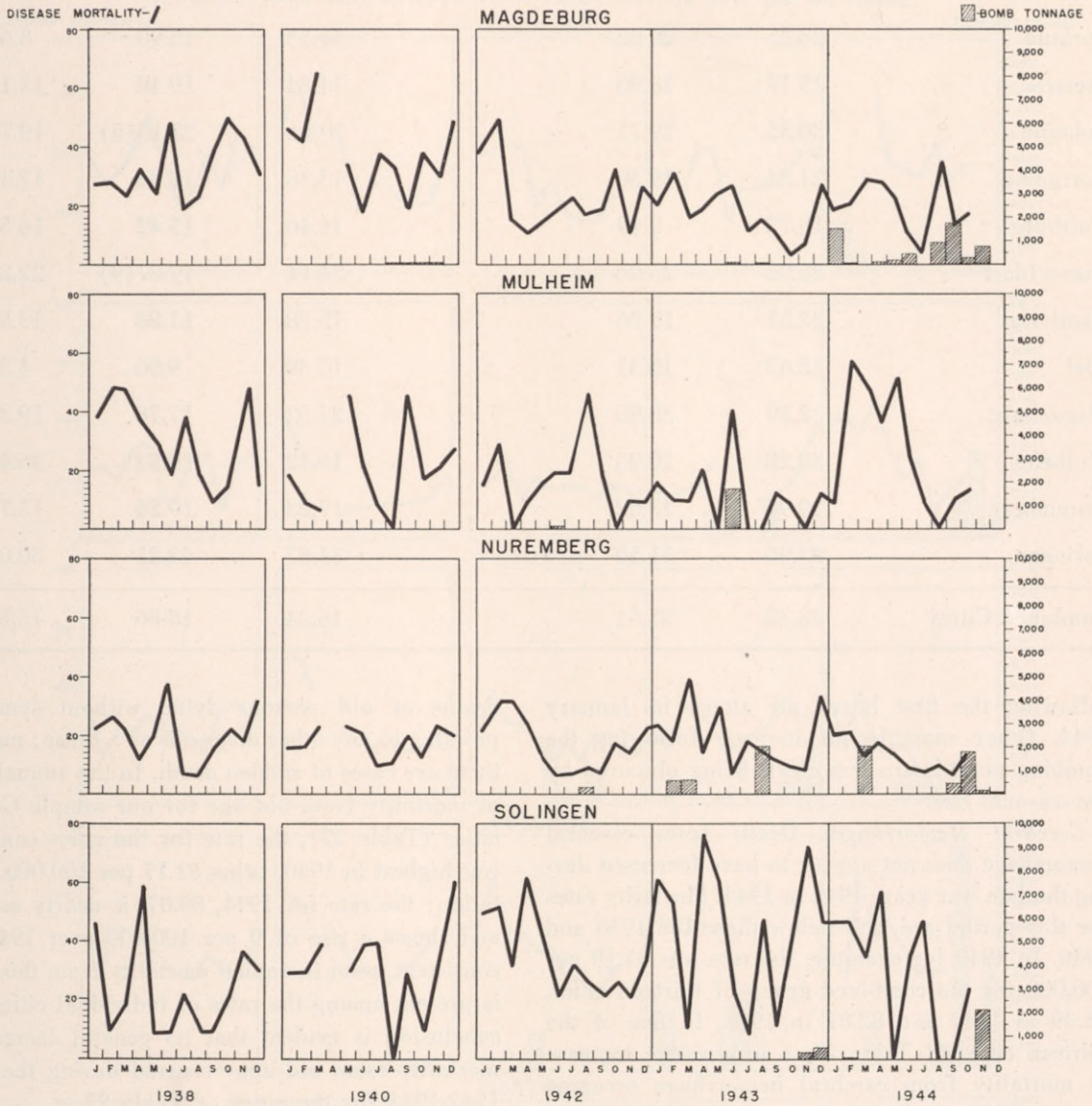


FIGURE 47 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
DIABETES
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



VITAL STATISTICS

TABLE 24. ANNUAL MORTALITY FROM DIABETES
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 100,000 population, annual basis)

City	1938	1940	1942	1943	1944
Augsburg	17.50	14.76	11.21	9.19	5.90(10)
Bochum	23.25	20.02	14.33	15.90	8.64(10)
Bremen	15.12	18.90	14.84	10.48	13.10(10)
Cologne	30.35	29.71	20.41	22.19(5)	19.78(8)
Dortmund	21.54	19.30	13.38	17.34	17.42(9)
Duisburg	16.72	9.49	11.46	15.42	16.59(10)
Duesseldorf	28.95	25.90	24.14	19.87(9)	22.85(7)
Hamburg	22.51	19.26	15.28	11.88	13.59(10)
Kiel	15.63	15.31	10.39	9.06	4.35(10)
Magdeburg	32.59	38.95	23.52	17.78	19.31(10)
Mulheim	30.28	20.93	16.42	10.82	26.44(10)
Nuremberg	19.94	18.62	17.23	19.24	13.79(10)
Solingen	23.96	31.50	34.87	42.21	30.08(10)
Combined Cities	23.32	21.51	16.84	15.66	15.54(10)

following the first heavy air attack in January 1944. Other examples of increase following the bombing periods are less clear, being obscured by the seasonal rise.

Cerebral Hemorrhage: Death from cerebral hemorrhage does not appear to have increased during the late war years 1942 to 1944. Mortality rates for this period are well below those for 1938 and 1940. In 1940 for example, the rate was 97.19 per 100,000 for the combined group of thirteen cities, 83.39 in 1942 and 82.81 in 1944. In five of the thirteen cities of Table 26, a progressive increase in mortality from cerebral hemorrhage occurred during 1942 to 1944; in general however, the magnitude of the rates in 1944 was less than in 1938 or 1940.

Figure 49 shows monthly trends of mortality rates of cerebral hemorrhage compared with the frequency and severity of air attacks. No clear relationship is shown except in Magdeburg where a sharp and definite increase occurred in 1944 following the heavy air attacks in January.

Old Age: Deaths classed as old age comprise all

deaths of old persons dying without symptoms pointing to any other diagnosis as a cause; many of them are cases of sudden death. In the annual table of mortality from old age for our sample German cities (Table 27), the rate for the cities combined was highest in 1940, being 81.17 per 100,000 population; the rate for 1944, 80.07, is nearly as high, and shows a rise of 9 per 100,000 over 1943. No consistent trend in annual mortality from this cause is present among the rates of individual cities. The conclusion is evident that no general increase in mortality from old age occurred during the years 1942-1944 for the cities of Table 27.

The trend of monthly mortality rates for old age is shown in Figure 50. While an increase during and following air attacks is shown for several cities, Bochum and Cologne, for example, the normal high-winter fluctuation occurs at the same time to obscure the relation to the air attacks. A later analysis, adjusting for season, demonstrates a definite increase in old age mortality following air attacks.

FIGURE 48

THE BOMBING EXPERIENCE AND MORTALITY FROM
HEART DISEASE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

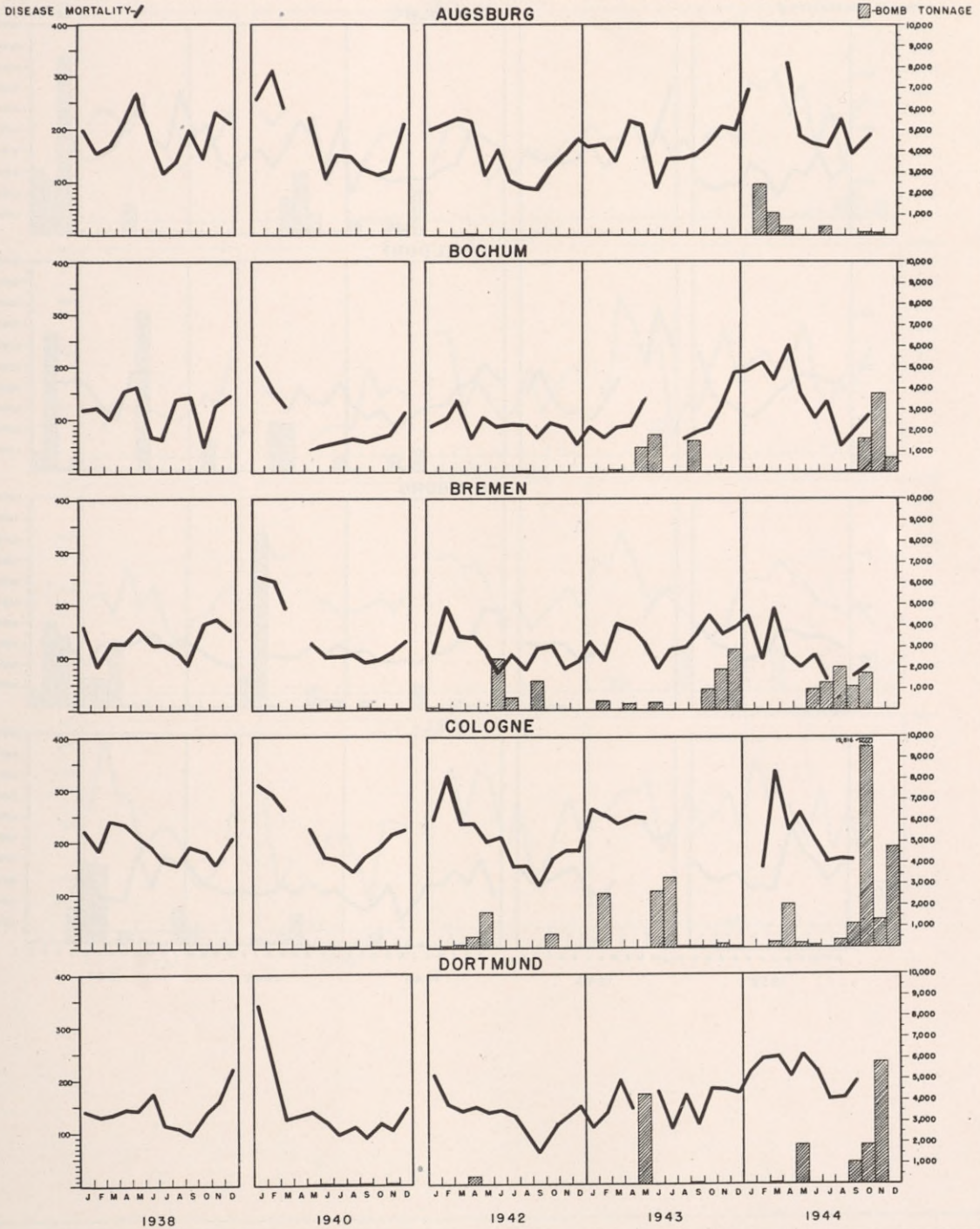


FIGURE 48 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
HEART DISEASE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

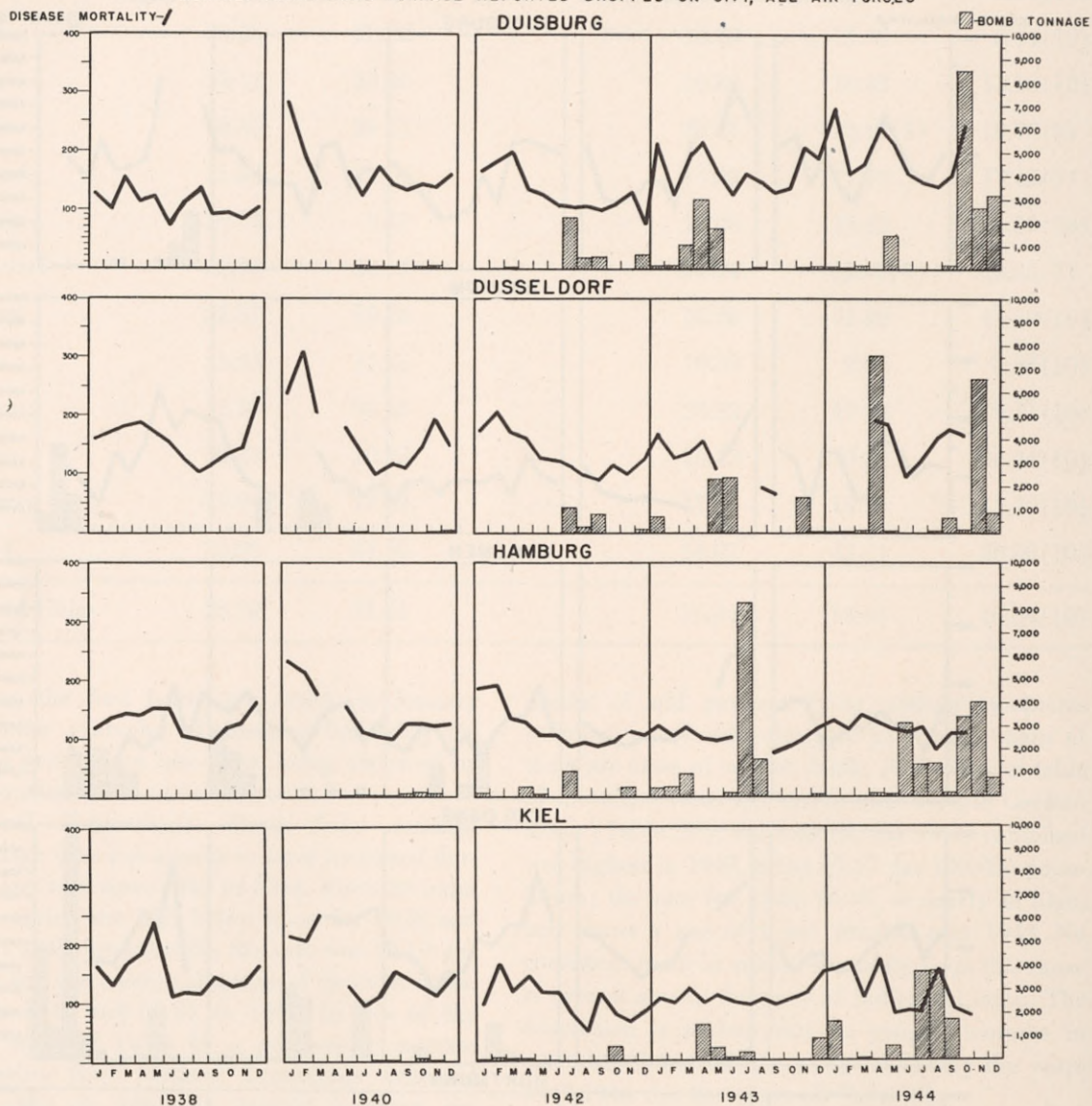


FIGURE 48 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
HEART DISEASE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

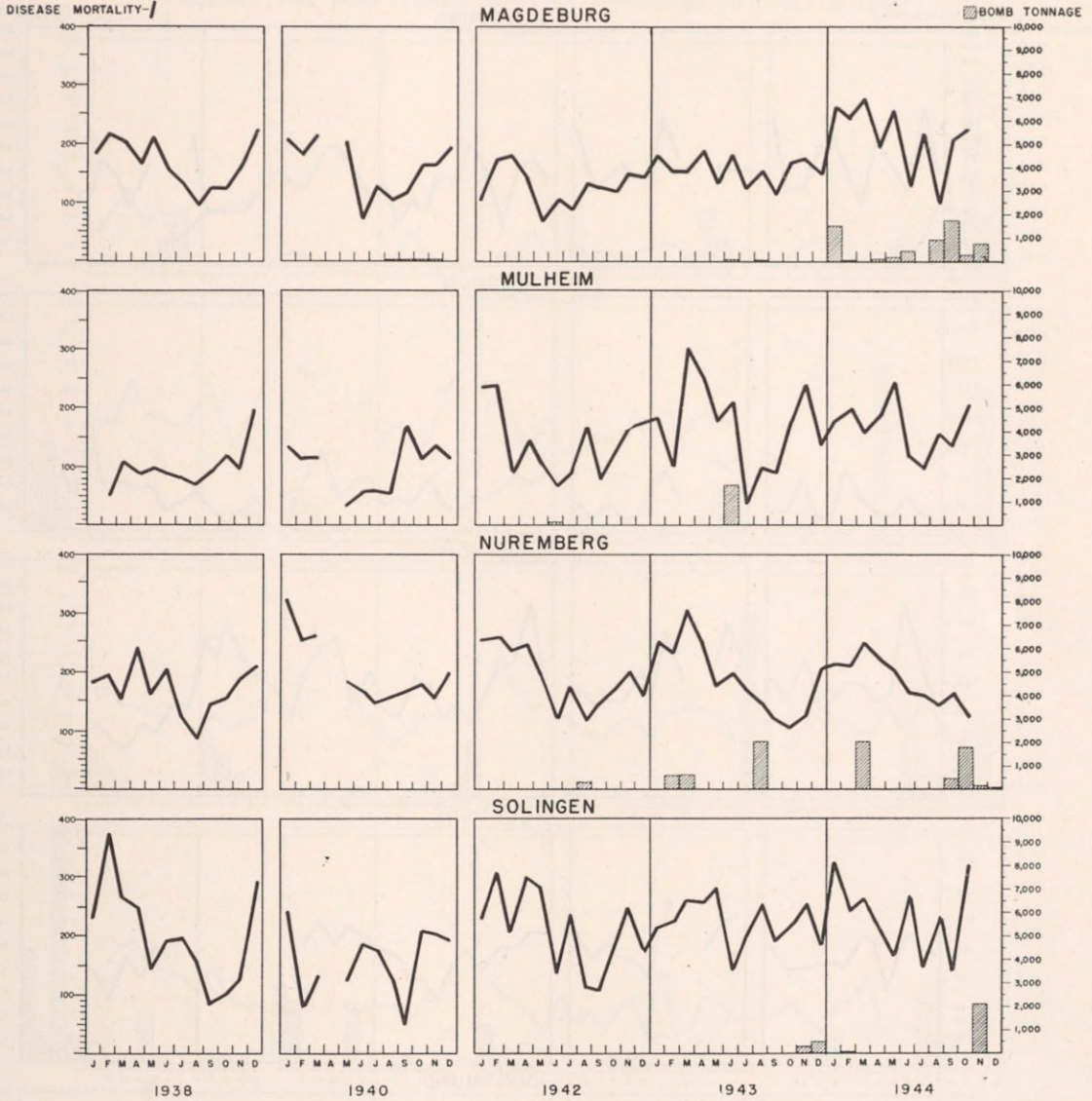


FIGURE 49

THE BOMBING EXPERIENCE AND MORTALITY FROM
CEREBRAL HEMORRHAGE
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

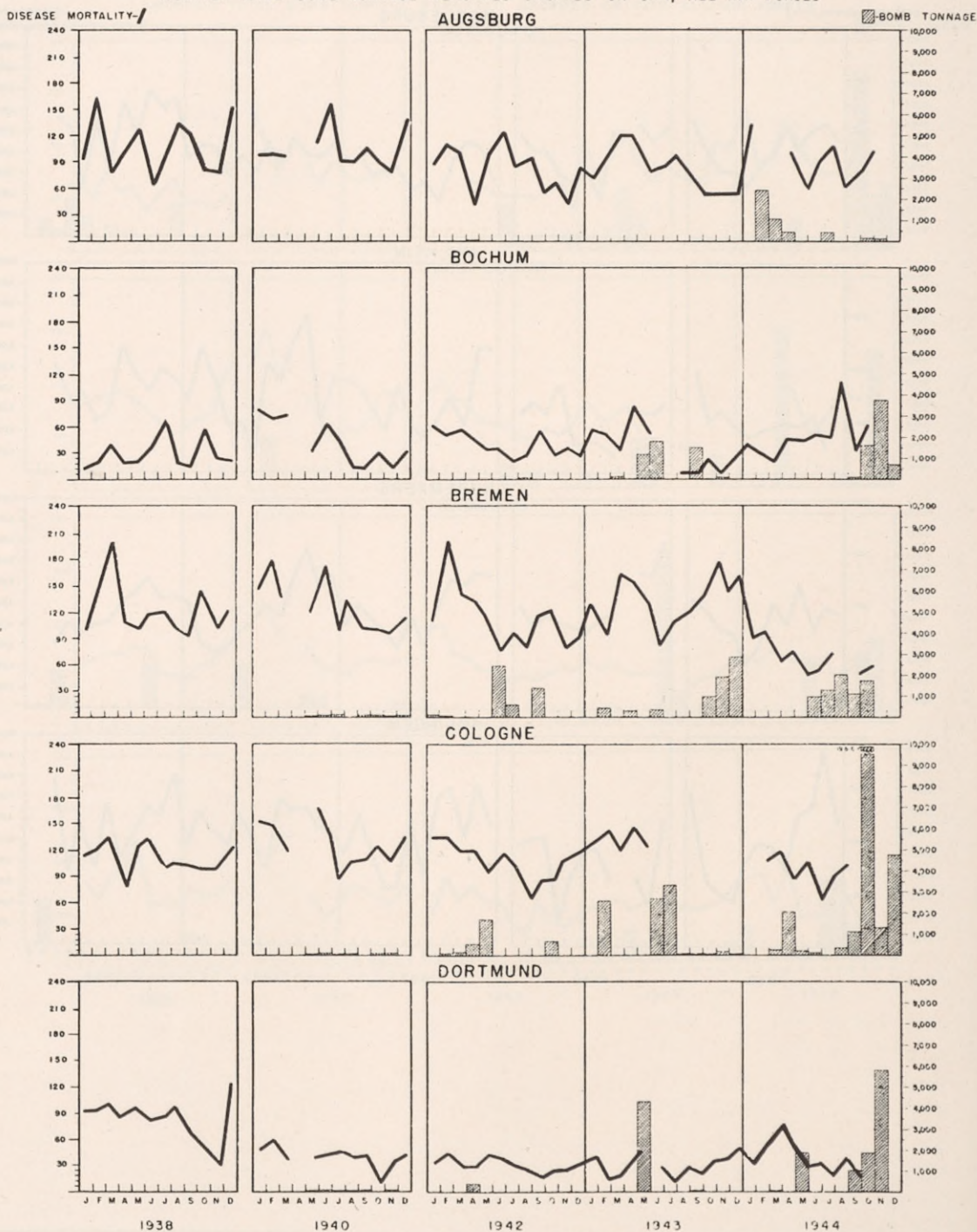


FIGURE 49 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
CEREBRAL HEMORRHAGE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES'

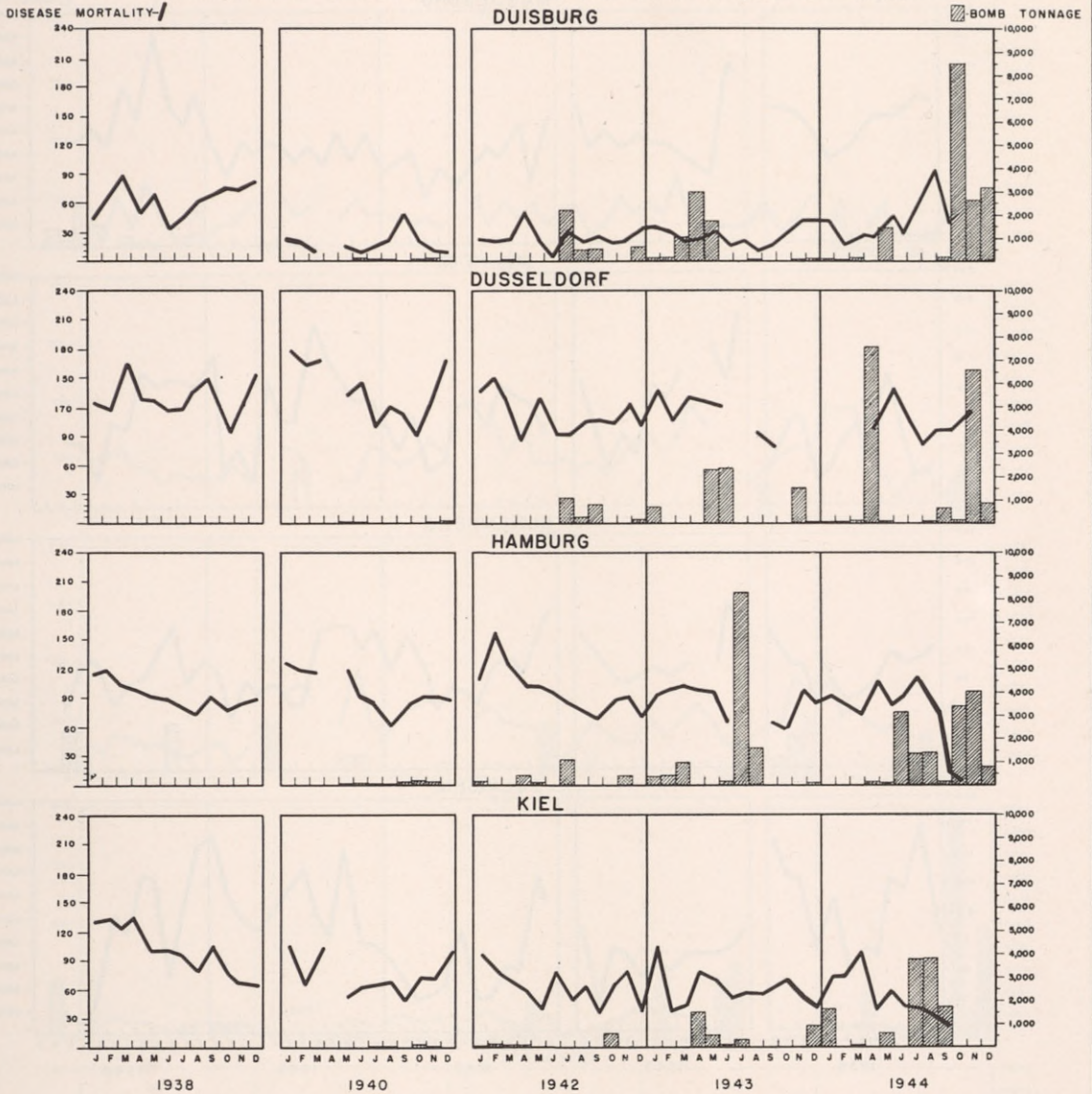


FIGURE 49 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
CEREBRAL HEMORRHAGE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



FIGURE 50

THE BOMBING EXPERIENCE AND MORTALITY FROM
OLD AGE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

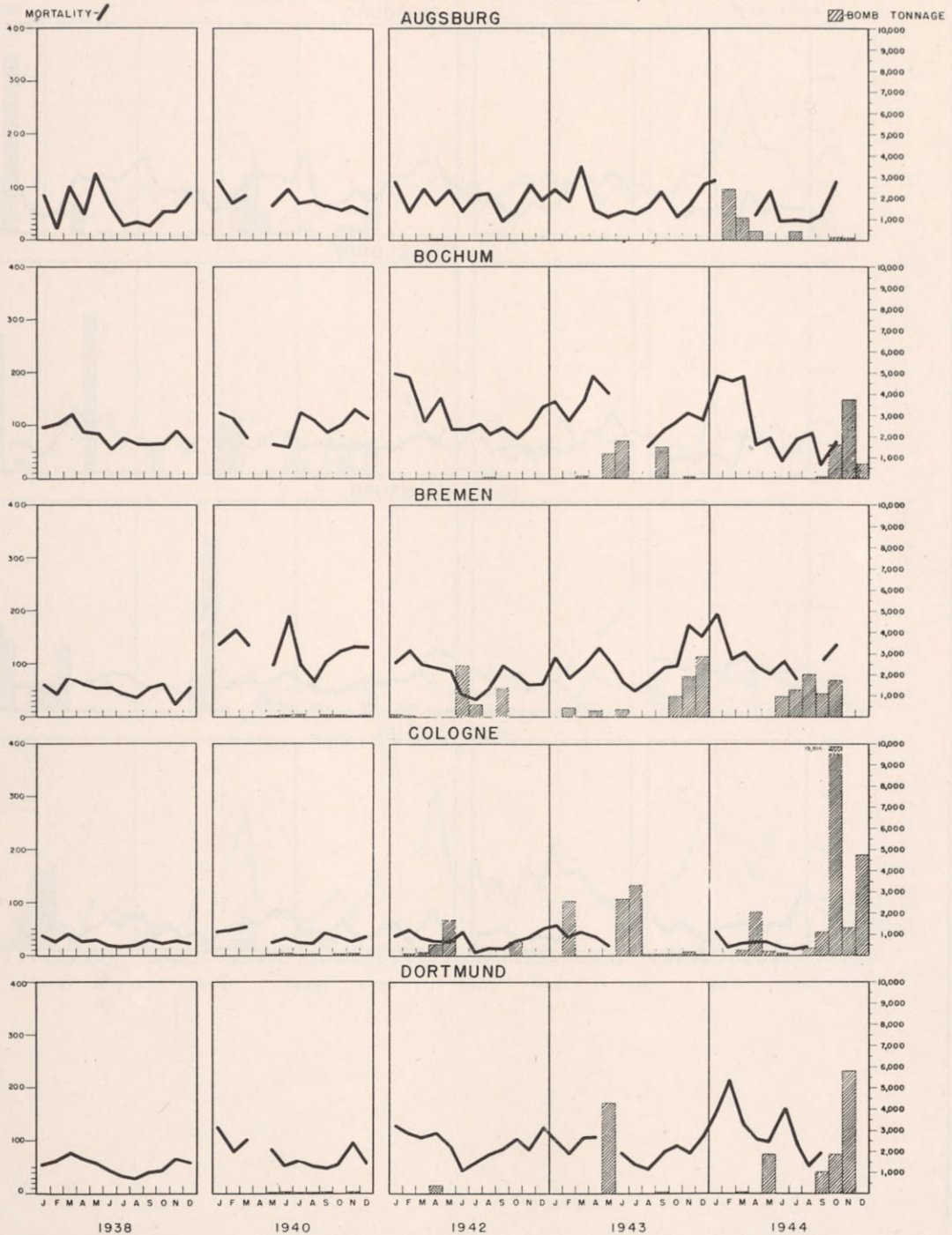


FIGURE 50 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
OLD AGE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

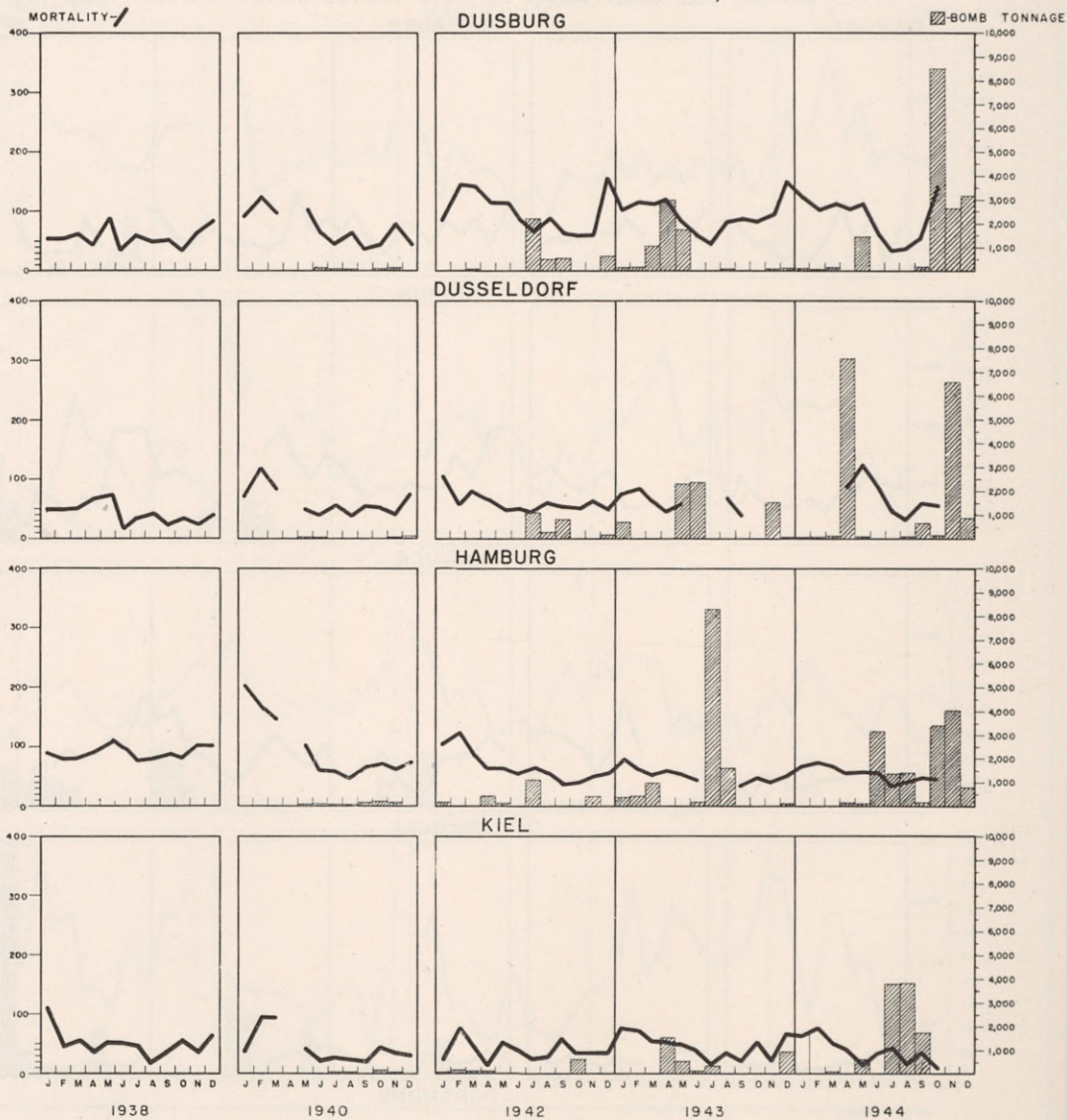
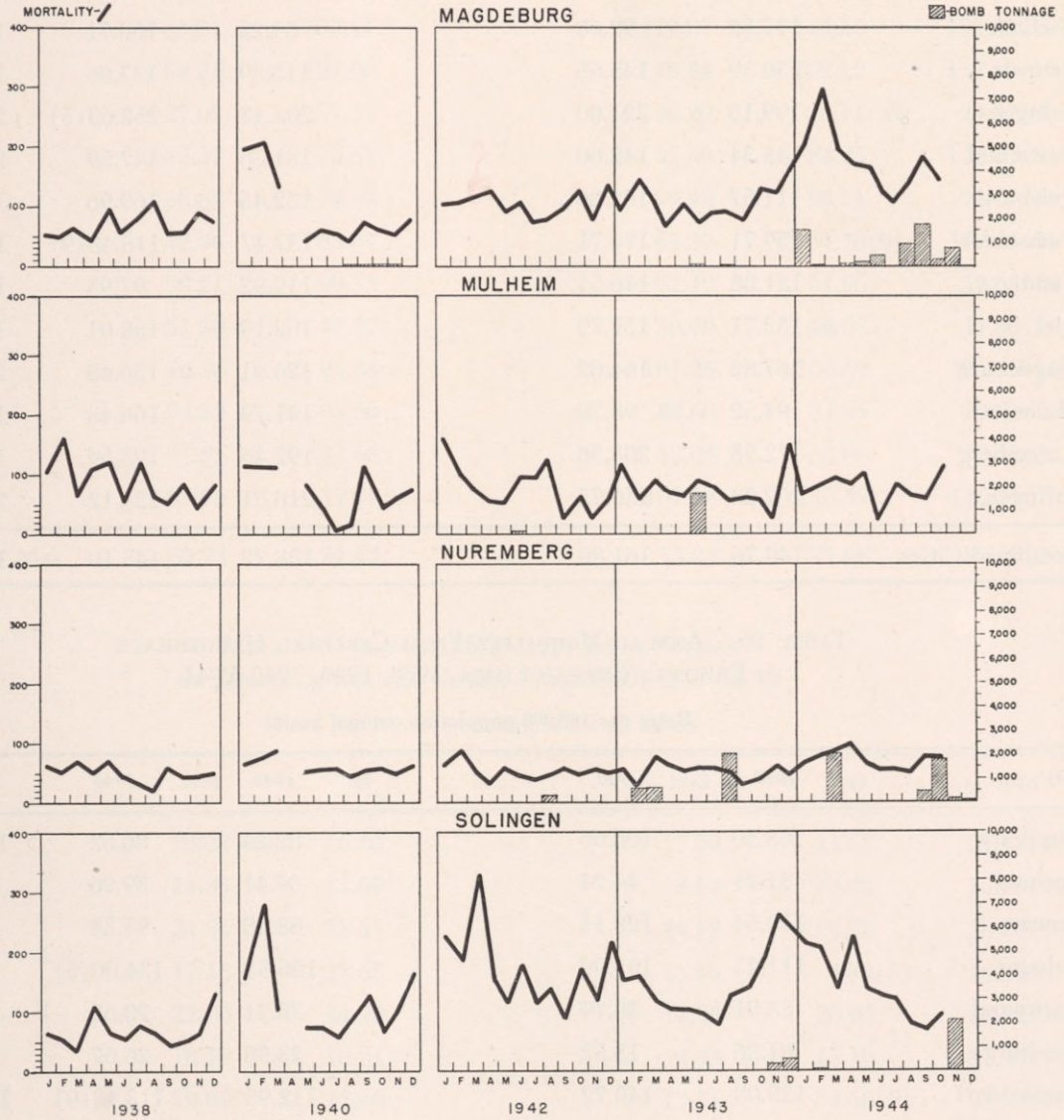


FIGURE 50 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM
 OLD AGE
 IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
 MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES.



VITAL STATISTICS

TABLE 25. ANNUAL MORTALITY FROM HEART DISEASE
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 100,000 population, annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	186.51	189.70	155.41	170.88	244.72(10)
Bochum	117.52	92.68	89.25	100.71	152.16(10)
Bremen	130.39	145.65	113.39	133.86	108.07(10)
Cologne	199.15	221.00	203.43	252.63(5)	208.50(8)
Dortmund	145.34	142.60	131.36	147.59	212.53(9)
Duisburg	111.57	162.80	132.45	169.96	198.62(10)
Duesseldorf	159.71	174.71	137.47	118.48(9)	161.03(7)
Hamburg	131.88	146.54	119.92	97.93	116.11(10)
Kiel	152.71	157.79	102.19	108.01	119.30(10)
Magdeburg	167.82	164.02	126.91	156.48	220.79(10)
Mulheim	94.52	96.70	141.79	166.43	168.97(10)
Nuremberg	172.25	203.36	192.46	193.59	189.28(10)
Solingen	202.23	156.75	210.01	223.12	233.12(10)
Combined Cities	149.76	161.80	138.72	145.10	164.49(10)

TABLE 26. ANNUAL MORTALITY FROM CEREBRAL HEMORRHAGE
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 100,000 population, annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	108.30	106.06	82.24	86.52	104.18(10)
Bochum	31.21	44.24	39.41	39.96	47.18(10)
Bremen	119.54	128.13	88.58	91.34	66.95(10)
Cologne	111.23	137.99	106.33	134.00(5)	95.98(8)
Dortmund	83.91	38.79	30.21	28.65	37.19(9)
Duisburg	61.86	15.52	23.98	26.67	37.98(10)
Duesseldorf	129.08	140.72	112.95	113.43(9)	108.82(7)
Hamburg	91.40	100.30	98.64	82.96	91.97(10)
Kiel	97.39	75.43	60.97	58.43	54.43(10)
Magdeburg	126.70	115.40	89.16	97.50	126.84(10)
Mulheim	70.15	116.90	86.57	104.02	109.20(10)
Nuremberg	102.58	116.02	108.21	104.96	103.62(10)
Solingen	130.36	75.00	73.79	134.39	100.98(10)
Combined Cities	96.83	97.19	83.39	84.43	82.81(10)

VITAL STATISTICS

TABLE 27. ANNUAL MORTALITY FROM OLD AGE
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 100,000 population, annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	61.81	74.90	77.97	73.00	75.68(10)
Bochum	81.21	100.11	119.87	134.56	102.33(10)
Bremen	52.21	127.90	79.54	102.12	117.89(10)
Cologne	27.09	37.27	30.20	40.11(5)	24.32(8)
Dortmund	53.57	78.51	95.60	84.75	124.67(9)
Duisburg	56.82	78.04	99.93	96.71	91.67(10)
Duesseldorf	42.96	63.01	64.30	64.30(9)	73.44(7)
Hamburg	90.21	99.53	67.19	51.95	57.53(10)
Kiel	51.30	47.37	39.49	48.08	41.80(10)
Magdeburg	70.36	91.38	104.26	106.69	176.95(10)
Mulheim	94.52	73.60	80.60	77.39	79.31(10)
Nuremberg	51.65	61.66	53.84	53.06	72.28(10)
Solingen	69.76	117.75	167.84	145.59	146.11(10)
Combined Cities	62.23	81.17	73.24	71.08	80.07(10)

TABLE 28. ANNUAL MORTALITY FROM SUICIDE
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 100,000 population, annual basis)

<i>City</i>	<i>1938</i>	<i>1940</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>
Augsburg	20.24	16.40	17.09	21.63	29.48(10)
Bochum	14.33	13.89	8.14	13.05	15.28(10)
Bremen	24.54	23.51	24.12	26.05	38.20(10)
Cologne	17.45	13.68	15.86	9.39(5)	16.54(8)
Dortmund	22.66	14.99	14.72	20.95	18.61(9)
Duisburg	18.10	16.21	9.33	15.10	17.46(10)
Duesseldorf	19.61	12.68	13.71	13.46(9)	21.23(7)
Hamburg	41.56	30.12	32.23	35.71	37.49(10)
Kiel	34.47	27.69	23.56	26.48	27.87(10)
Magdeburg	31.98	31.63	23.81	23.41	38.63(10)
Mulheim	14.03	19.48	6.72	18.31	10.34(10)
Nuremberg	41.08	34.73	35.80	36.44	38.86(10)
Solingen	23.25	19.50	12.97	16.37	25.78(10)
Combined Cities	28.31	22.39	21.78	24.35	28.22(10)

Suicide

The suicide rate fell from 28.31 in 1938 to 22.39 in 1940 among the thirteen German cities included in Table 28. The rate remained about the same in 1942, rose slightly in 1943 and still more in 1944 to 28.22. This progressive increase in suicides was shown for eight of the individual cities, and was highest in Augsburg and Bremen.

In Figure 51 the monthly suicide curve is shown in relation to the air attacks. Sharp increases in the mortality rate occur following many periods of bombing. In general, these appear following the first heavy attack on the cities as in Augsburg, Bochum, Bremen, Cologne, Hamburg and Magdeburg, for example. While it would appear from these data that suicides occur more frequently following periods of air attacks than at times when the cities were free from bombing, the analysis of the next section shows that the increase is not statistically significant. This question will be taken up again in the following section of the present chapter.

Accidents

In 1940 the annual mortality from accidents was 50.29 in the combined group of German cities, Table 29. The mortality rate did not change substantially until 1944 when it arose to 58.06. This increase was shown for nine of the thirteen individual cities. Aside from this small increase in 1944, no definite trend in accidental death was noted. Figure 52, showing monthly trends of accident mortality and bombing periods, indicates no relationship of the mortality to periods of air raids.

Effect of air attacks on mortality trends

Many charts have been presented in the preceding sections of this chapter and in the sections on communicable diseases and tuberculosis of Chapter Four to show the monthly trend of disease incidence and mortality as related to the tonnage of bombs dropped monthly on each of the various cities. These charts give a picture of the general relationship between the course of the disease and bombing, but in most instances the overall conclusions regarding the effect of air attacks on the rates are confused by their seasonal fluctuation, the lack of data for the months immediately following the severe air attacks, and the defective reporting so often occurring after these attacks. The present section deals with a more specific consideration of the problem. Here separate air attacks or continued

periods of air activity have been taken as the reference point and overall mortality rates have been computed for a suitable number of weeks preceding the air attack and a similar period following the attack. The factor of seasonal change has been taken into account and adjusted before the actual comparison of the pre- and post-bombing raids. Mortality rates only have been dealt with since the data secured from the local sources on case incidence was on a monthly basis and did not lend themselves to this type of analysis.

Method: The bombing charts, showing the weekly number of planes reporting the city as a target and the bomb tonnage dropped, were examined for each of the thirteen selected cities for which mortality data were available. Weekly periods of air attacks varying from one to sixteen weeks were selected which showed a period previous to the attack and a period subsequent to the attack during which the city was free of bombing. A total of 48 bombing periods was selected in this manner. The pre-bombing and the post-bombing periods were not constant in length, but varied according to the time period available for analysis; in no case, however, was either period less than four weeks, the maximum period being eight weeks. The weeks selected for the pre-bombing period were separated from the previous bombing attack made on the city by an interval of at least eight weeks. A summary of the cities included, the bombing periods, and the weeks utilized for each attack is given in Table 30.

For each of the periods of the separate bombing attacks, the weekly mortality data as given in the *Reichsgesundheitsblatt* were summed for all causes of death, infant mortality, and the following specific causes: scarlet fever, whooping cough, diphtheria, measles, tuberculosis (all forms), pneumonia and influenza, diabetes, cerebral hemorrhage, heart disease, old age, suicide, and accidents. Each figure was multiplied by the appropriate constant to give the number of deaths on an annual basis, and rates were computed using for each period the population for the center of the time period. The seasonal fluctuation of mortality rates was a factor which had to be considered and eliminated. This was done by dividing each rate by a constant expressing the mortality rate for that period as a proportion of the average monthly mortality rate. The basic data utilized for this purpose were taken from monthly mortality indices for Germany and the Netherlands as given in

VITAL STATISTICS

TABLE 29. ANNUAL MORTALITY FROM ACCIDENTS
IN THIRTEEN GERMAN CITIES, 1938, 1940, 1942-43-44

(Rates per 100,000 population, annual basis)

City	1938	1940	1942	1943	1944
Augsburg	22.97	30.61	35.78	30.82	41.28(10)
Bochum	33.12	46.50	56.03	57.08	67.77(10)
Bremen	50.50	47.47	41.74	44.32	43.30(10)
Cologne	34.52	50.04	39.31	52.49(5)	50.26(8)
Dortmund	45.33	59.77	54.30	58.27	87.86(9)
Duisburg	44.67	65.54	70.35	71.33	80.32(10)
Duesseldorf	48.94	64.30	47.30	45.44(9)	56.59(7)
Hamburg	42.81	52.57	57.61	63.03	65.85(10)
Kiel	42.48	43.73	40.53	33.45	35.27(10)
Magdeburg	40.51	44.81	45.01	41.79	63.16(10)
Mulheim	34.71	46.90	55.97	47.43	59.77(10)
Nuremberg	36.52	29.45	38.49	40.52	36.77(10)
Solingen	11.98	16.50	18.65	24.12	23.63(10)
Combined Cities	40.53	50.29	49.56	52.19	58.06(10)

Prinzling's Handbuch der Medizinischen Statistik, Vol. 2, 1931. Before being used, these indices were checked against quarterly data given in the *Statistische Sonderbeilage* of the *Reichsgesundheitsblatt* for the years 1937 and 1938. All rates were computed per 100,000 population except the infant mortality rates which were computed per 1,000 live births reported in the same period.

After adjustment of the rates for seasonal changes, the rate for the pre-bombing period was subtracted from that of the post-bombing period. A tabulation of differences was prepared for the 48 air attacks. These data unfortunately do not include bombing attacks made subsequent to November, 1944, when the intensity of Allied assaults increased manifold, since mortality tabulations were not available after the end of 1944. The test of significance used was the "t" test described in Fisher's *Statistical Methods for Research Workers*, pp. 119-122, ninth ed., 1944.

Results: A summary of the results of the analysis is given in Table 31 in which the mean differences are shown according to the destructive magnitude

of the bombing period as measured by the weight of bombs dropped. The attacks have been divided into three groups: under 100 tons, 100 to 1,999 tons and 2,000 or more. This breakdown was essential. Small attacks appeared to have no effect on mortality rates while too often the largest raids were so damaging that the mortality recording system was either destroyed or its activities seriously impaired. Other breakdowns of the data were examined to ascertain if a picture could be secured within other groupings of the attacks. The results were largely negative. Neither size of the initial or pre-bombing raid, geographical location of the city, or year yielded the effects other than those described in Table 31.

The mortality rates which exhibited a definite and significant increase after bombing periods, for the tonnage group 100-1,999, were the following:

1. All Causes
2. Pneumonia and Influenza
3. Heart Disease
4. Old Age

The all-cause mortality rate, it should be empha-

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TABLE 30. SUMMARY OF AIR RAID ATTACKS
SELECTED FOR STUDY OF MORTALITY RATES

Town	Initial Week of Periods*			Weeks in Period			Tonnage Dropped
	Pre- Bombing	Bombing	Post- Bombing	Pre- Bombing	Bombing	Post- Bombing	
Augsburg	344	352	401	8	1	5	100
Augsburg	425	429	431	4	2	8	468
Bochum	306	314	315	8	1	4	112
Bochum	332	340	341	7	1	8	1505
Bremen	029	037	038	8	1	8	66
Bremen	149	203	208	6	5	8	175
Bremen	216	223	228	7	5	8	3028
Bremen	301	309	310	8	1	6	479
Bremen	334	341	342	7	1	4	970
Cologne	040	048	049	8	1	4	72
Cologne	151	207	223	8	16	8	2407
Cologne	234	242	243	8	1	7	672
Cologne	251	306	310	7	4	8	2593
Cologne	426	434	436	8	2	4	339
Dortmund	208	216	217	8	1	8	358
Dortmund	414	422	423	8	1	8	1890
Duisburg	017	022	023	4	1	8	52
Duisburg	039	047	048	8	1	5	64
Duisburg	221	229	233	8	4	4	2730
Duisburg	246	301	303	6	2	6	741
Duisburg	403	411	412	7	1	8	51
Duesseldorf	223	231	238	8	7	8	2216
Duesseldorf	430	436	438	6	2	5	657
Frankfort	227	235	238	8	3	8	989
Frankfort	307	315	316	8	1	8	1188
Frankfort	333	341	344	8	3	4	1520
Hamburg	029	037	038	8	1	5	77
Hamburg	150	203	204	5	1	8	184
Hamburg	223	231	232	8	1	8	1130
Hamburg	240	246	247	6	1	8	440
Hamburg	319	326	335	7	3	6	10,074
Hamburg	343	351	352	8	1	8	87
Hamburg	411	418	419	7	1	4	65
Kiel	034	042	043	8	1	8	80
Kiel	201	209	212	8	3	6	316
Kiel	234	242	243	7	1	7	633
Kiel	307	315	316	8	1	4	1535
Kiel	343	351	403	7	4	7	2632
Kiel	413	421	423	8	2	5	621
Magdeburg	316	324	325	8	1	8	61
Magdeburg	348	404	405	7	1	7	1489
Magdeburg	413	418	419	5	1	4	60
Mulheim	213	221	222	8	1	8	113
Nuremberg	227	235	236	8	1	8	292
Nuremberg	302	310	312	8	2	8	1204
Nuremberg	325	333	336	8	3	8	2034
Nuremberg	406	414	415	7	1	8	2047
Solingen	341	349	350	8	1	8	783

* The first digit indicates the year, and the last two digits the week of the year (week ending Saturday). For example, 344 is the 44th week in 1943.

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TABLE 31. SUMMARY OF CHANGES IN MORTALITY RATES FOLLOWING BOMBING

Cause of Death	<i>Mean Increase in Mortality Rate after Attack Period</i>			
	<i>Less than 100</i>	<i>Bomb Tonnage Dropped:</i>		<i>All Attacks</i>
		<i>100-1,999</i>	<i>2,000 and over</i>	
All Causes	32.00	119.28**	44.89	68.50**
Infant Mortality	9.01	-1.05	12.12	3.72
Tuberculosis	-7.57	0.45	-16.86	-4.63
Pneumonia and				
Influenza	2.25	14.83*	-6.67	7.91
Diphtheria	1.59	2.88	-2.98	1.48
Scarlet Fever	-0.71	0.76	-4.15	-0.50
Whooping Cough	-0.32	1.01	-1.50	0.23
Measles	-0.29	0.03	0.84	0.11
Diabetes	0.31	1.73	0.48	1.17
Cerebral Hemorrhage	-5.88	7.23	4.62	3.74
Heart Disease	1.53	12.11*	-7.56	6.00
Old Age	5.72	14.74**	-5.27	8.92
Suicide	-0.71	2.20	5.02	2.06
Accidents	-1.46	1.85	3.27	1.36

* Significant, p less than 0.05, greater than 0.01.

** Highly significant, p less than 0.01.

sized, is exclusive of actual air-raid deaths. An increase in the death rate from pneumonia and influenza was no doubt to be anticipated as a development of the prolonged time spent in air raid shelters and the exposure to hardship following the attacks. Nor is it surprising that an increase in deaths from heart disease and old age occurred. Old persons, it may be presumed, are well taken care of during the period of bombing but are subject to the stress of existence during and following the periods of attacks. The unusual strain of such times is undoubtedly sufficiently great to cause many old persons to weaken and succumb from the concomitant conditions usually described in the death report simply as heart disease or as old age.

The results for the acute communicable disease are negative. It is to be remembered in this connection that the case incidence data, presented in the charts of Chapter Four, were not included in the present analysis. This fact is to be regretted,

for case incidence data by weeks, so necessary for the present purpose, might have shown a more definite relation between the increase of these diseases and air attacks.

It is hardly to be concluded that other mortality rates are not effected by bombing attacks, but rather that such rates based on information secured from badly bombed cities cannot be expected to reveal other than the most marked changes in disease mortality. The very effect of bombing in destroying records and in over-taxing the medical facilities of the city to an extent where the filling out of forms and certificates becomes a secondary matter, diminishes the accuracy of the basic data. Population movements following bombing attacks are of large magnitude and do not permit the calculation of rates by age and sex groups. If this were possible, greater changes in such specific mortality rates might possibly be shown.

FIGURE 51

THE BOMBING EXPERIENCE AND MORTALITY FROM SUICIDE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES



FIGURE 51 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM
SUICIDE
IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

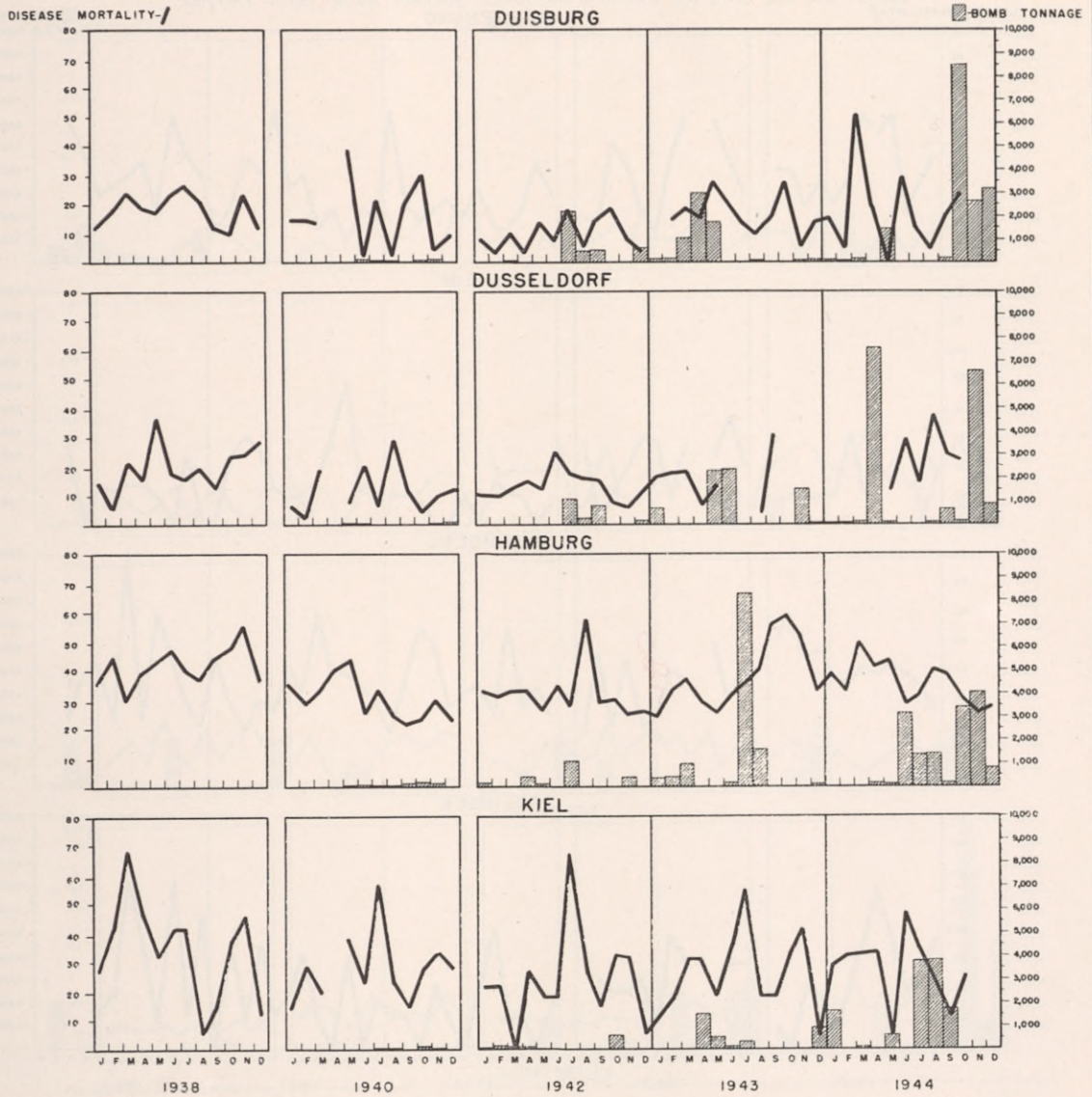


FIGURE 51 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM SUICIDE IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES.

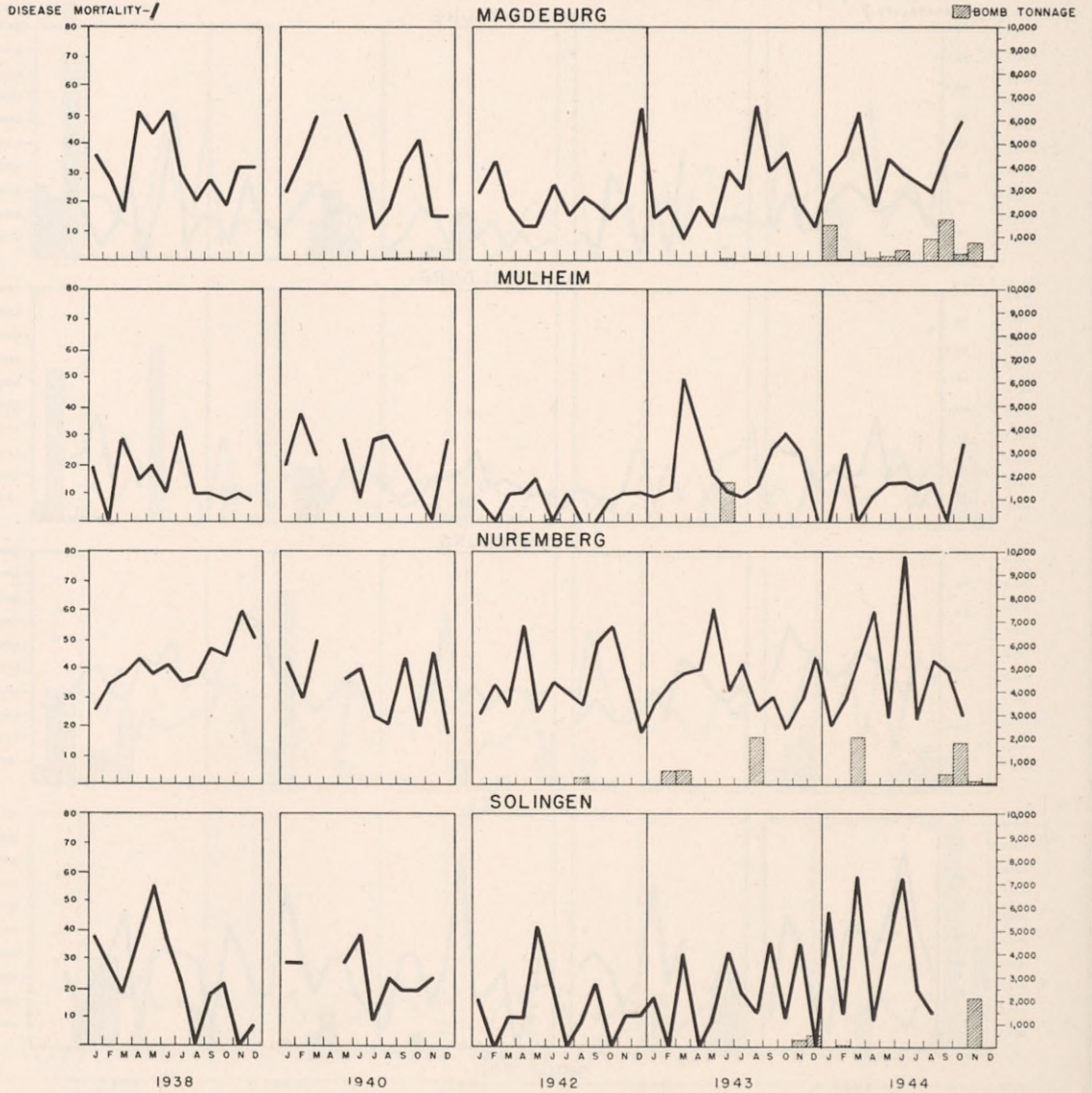


FIGURE 52

THE BOMBING EXPERIENCE AND MORTALITY FROM ACCIDENTS IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES

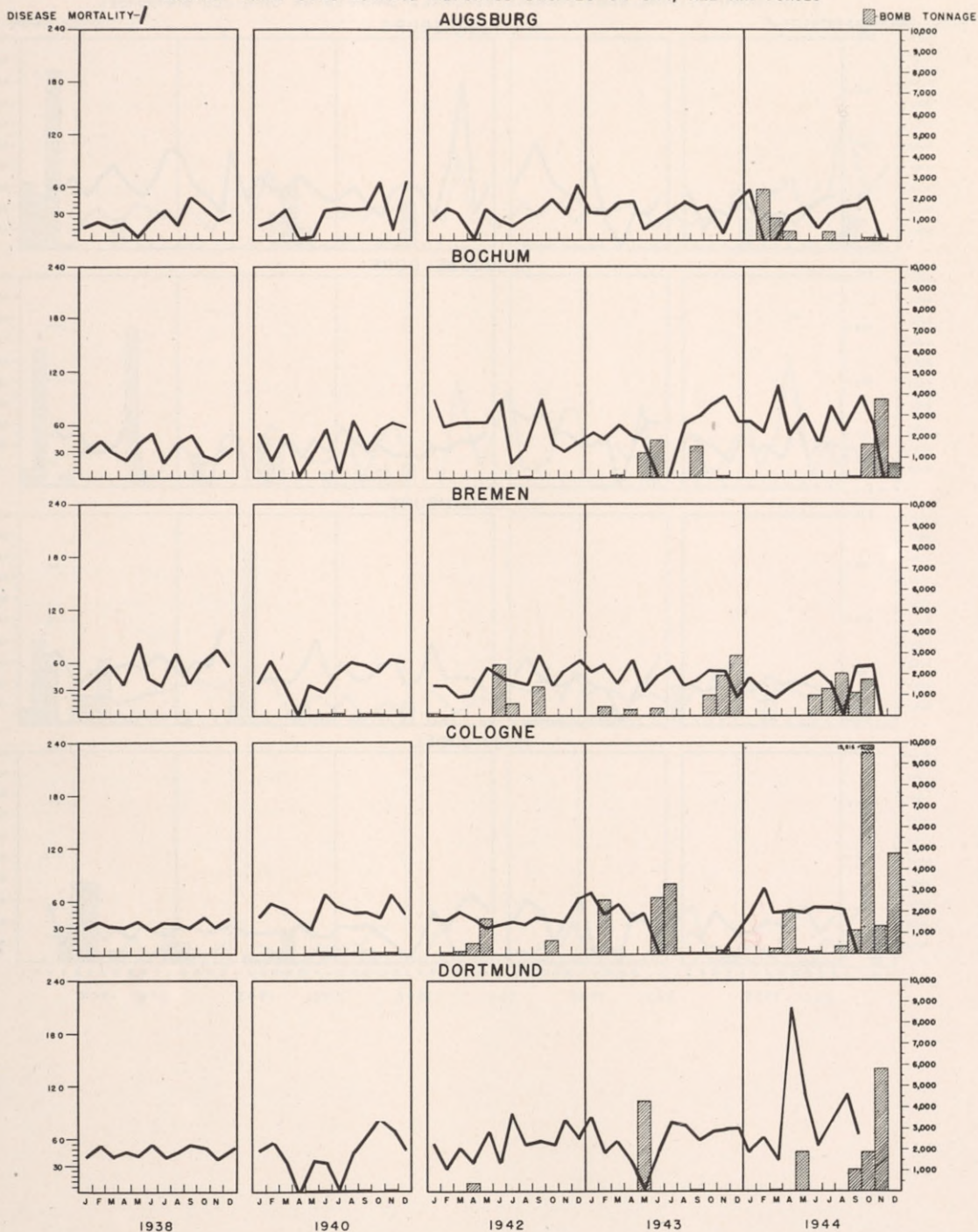


FIGURE 52 (continued)

THE BOMBING EXPERIENCE AND MORTALITY FROM ACCIDENTS IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES.

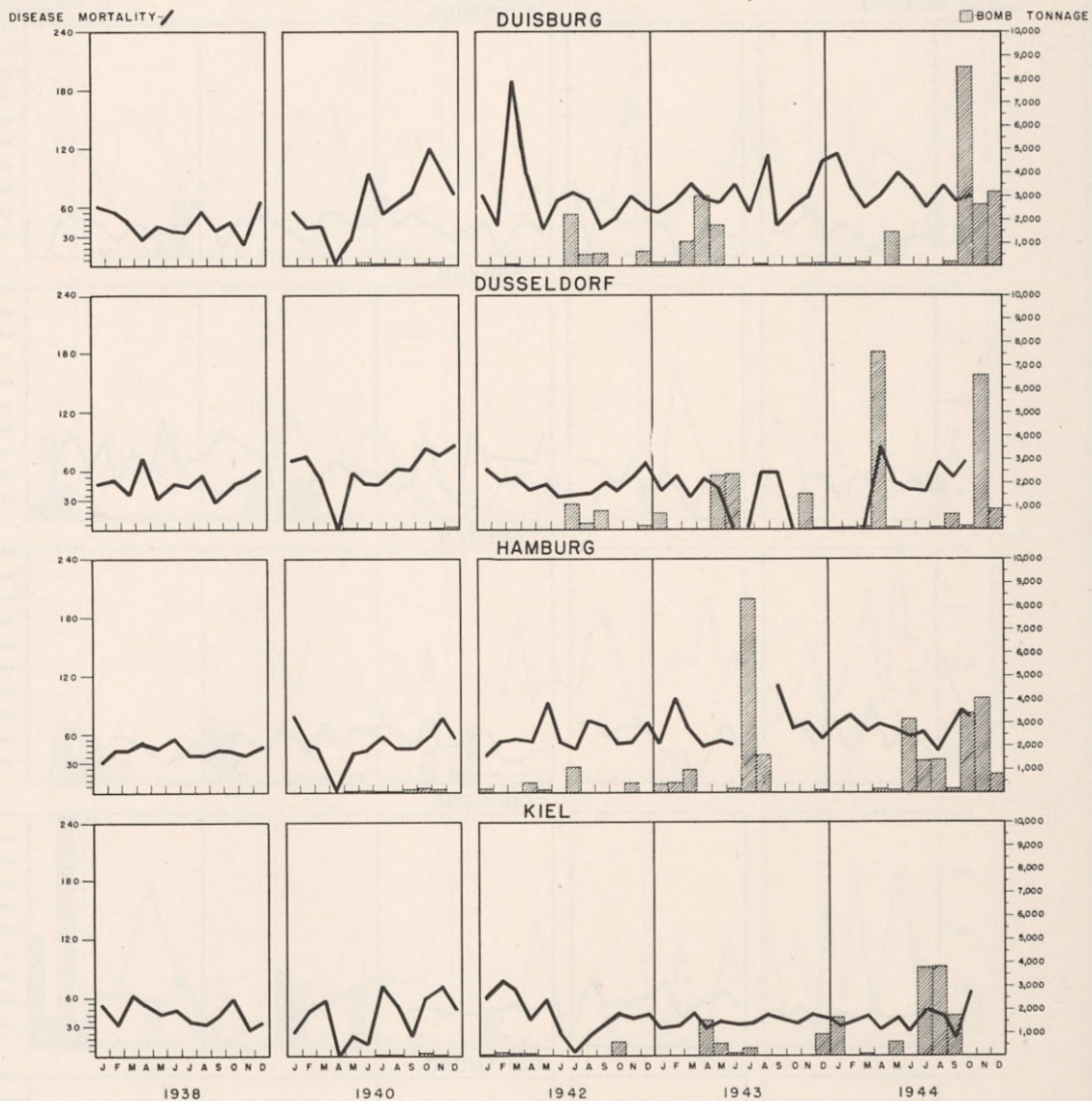


FIGURE 52 (concluded)

THE BOMBING EXPERIENCE AND MORTALITY FROM ACCIDENTS IN THIRTEEN GERMAN CITIES

MONTHLY DEATH RATES PER 100,000 POPULATION, ANNUAL BASIS
MONTHLY TOTAL BOMB TONNAGE REPORTED DROPPED ON CITY, ALL AIR FORCES.



VITAL STATISTICS

A further explanation of the failure of other post-bombing disease mortality rates to show increases may lie in the placing of "air attack" on the death certificate as the cause of death rather than the disease itself. Many deaths have undoubtedly been certified as due to the air raids when such would not actually have been the case had the individual not been suffering from the disease from which he actually died. No method is available to resolve the dilemma, so that the findings of a positive increase in disease following bombing had to be made despite the attribution of many deaths to bombing rather than to the disease involved.

Summary

Investigations of the vital statistics of Germany were limited to those of cities since the Allied air attacks were directed in large part towards urban territory. Published mortality data in the *Reichsgesundheitsblatt* were checked before using against material collected in German cities by the statistical team. Information on the case incidence of disease and on population was secured from local authorities in German cities. After the rejection of those cities for which the data secured were doubtful or quite incomplete, thirteen cities remained for analysis. These were: Augsburg, Bochum, Bremen, Cologne, Dortmund, Duisburg, Duesseldorf, Hamburg, Kiel, Magdeburg, Mulheim, Nuremberg, and Soligen. Monthly and annual case incidence and mortality rates were computed for each. The monthly rates were studied with respect to the frequency and intensity of the Allied air attacks on each of the cities.

The conclusions reached as a result of this anal-

ysis for the acute communicable diseases and for tuberculosis are presented in Chapter Four.

The birth rate for Germany, which was increasing up to 1939, fell consistently during the years of war. The birth rate of German cities decreased markedly following initiation of the heavy Allied bombings. It is not known to what extent the urban birth rate fell because of declining fertility, since a great part of the decrease occurred because of the evacuation of pregnant mothers from the cities to the country. No data were available as to the birth rate in the rural districts.

Mortality from all causes of death, exclusive of the actual air raid deaths, increased with intensified aerial bombing. The infant mortality rate increased during the period of the war, but no evidence was available that the increase was directly related to the bombing attacks. This is not surprising in view of the evacuation of mothers and children from the areas in which heavy bombing had occurred or was likely to occur. With respect to the diseases of adult life, the mortality from diabetes and cerebral hemorrhage decreased during the war years and have no relation to bombing. Heart disease, on the other hand, was clearly related to the periods of air attacks, mortality from this complex of diseases having risen following periods of heavy air attacks. Deaths registered as due to old age likewise increased following periods of heavy bombing. While no clear cut evidence that the number of suicides rose after air attacks was secured, the suicide rate increased markedly following several air attacks in a number of cities. The mortality from pneumonia and influenza also increased during those periods after air attacks.



CHAPTER SEVEN

MEDICAL PERSONNEL

HERMANN K. ROSMANN, M.D., MADISON, WISCONSIN

An explanation of the availability of physicians, nurses, and other professional personnel is necessary to an understanding of the ability of the German medical profession to render complete medical attention to the population of their country during the war. Looking back on the problems of procurement and assignment in the United States during the war when the medical profession was confronted only with the supply of additional medical care for the Armed Forces, one can have some appreciation of the magnitude of the problem with which the German medical profession was faced when they had to cope with the steadily increasing Allied air attack. In this chapter an attempt is made to reconstruct a clear picture of the manner in which the government sought to locate physicians and nurses throughout Germany to meet the increased demand for medical care resulting from the air offensive.

Germany's national health administration

LIEUTENANT COLONEL RICHARD L. MEILING

The national medical and health organization of Germany was perhaps the most thorough, powerful, closely knit body for the control of a nation's health that the world has seen. This organization, which actually was brought to completion under the Nazis, may be said to have originated with the public health law of 1874, which established the first national standards for smallpox vaccination. Later, in 1900, another law was enacted which provided for a unified control of contagious diseases. In 1920, a national narcotic law was passed and between that time and the assumption of power by the Nazis in 1933 there was a gradual trend throughout Germany toward a vigorous and powerful public health program. Until the Nazis seized power, the medical and health organizations were centralized from the local offices up to the level of the states but they still lacked that cohesion which would bring them together as a national unit. In 1933, the first step toward establishing a strong central government of the Reich was the solidification of the national and the Prussian

governmental agencies. With this move the Director of Public Health in the Ministry of the Interior was elevated to the position of Secretary of State in the Ministry. For the first time this influential position was occupied by a physician, Dr. A. Guett. A year later, in July, 1935, the entire public health service of the German nation was unified.

What then appeared to be a thoroughly centralized national public health service was made even more influential by the changes in other aspects of the national government, as when, for example, in August, 1934, Hitler succeeded President von Hindenburg and thus became the supreme head of the government as well as the leader of the National Socialist Party. This unification of political party and government was immediately reflected throughout all levels of the state structure. As a result, there arose in the state public health service a twin organization controlled by the Nazi Party that maintained right down through the health organization structure to the municipal level a political counterpart to each state office in the form of a party health authority. For example, in Bavaria the state public health director (*Ministerial Rat*) functioned as a part of the State Ministry of the Interior. Within the Gau, which is the political and geographical equivalent to a state, there was a director of medical services known as the *Gau Arzt* who held the additional position of chief of all the approved medical organizations in his area. Some of the higher authorities in the national health service and, in particular, Professor Karl Brandt, who was Reich Commissar for Health, and General Siegfried Handloser, the Director of Medical Services of the Armed Forces, felt that this duplication of responsibility by the Nazi Party and the government in matters of public health was an important factor in what they stated to be inadequate planning for the protection of the health of the civilian population to meet the combined bomber offensive of the Allies.

The responsibility for many phases of national health was also shared by a number of federal departments other than the Ministry of the Interior.

MEDICAL PERSONNEL

For example, the Ministry of Education was responsible for the selection and appointment (subject to Nazi Party approval, of course) of all members of medical faculties of the German universities; the Ministry of Labor supervised and controlled all health insurance and industrial compensation laws; Dr. Goebbels' Propaganda Ministry controlled the conventions of medical and associated scientific bodies and the publication of medical journals and medical advertising as well as the operation of the health resorts; the Ministries of Commerce and Food had specific health responsibilities to be discharged in their management of the production, distribution, and control of food and food products; the Ministry of Commerce, the Office of the Goering Four-Year Plan, and Albert Speer's Ministry of Munitions and War Production each had a voice in the production and allocation of critical raw materials in the industries producing pharmaceutical and biologic products, and surgical and hospital supplies and equipment. The great construction organization known as the "Organization Todt" built all the hospitals, sanatoriums, laboratories, and air raid hospital facilities which were constructed with federal funds.

It is obvious from this then that, while there was tight central control of each phase of the German health organization, an extraordinary amount of co-operative spirit, insight, and understanding would have been required on the part of each bureaucrat in each of these separate sections of the public health organization to have given the entire structure that cohesion and integration which was necessary. Aside from this variegated structure for the protection of civilian health, the armed forces and the semimilitary political forces each had a medical service completely independent and more or less self-sustaining. These forces included the Army, the Navy, the Air Force, the Waffen SS, the Allgemeine SS, the Hitler Youth, the SA, the NSKK, the Organization Todt, the Arbeitsfront, the National Police, the Youth Labor Corps, and so on through the Nazi organization catalogue.

To complicate further this complex structure there were the welfare agencies whose mission is often difficult to distinguish from that of the health organization. They were at least always intimately associated. These agencies were placed under the control of the Nazi Party shortly after 1933. Only three were permitted to continue: the Catholic Charities, the German Red Cross, and the National Socialist Public Welfare Fund (National Sozialis-

tische Volkswohlfahrt or NSV). Although the administration and function of the German Red Cross were under the supervision of the Ministry of the Interior it was likewise under close political control. The president of the Red Cross was an SS officer. Investigations revealed that the more important executive positions in the Red Cross were occupied by SS officials. The Catholic Charities were forced to confine their work during the war years to the Catholic hospitals. The NSV was the organization most favored by the state and in all cases was given the strongest financial backing and the greatest responsibility. For example, during any crisis, such as an air raid, the other agencies automatically came under the control of the NSV and had to take their orders from these political welfare workers. The Red Cross was usually responsible for the first aid attention and initial evacuation of the casualties while those features of welfare work which are most apparent to the recipient and which, therefore, could be relied upon to enhance the gratitude displayed toward the Nazi Party were reserved for the NSV. They made a great display of feeding and sheltering the homeless, supervising the mass evacuations, organizing the activities at the reception areas, and, with the Hitler Youth, guided the welfare and educational work of the evacuated school children. An additional aspect of this use of social welfare as a political instrument was in the manner in which all evacuees, including school children, air raid victims, and expectant mothers, were regarded as "guests of the Fuehrer," and hence under party control. (See the section on maternal and infant care in Chapter Nine.)

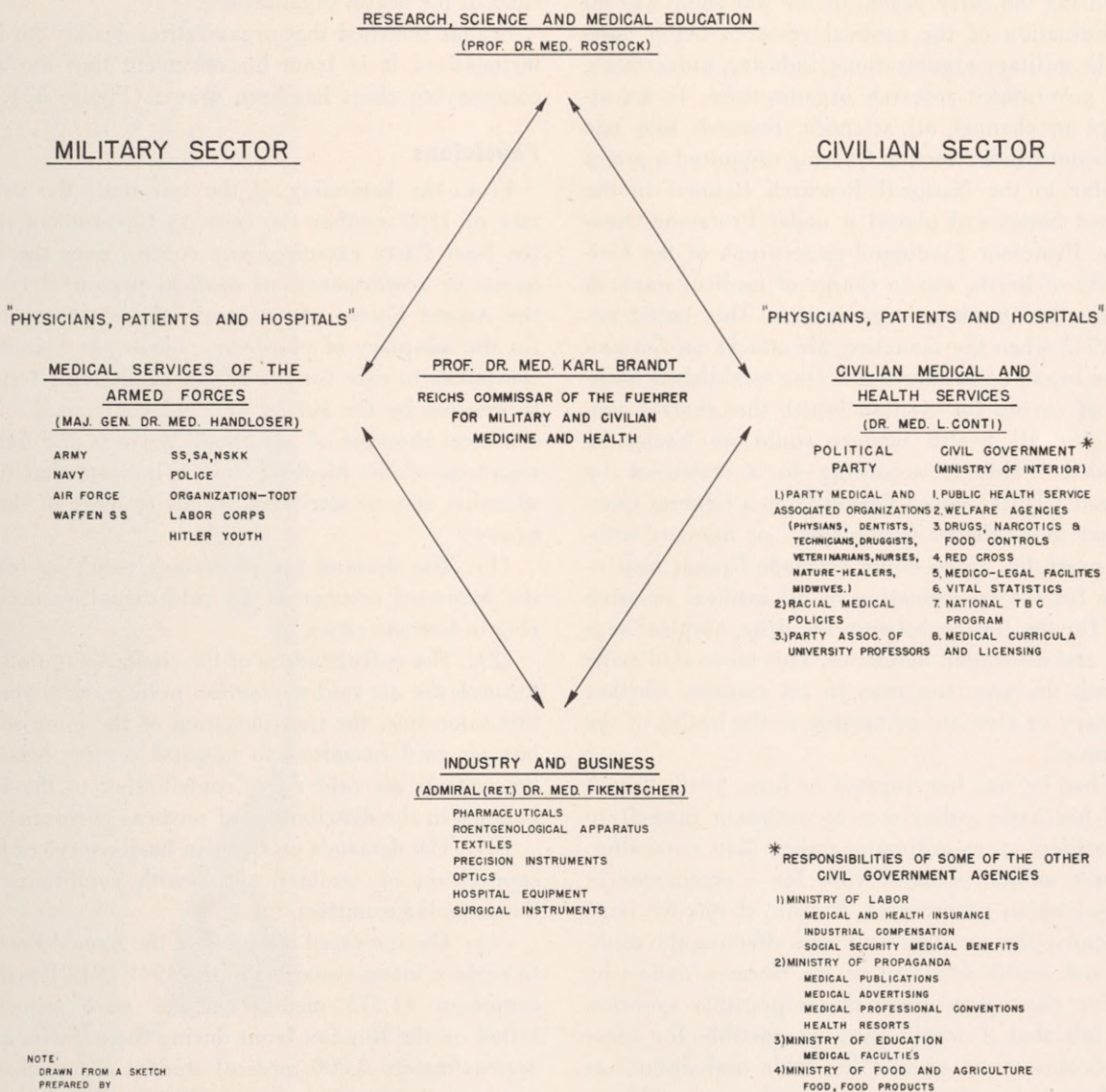
The impact of the general over-all hardships of the war and of aerial bombardment of the cities of Germany, in particular, upon this heterogeneous governmental and political hodgepodge, began to make itself felt in 1942. As the tempo of allied strategic bombing increased in 1942 the confusion resulting from the pull and strain of each of these organizations moving in a different direction without integration or control from above made resolution of the national medical and health problem no longer escapable.

On July 12, 1942, Hitler appointed Professor Karl Brandt (associate professor of surgery at the University of Berlin and personal physician to the Fuehrer) to be "General Commissar of the Fuehrer for all Military and Civilian Medicine and Health" (*Generalkommissar des Fuehrers fuer das Sanitaets-und Gesundheitswesen*). At the same time

FIGURE 53

SCHEMATIC PRESENTATION OF THE GERMAN NATIONAL MEDICAL AND HEALTH ORGANIZATION DURING THE CRITICAL WAR YEARS 1942-45

(NOTE--THAT EACH AGENCY WAS HEADED BY A PHYSICIAN--THAT PROF BRANDT WAS IN A POSITION TO RESOLVE DIFFERENCES BETWEEN THE CIVILIAN AND MILITARY SECTORS AND TO PROTECT THE NATIONAL INTERESTS OF BOTH--THAT EACH AGENCY RETAINED ITS SELF SUFFICIENCY)



NOTE:
DRAWN FROM A SKETCH
PREPARED BY
PROF. BRANDT, JUNE 18, 1945

Major General Handloser was appointed Director of Medical Services for all the armed forces and thus became responsible for the health of the Army, Navy, Air Force, SS, German Police, Youth Labor Corps, Organization Todt, and all semimilitary party organizations. It might be said that he was the military counterpart of Dr. Leonardo Conti, the head of the German public health service and the State Secretary for Civilian Health in the Ministry of the Interior. Brandt was the court of last appeal in resolving disagreements between the military and the civilian sectors of the German nation.

During the early period of the war there was no co-ordination of the medical research being done by the military organizations, industry, universities, and government research organizations. In an attempt to channel all scientific research into one well-controlled direction Goering organized a group similar to the National Research Council in the United States and placed it under Professor Osenberg. Professor Ferdinand Sauerbruch of the University of Berlin was in charge of medical research within the Osenberg organization. This lasted until 1943 when the mounting air attacks on German cities began so to disorganize the established methods of caring for civilian health that central control for all health matters could no longer be avoided. (This is according to a statement by Brandt.) Hitler raised Brandt from a General Commissar to a "Reichs Commissar," or minister without portfolio. In so doing he made Brandt responsible for the co-ordination of all medical research and for the liaison between the drug, surgical supply, and associated industries. This move also made Brandt the very top man in all matters, whether military or civilian, pertaining to the health of the Germans.

When he was interrogated in June, 1945, Brandt said his basic policy was to maintain himself in a position of co-ordinator rather than controller, a most unique point of view for a commissar in a totalitarian government. He said it was his hope to resolve the complex problems affecting the medical and health situation of the German nation by having physicians direct the responsible agencies. He felt that it would then be possible for these physicians to sit around the table and discuss as professional medical men any conflicts or problems which arose.

He appointed Professor Paul Rostock to supervise and direct the medical research and educational program of the nation. Admiral Fickentscher, the

retired Director of Medical Services of the German Navy, became the co-ordinator for supply. The latter was responsible for monitoring not only the allocation of critical raw materials in the pharmaceutical, optical, textile, and surgical supply industries but he had also to see to it that manufacturers of these essential products were protected by the deferment from military services of a sufficient number of skilled technicians to assure the supply of finished goods. Fickentscher had his own priorities' board to guide and control the division of available supplies between the military and civilian sides of the health organization.

Brandt sketched this organization during the interrogation. It is from his statement that the accompanying chart has been drawn (Figure 53).

Physicians

From the beginning of the war until the summer of 1942 neither the German Government nor the Nazi Party exercised any control over the requests or requirements of medical personnel from the Armed Forces. As a result, those responsible for the adequacy of physicians, nurses, and similar specialists to care for the health of civilians found themselves by the spring of 1942 confronted with a critical shortage of personnel. Records and interrogations of the Medical Branch indicate that this situation may be attributed to one or more of these causes:

- (1). The demand for physicians resulting from the increased number of air raid casualties occurring in German cities.

- (2). The redistribution of the civilian population through the air raid evacuation policies and, along this same line, the transportation of the more serious air raid casualties to hospital centers outside the critical air raid zones contributing to the imbalance in the distribution of medical personnel.

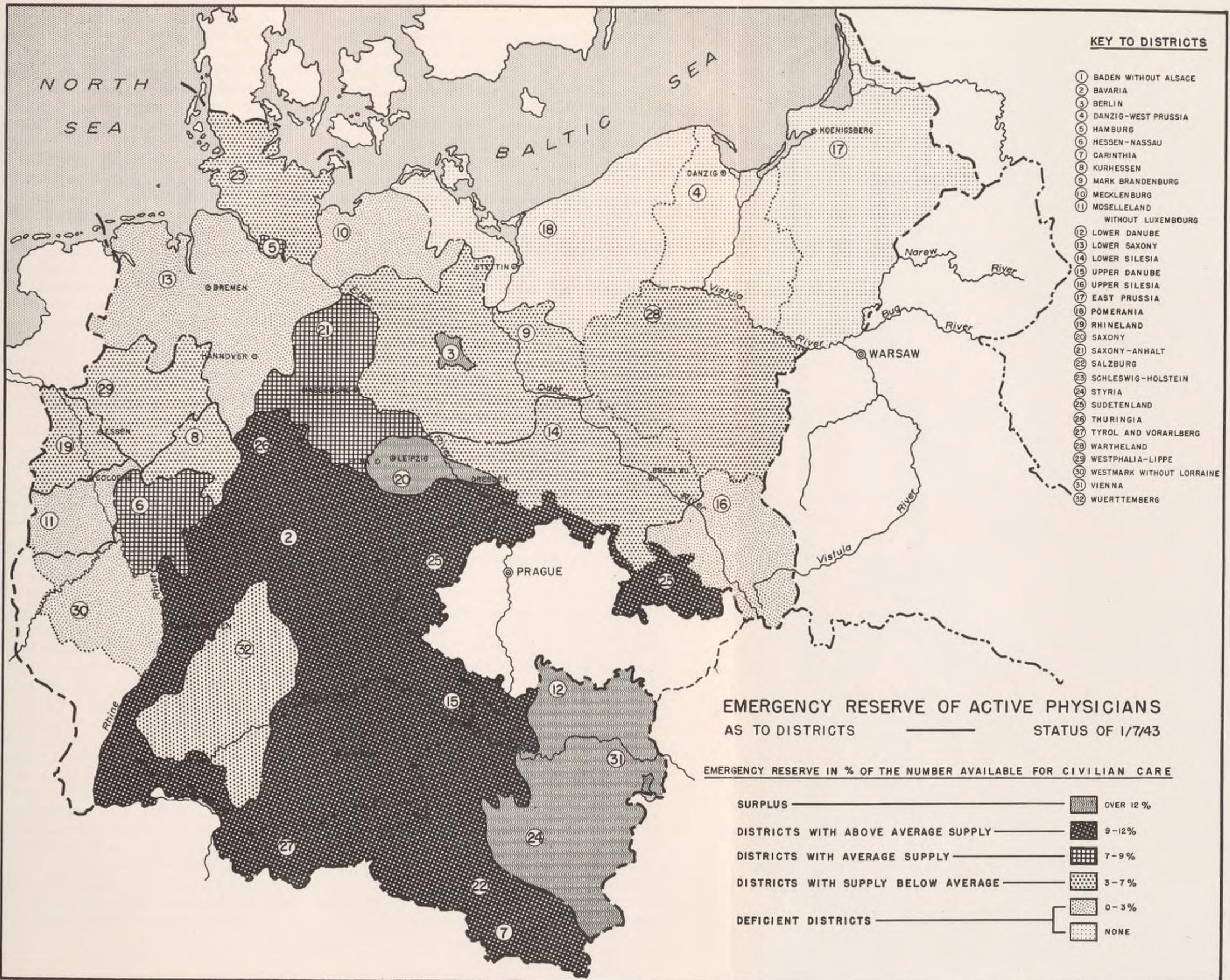
- (3). The demands on German health services for supervision of sanitary and health conditions in the occupied countries.

- (4). The increased demands of the Armed Forces to replace losses sustained in the 1941-1942 Russian campaign (1,775 medical officers were reported killed on the Russian front during these years, and approximately 3,000 medical student cadet officers were also lost in this campaign).

- (5). The increased demand for physicians in the various industries engaged principally in the manufacture of armaments.

The abrupt demand for more medical care for

FIGURE 54



civilians when the air war was just starting brought to the attention of German health officials the danger of the more or less uncontrolled induction of physicians into the Armed Forces. Conti at first attempted to establish a backlog of physicians to be used in the impending air raids by requesting the release of 2,000 men from the Armed Forces in late 1942. He received just half of the requested number.

Subsequently, to stabilize the distribution of physicians an agreement was reached between Handloser and Conti whereby each time a practicing physician entered the Armed Forces, the latter were required to relinquish a similarly qualified individual to the civilian sector. Any increase in the requirements for the Armed Forces was to be met by the immediate induction of all physically qualified medical students upon their graduation. The increased demand for the civilian side was met through the newly graduated women doctors, the counting of all doctors over 70 as "half-physicians" for the purpose of allocation and distribution, and the reinstatement of Jewish physicians into the practice of medicine. It is interesting to note that by 1943 all physicians of 50 per cent Jewish ancestry were reinstated to full medical practice, and in the summer of 1944 when the air raid casualties increased in alarming proportions all physicians of 100 per cent Jewish ancestry were reinstated to full medical practice.

Conti has stated that this exchange agreement was worked out smoothly, but there are indications that it was the inability of the military, which was trying to provide care for the wounded at the front, and the civilians, who were alarmed at the inadequacy of the care given after the initial big scale raids, that precipitated Hitler's decision to name a health commissar for the nation. Brandt was made responsible to Hitler alone and his first mission was to find medical personnel to meet both the military and the civilian needs of the nation.

Dr. Leonardo Conti who, in addition to his governmental position in the Ministry of the Interior, was the party leader of all German physicians, but who had both political and governmental powers consistent only with those to be found in a totalitarian state, established a department within the National Chamber of Physicians (*Reichs Aerztekammer*) charged with the responsibility of the equitable distribution of physicians throughout the nation to meet the civilian needs under the changing conditions caused by aerial warfare.

It was found necessary to provide approximately 2,824 physicians over and above the normal requirements to care for air raid casualties. To accomplish this a reserve was set up. Figure 54 shows the source of these "extra" physicians and is said to have been based upon the ratio of physicians to population and the expected danger of air attack. The basis was 1 physician to each 125 hospital patients (air raid casualties). When it was decided to divide the nation into four "zones of air raid danger" according to degree of severity of the anticipated allied aerial assault, additional physicians were made available to the four zones in these proportions:

Zone I—Zone of Hamburg, the Rhineland, and the Ruhr received an addition of 16 per cent.

Zone II—Berlin and Baden received an addition of 12 per cent.

Zone III—Bavaria and Moselland received an addition of 8 per cent.

Zone IV—Danzig, Vienna, Thuringia received an addition of 4 per cent.

These four critical air raid districts thus required 2,088 additional physicians. This national plan provided roughly 1 doctor for each 6,670 civilians in towns or areas under 50,000 population and 1 doctor for each 3,333 civilians in towns of more than 50,000 population. The agricultural areas and the mountain areas received a prescribed percentage increase and the thirty German medical schools were authorized a total of 595 physicians to staff the full-time teaching and research positions.

In October, 1944, Handloser issued a directive that military health services, medical officers, facilities, and equipment were to be made available for the care of German civilians, particularly for the air raid casualties as well as for military personnel. This relieved the situation somewhat. Although there was considerable confusion resulting from so many people working at cross purposes in an effort to bring some order out of the chaos in the distribution of physicians in Germany, in the end there appears to have been a reasonably equitable distribution of physicians in that nation.

It is difficult to state categorically whether the plan of allocation and distribution had a deleterious effect on the quality of medical care. As the interviews with physicians throughout the American, French, and British occupied areas revealed, every physician in Germany had to do about twice as much work during the war as he did during

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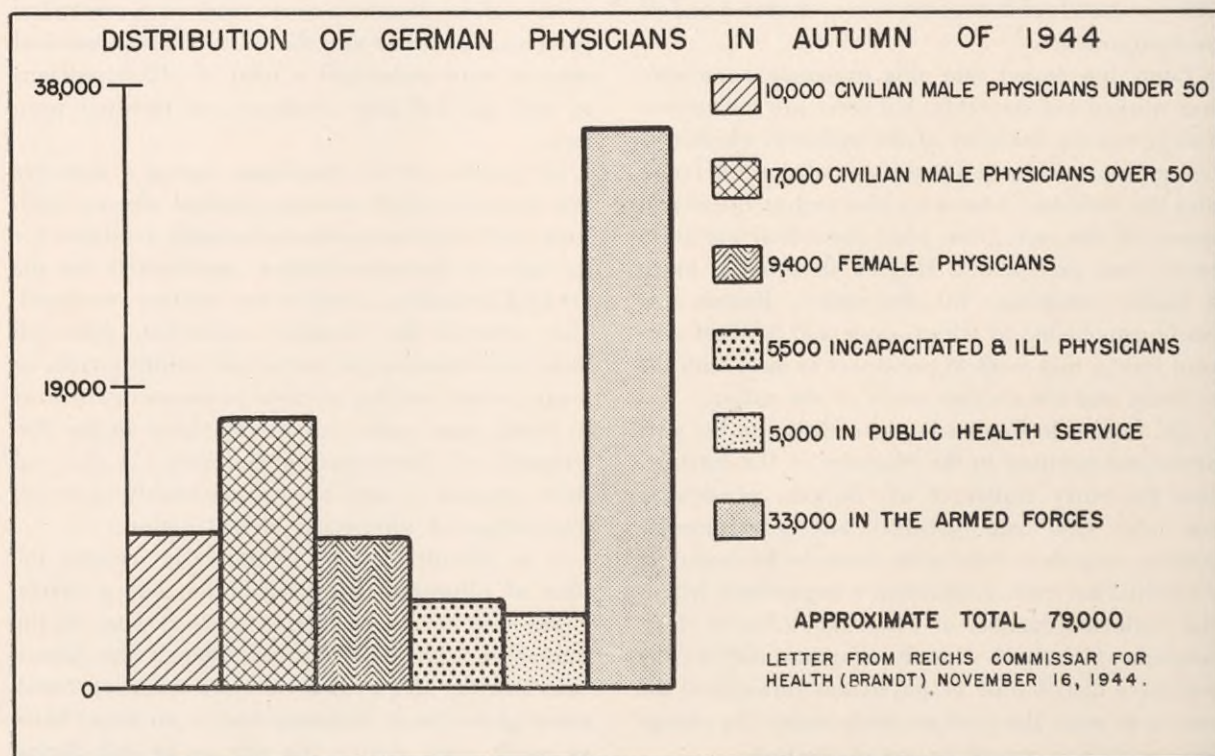
peacetime. Add to this the extremely trying conditions under which he had to work, add such factors as day and night air raids and alarms, frequently twenty-four hour tours of duty in air raid shelters, not to mention the inadequacy of medical supplies and the destruction of facilities and personal losses (see Chapter Nine), and it is reasonable to assume that the quality of medical care was indeed lowered. There were older physicians at work as is shown by the fact that the average age of the German physician on the home front in 1942 was 58 years, but by January, 1945, the average age had increased to 62 years. In the Army, after October, 1944, medical officers who had reached the retirement age of 65 were retained in the service and were required to do the same amount of work under the same conditions as the younger men. There were 82,400 physicians in greater Germany in November, 1944, of which 33,000 were in the Armed Forces. If one includes the various semimilitary organizations with their independent medical services this last figure will be raised to approximately 47,000 for a population of 66,000,000 for Germany proper (see Figure 55).

Perhaps the best proof of whether the Germans were satisfied with their ultimate solution of the problem of allocation and distribution of physicians can be had by comparing what they did during the war with what they planned to do in the postwar period. In 1943 a plan was prepared for the repopulation of Germany with the required number of physicians during the years to follow the conclusion of hostilities. This was based upon physician losses and the increased civilian and military patient load which went hand in hand with the war and aerial bombardment of the German homeland. To provide 5,000 medical graduates each year, 30,000 medical students were to attend medical school (two semesters each year, ten semesters in all), with a proposed ratio of two to one between men and women students. It was anticipated it would take twenty-five years following the cessation of hostilities to accomplish the ratio of 1 physician for each 1,000 inhabitants.

Dentists

Detailed information concerning the influence of the air war on the German civilian population with reference to the allocation and distribution of den-

FIGURE 55



tists was not obtained during this survey. This should not lead to the conclusion that such problems did not exist; no member of the dental profession was available to the Medical Branch of the USSBS.

When the war started in 1939 there were some 20,000 dentists in Germany. At first those inducted were not commissioned as officers since there was no dental corps. In fact it was not until 1941 that the various medical services of the Armed Forces each established a separate dental corps. It is estimated that in 1942 approximately 8,000 dentists were Dental Corps officers in the Armed Forces. In addition, more than 3,000 German dentists were either line officers or enlisted men with combat or service elements.

The term *dentist* is employed here in the same sense in which it is used in the United States (DDS) and not as it is used in Germany where *dentist* refers to the American equivalent of a dental technician or hygienist.

Nurses

The allocation and distribution of nursing personnel in Germany did not present the same type of problems as did the physician personnel. Despite the emergency created by the war and the intensification of this situation brought about by the injury to thousands of civilians in the air offensive it was not necessary for the German government to resort to the expediency of drafting nurses. That this was unnecessary may be attributed to the fact that the great majority of nurses in the Reich belonged to such religious or state organizations as the Catholic or Protestant church orders, the German Red Cross, or the National Socialist Nurses Association. This last category was an organization which sprang up in the late 1930's in nonsectarian hospitals. After 1939, all nurses' training in the sectarian institutions was discontinued. Thus all student nurses training came under the Red Cross or the "Brown Sisters," who, incidentally, were under the supervision of the NSV (see the discussion of Germany's national health administration in the first section).

Generally speaking, in the civilian institutions an effort was made at the beginning of the war to maintain a ratio of one nurse to every seven hospital beds. By 1944, however, the losses among the nursing personnel and the increased military, civilian, and air defense demands upon their services had reduced this ratio to one nurse to twenty hos-

pital beds. It was frequently stated that the hospital authorities regarded themselves fortunate if even this ratio could be maintained.

The actual statistical distribution of nurses was as follows: at the outbreak of the war there were approximately 5,500 Red Cross nurses assigned to the Armed Forces. This number had increased to 14,000 by January, 1945. Altogether there is said to have been approximately 40,000 Catholic nursing sisters and 16,000 nurses drawn from Protestant organizations and from the Nazi Nurse Association. In Germany as a whole, according to Mrs. von Oertzen, Chief Nurse of the German Red Cross, there were 60,000 Catholic, 40,000 Protestant, and 40,000 Red Cross nurses, in addition to about 10,000 of the so-called "Brown Sisters." To this should be added the 30,000 nurses who were independent of any organizational control.

The duration of nurses' training was not shortened during the war. An applicant could become a registered nurse either by taking the course prescribed by the Red Cross or by one of the sectarian groups or could be given credit for work as a nurse's aide. In the latter case after the completion of a year and a half of continuous work as a nurse's aide any woman could receive three additional months of academic work and become eligible to take the state examination. Those who chose the somewhat longer route took the usual course of one and one-half years of academic studies and one year of practical work in a military or civilian hospital and then became eligible for the government examination for trained nurses.

The personal and professional hardships encountered by these women during the combined aerial offensive on the German cities would be difficult to overestimate. The first problem to confront the authorities was one of the personal health of the nurses working in the cities receiving the heavy assault. Mrs. von Oertzen declared there was a marked increase in tuberculosis and heart disease. This was attributed to the constant state of extreme fatigue resulting from having to work long hours and particularly to the extra physical exertion involved in moving patients from wards to air raid shelters and back to the wards each time there was an alert. This fatigue is said to have been responsible also for the fact that menstrual disturbances and secondary anemia became the rule rather than the exception. It was frequently accompanied by insomnia and even well-developed neuroses. Nurses were required to live and work under very crowded

conditions. Many of the air raid shelters had poor or inadequate ventilation systems; the illumination was not much better. The number actually killed or wounded has not been definitely established. Mrs. von Oertzen estimates, however, that during the last months of 1944 the Red Cross nurses suffered a casualty rate of 10 per cent as a result of the air raids and of this number 10 per cent were said to have been killed.

Not only the work in the air raid shelters but the attempt to utilize small hotels, schools, and private homes as auxiliary hospitals placed an increased burden on the individual nurse because these substitutes often lacked the equipment and the architectural planning which made for efficient operation. Mrs. von Oertzen remarked that from the point of view of the nurses the *Aktion Brandt* hospitals were ideal in many respects. (See Chapter Nine for a description of these hospitals.)

Perhaps the most difficult problem encountered in the actual rendering of nursing care was in the treatment of an excessive number of cases of burns. It was difficult to maintain the usual standards of cleanliness for the water supply in most of the hospital facilities was usually disrupted in or after most air raids. It was a laborious task to move the patients and to protect them from infection under the comparatively primitive conditions that existed, and the daily redressing of their wounds presented additional work.

Women's volunteer units

As an auxiliary service performing elementary nursing care the Germans organized a First Aid Women's Volunteer Service which was comparable to the American Red Cross nurses' aides. Members of this organization received twenty hours of first aid instruction and were usually employed in the dispensaries, in air raid shelters, and in other medical facilities associated with civilian defense. If they desired, members of this group could complete forty-two hours of additional instruction (forty hours of which were in first aid and two of which were in "political indoctrination") and they would then be permitted to take the examination to become nurses' aides. By 1945 the Women Volunteers of the Red Cross numbered approximately 500,000.

Nurses' aides were on a somewhat higher level than were the so-called "First Aid Women." They were assigned to physicians in hospitals, air raid shelters, and industrial dispensaries, and were not

infrequently found operating a medical dispensary in the evacuation and reception areas. In their work they performed all of the simpler types of nursing care.

The general practitioner

GEORGE A. WULP, M.D.

In describing some of the problems of the general practitioner in a country where every city is under violent air attack it is necessary to point out some of the factors governing his position in the profession as a whole. The general practitioner or *Praktische Arzt* in Germany includes the so-called family doctor and the insurance doctor. This group comprises a much smaller percentage of the total number of registered physicians than in the United States because there are proportionately more specialists, more full-time hospital doctors, and more full-time or part-time *Amtsärzte* or governmentally employed doctors in Germany. Of the general practitioners more than one half are insurance doctors, i.e., their entire income is derived from patients in a panel covered by sickness insurance. That this is so may readily be understood when it is realized that all wage earners of a certain income bracket must carry sickness insurance. (Sickness insurance is discussed in detail in Chapter Five on industrial health.)

During the last years of the war the total number of general practitioners was a little more than half of what it had been before the war; there was proportionately a greater number of women physicians, as well as both men and women physicians of over 55 years of age. The greatest loss of course was in men up to 55 since this was the age group eligible for induction into the Armed Forces. In the last six months of the conflict general practitioners up to the age of 65 were being commissioned for front-line duty.

During the last two years of the war the general practitioner was under the iron-clad control of the government. This control was exercised through the local medical society. It told him where he could get his equipment, what he could have, where he could practice, and even went so far as to move him from one section of the country to the other. In many respects the civilian practitioner was no better off than the Army medical officer when it came to exercising his own professional freedom. Dr. Conti, who was head of the German Medical Society (*Reichsärztekammer*) in addition to being the head of the national public

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health service, hoped with these rigid controls to distribute physicians as impartially as possible and still to maintain a physician to patient ratio of from 1 physician to every 2,000 to 4,000 inhabitants. These plans often needed revision during the last years of the war since it was frequently necessary for Conti's organization to send physicians from the less critical areas to locations in which the civilian population was in greater need of them because the air raids had become more intense.

These governmental regulations and the uncertainty they created in the minds of the doctors were the least of the general practitioner's difficulties during the war years. Every one of them had about again as much to do as formerly and, in addition, had to do it under considerable handicaps, the direct and indirect effects of bombing being among them. Many physicians with whom the investigators talked had had their homes and their offices, or both, bombed out not only once but several times; it was not unusual for a doctor and his family to live in one or two patched-up rooms in a cellar with very few facilities of any kind. If he had been fortunate enough to have evacuated his family to a safe place the doctor, living alone, did not have even these curtailed "comforts" of a home. If he had moved his family any distance away, it is more likely than not that he had had no word from them after the fall of 1944 when the Allies' bombers went to work on the German communications and transportation systems. He probably had no assistant or office help and, in fact, there was little to make for peace of mind or to help relieve his increasing fatigue.

Despite the fact that he worked long hours and had much traveling to do the physician received no supplementary food ration and his gasoline quota was in many instances too small for his needs. This was especially true in the country where the distances were greater. Not a few doctors had to use wood-burning boilers for their cars. This added so much weight to the car that it often bogged down on the country roads. Others spent many hours a day walking or bicycling. These travel hazards were a particular hardship to the older men who had come back into practice and to those released from the Army for medical reasons.

In the actual practice of their profession they were also hampered by many aggravating factors. Although the Ministry of Health tried to give the doctors more help (as nurses' aides or volunteers)

they were not infrequently without any office assistant. Laboratory facilities had been sharply curtailed so that such examinations as blood chemistries were done only on stated days, and much of the routine work that would ordinarily have been done in the doctor's office had to be eliminated for lack of reagents and time. When he wanted to prescribe for a patient it was frequently necessary for him to get in touch with the druggist (seldom by telephone) first to find out whether the required medication was available or whether he had to work out a substitute. Forms had to be filled out for insulin cards, extra rations, sick leaves, and so on down through the gamut of bureaucratic printing. Despite the fact that the general public had been asked to place requests for house calls early in the morning this was often impractical. Furthermore, the general practitioner's day was often broken by the necessity of many hours of air raid work. The moment the first alarm sounded he had to go to his post in the shelter. The alarm might last all night. If the planes came over and went on to another city he had to be the pillar of courage for those huddled together. If they dropped their load on his city he had to care for the wounded and the dying until the job was done. This was the experience of every general practitioner interviewed in Germany.

The general shortage of doctors being reflected in the shortage of specialists also, it became the task of the general practitioner to widen the scope of his work to include surgery, obstetrics, and other specialized types of practice. This tended toward an equalizing or leveling of all medical practice which under other circumstances might be a healthy development, but when the general practitioner had more than he could do at best, he had no time to improve his skill in special fields where he had become rusty.

Toward the end of the war the general practitioner had become physically and nervously exhausted. He had done the work twice as many physicians used to handle, going without vacations, sacrificing home and family life, giving up study in his profession, going without many of his necessary professional "tools," working almost constantly under adverse conditions—and yet he did a good job. There were undoubtedly instances when a patient's illness became aggravated because a physician could not see him soon enough, as for example in a case of ruptured peptic ulcers with no attention for two days. But more frequently it was dis-

closed that on the whole civilians had "adequate medical care," the "shortage of doctors is not apparent," "the situation is still bearable." And a survey of the health of the German population does not indicate that the shortage of general practitioners had had too harmful an effect.

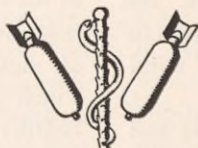
The specialist

The greatest burden of the strain of war was borne by the top specialists. The statistics reveal, for instance, that two thirds of division chiefs in internal medicine and in surgery were called in to the Armed Forces. Specialists in private practice contributed their share as well; 960 of 2,090 internists, 910 of 2,010 surgeons, 115 of 330 orthopedic surgeons had to serve the home front.

Those who remained had to cope with often poorly educated and inexperienced assistants. The curtailment in gasoline and the insufficient quality of medical journals helped to make professional life difficult. Roentgenologists suffered under the loss of x-ray equipment, which was difficult to replace, and repairs took an unduly long time. Since about 1942, a new era—the "bunkerlife"—started, and the physicians who had to spend most of their time under the influence of artificial light and in-

adequately ventilated rooms were the specialists. Most of the doctors could stand up against this unusual situation quite well, but slowly a sensation of increasing fatigue was noticed. On top of this strange professional life, all the usual hardships, like lack of sleep and permanent nervous tension, made their existence hard to bear. Lack of sufficient food was the main complaint in many instances, as even surgeons were not eligible for extra rations. Only after the great catastrophe in Hamburg did doctors as well as other people residing in this district get supplementary food for a period of three months. In addition to all these physical hardships, many specialists, very well acquainted with international professional and civil life, were greatly disturbed by the course of the war and by the faulty assumptions and doctrines of the Nazi regime.

Nevertheless, they went on with their work and were very proficient despite having no holidays, no leisure, and being forced to do a double amount of work. Dr. Leonardo Conti, fully recognizing this situation, paid the highest tribute to the achievements of his colleagues, and Dr. Handloser considered the work of the German surgeons superb.



CHAPTER EIGHT

MEDICAL EDUCATION

HANS H. REESE, M.D., MADISON, WISCONSIN

Medical education in Germany experienced many changes during the war but, except for the direct effect of the physical destruction of university buildings, hospitals, and clinics, few of these were related to bombing. Although continuing air raids raised new problems of patient care and treatment which had to be met by radical revisions of medical administration and of programs of medical care, these had to be accomplished with practising physicians and medical officers rather than among students still engaged in acquiring the fundamentals of medicine. The destruction by air attack of universities and medical schools in the later years of the war may have had little influence on the outcome of the conflict, but nevertheless it will be serious for German medicine of the future and the consequent effect on the health of the population of the country.

Germany's outstanding tradition in medicine and medical education began to deteriorate gradually during the turbulent twenties, a process which was greatly accelerated when the Nazis took over. The old eagerness for scientific knowledge and training declined; students of the new Reich entered medical school to secure the personal benefits of government support; their time was taken by interests other than the study of medicine. The Nazi disregard for professional and scientific matters crippled all medical training during the latter years of the regime. When asked the reason, Professor Brandt, the Reichs Commissar for Medical and Health Affairs, answered that in an authoritative type of government the old line street fighter naturally distrusted and disliked anything he could not understand, or which, because of background and education, he felt was above him. Political funds and party contributions were used in the selection and rating of students. Many outstanding teachers had been discharged for political reasons and replaced by party stooges. Further, a unified study plan was instituted in 1938, stipulating educational requirements and minimal lecture program of twenty-five hours' clinical study weekly throughout all universities in Germany. This attempted unity

was designed to permit the forced transfer of students from overcrowded schools to less popular study centers with no interruption of studies. Hospitals approved for internships, residences and assistantships were supervised by regional deans in conjunction with the local medical societies.

The war and medical education

The history of medical education during the war was one of incessant conflict between the increasing manpower needs for the Armed Forces and the necessity of training physicians both for military service and for civilian practice. All students of medicine were called into service at the beginning of the war in 1939, but after the successful Polish campaign those who had completed at least one semester of medical study were permitted to return to their studies. Although the enrolment gradually increased from 17,000 in 1939 to 24,000 in 1941, and to 39,000 in 1944, the increase was in women students and in male Army students assigned to medical training. The latter, after 1943, were for the most part members of "student companies" and received training in medicine at the same time they performed their military duties. They numbered 11,000 in 1941 and increased to 16,000 in 1944. The women students increased from 6,500 to 14,000 during these years, while male civilian students decreased from 5,700 in 1941 to 2,900 in 1944.

The estimated annual replacement figure for the Medical Corps of the Army was placed at 3,000 for 1943. These were losses due to age, illness, accident, and death (including lives lost in combat). Replacement had to come from the graduates of three military academies who numbered 117 in 1943, and from the graduating classes of the universities, 1,550 in 1943, leaving a replacement deficit of 1,330 physicians. In an effort to fulfill these demands the tenth or last semester of study was canceled, and the students were assigned for the period to assistantships in city or field hospitals or, for a limited number, to postgraduate study. This step to lower professional training was considered

FIGURE 56

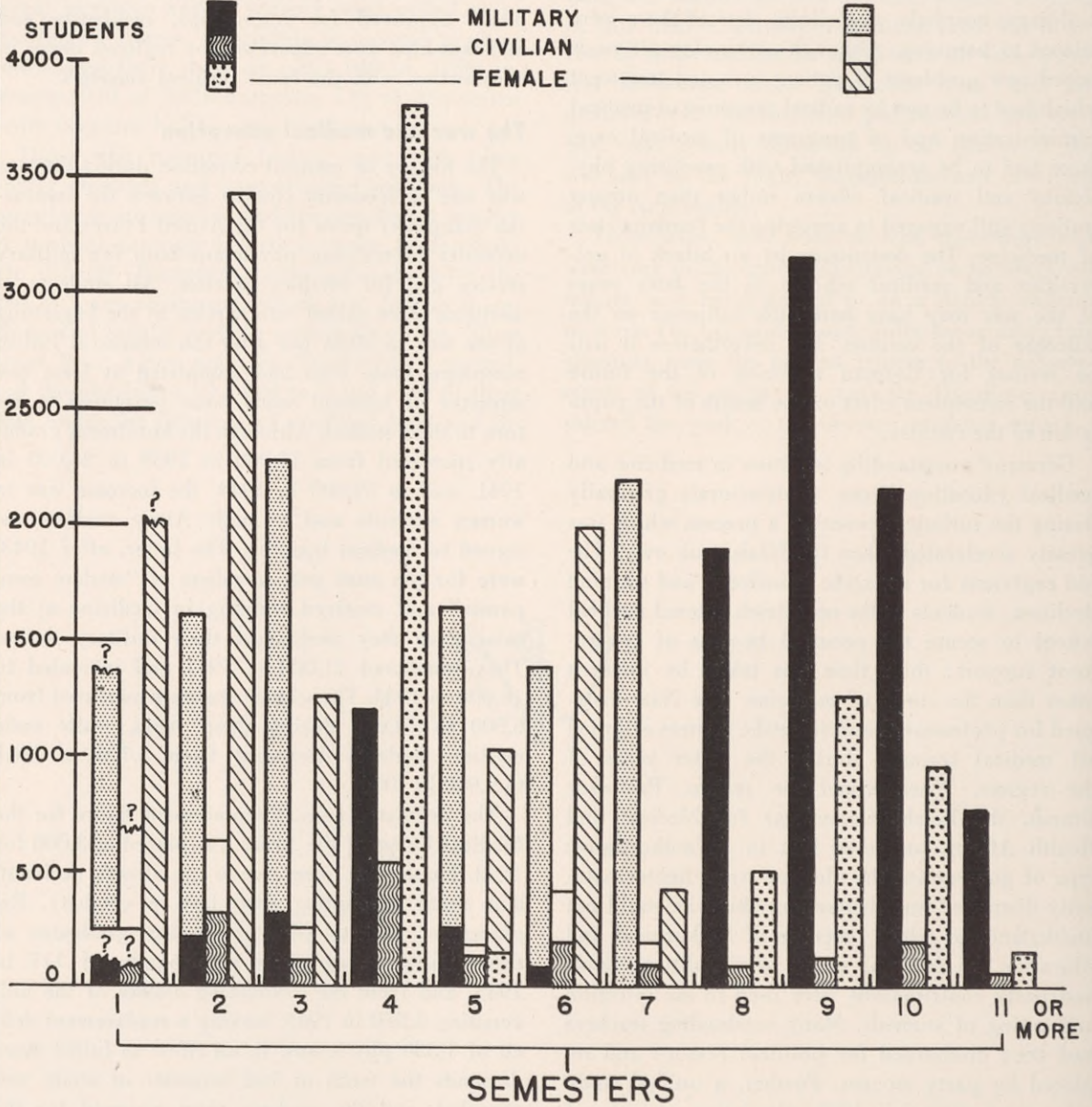
SEMESTER STRENGTH OF GERMAN NATIONAL MEDICAL STUDENTS WINTER SEMESTER 1944-1945

FROM THE FILES OF GENERAL ROSSTOCK-OFFICE OF THE REICHS' COMMISSAR FOR HEALTH

LEGEND

STUDENTS PERMITTED TO CONTINUE
STUDIES

STUDENTS DRAFTED FOR SERVICE



MEDICAL EDUCATION

preferable to party demands that all medical schools be closed in 1943.

However, the cancellation of the tenth semester proved to be only a temporary stop-gap. Late in 1943 an edict was issued closing the medical schools, the party officials maintaining that the soldiers in the student companies were there to seek shelter from front line duty and the women to escape work in war industries. At this time 53 per cent of the men and 38 per cent of the women enrolled in universities were studying medicine; taking into account dentistry and veterinary medicine, more than 60 per cent of the total university enrolment was engaged in the study of the medical sciences. At Berlin, for example, over 1,000 students were studying anatomy where only 300 had been registered in 1936. Lectures were thrice given; laboratory work was by demonstration. Professor Brandt pleaded with Goebbels, Speer, Conti, and the others responsible for the directive to eliminate medical education, to reconsider their actions in the light of what he termed a national catastrophe. As a result a compromise was reached whereby the fourth, ninth, and tenth semester students were admitted to medical facilities during the winter semester of 1944-45, thus retaining approximately 18,000 of the original 39,000 enrolled. Figure 56 shows the 1944-45 enrolment by semesters and the changes resulting from this drastic draft of students for service.

Little can be said for the quality of medical education during this period. Professor Brandt himself stated that the medical students graduating since 1938 would never mature to be outstanding physicians, but believed they could be further trained so that "it will be safe to allow them to practise on their own." In addition to the imposition of purely military duties and the lack of challenging responsibility under the military regime, the gravest interference with their studies occurred in the removal of libraries and the destruction of electric light and transportation systems. Lack of texts was another problem: a 1944 authorization for medical texts is shown in Table 32, but no evidence was found that the printing was actually carried out. Studies were frequently interrupted by air raids, by requests to help in devastated regions or to serve as "fire-watch" in university buildings at night.

TABLE 32. MEDICAL TEXTS AUTHORIZED IN 1944
Priority Printing Approved by the
Reichs Propaganda Ministry

<i>Subject</i>	<i>Number of Authorized separate copies Texts</i>	
Anatomy and embryology	11	67,750
Physiology, physical chemistry	10	53,900
Pathology	7	38,750
Hereditary medicine	5	25,300
Bacteriology, hygiene, infectious disease	10	30,625
Diagnosis (including X-ray)	4	24,925
Therapy, pharmacology, phar- macopoeia	7	53,350
Actinotherapy	5	12,100
Internal medicine, including tuberculosis	14	73,975
Pediatrics	6	20,550
Obstetrics and gynecology	9	35,600
Surgery, including ortho- pedics, urology, injuries	13	52,950
Dermatology and venereal disease	3	17,300
Ophthalmology	4	18,400
Ear, nose and throat	6	23,380
Neurology, psychiatry, psy- chology	8	40,950
History, terminology, ethics	6	51,700
Associated medical sciences	3	9,750
Dentistry	10	27,650
Total	141	678,905

The continued bombings resulted in an overcrowding in the still existing universities to a point where instruction was given only under severe difficulty. The medical curriculum was adjusted to practical and timely subjects with no opportunity for investigation or research. With the constantly increasing destruction, more and more universities had to be closed with a consequent overcrowding in the remaining institutions until in March, 1945, all educational facilities had succumbed to bombing. The lower grade and preparatory system had already been closed in the autumn of 1944. These enforced steps caused consternation among the people of Germany and produced a flood of comments and criticism in the press and in educational journals.



FIGURE 57. *Air raid damage to First Medical Clinic, University of Munich. Front view.*

Effect of bombing on German universities

The task of securing a detailed bombing survey of activities in German universities at the end of the war was difficult. Not only were faculties and student bodies scattered over the country, but more important was the utter destruction from frequent bombings and by fires of the institutions, the clinics, and laboratories of practically every university surveyed. For example, in the once spacious modern psychiatric clinic at Kiel not a single person was available for interrogation and discussions; in the bombed-out buildings once used for

preclinical studies, collections of specimens, instruments, and books were strewn over the floors, or piled in burned-out basements. It was true that many records were wilfully destroyed upon the nihilistic orders of the government, and others were burned or severely damaged by fire and water as the result of the frequent air raids. On the other hand, precautionary measures had distributed many archives, documents and records into rural areas. These were not checked by us because of the limited allotted time and personnel. If several leads could have been followed, a considerable number



FIGURE 58. Air raid damage to First Medical Clinic, University of Munich.

of libraries, collections of laboratory equipment, and other paraphernalia of medical research and teaching might have been uncovered.

The following descriptions of the state of the universities visited in May and June, 1945, may, however, be considered fairly typical of the fate of medical schools located in the larger cities of Germany. It is proper to mention that the selection of these schools for survey was determined in London before field work was begun so that we were in no sense guided to these places as "examples" of destruction by persons desiring to place before us as devastating a picture as possible.

University of Munich: Almost all of the internationally known University of Munich was completely destroyed; the once impressive administration building is a shell. The anatomy, physiology, physiochemistry, hygiene and bacteriology, botany, zoology, and chemistry institutes were damaged severely in July, 1943, still more incapacitated in December, 1944, and transformed into ruins and rubble by an extremely devastating air raid by 600 planes of the Royal Air Force, striking at the city

area on January 7, 1945. The surgical, internal medicine, pediatrics, eye, dental and outpatient clinics were severely damaged (Figures 57-62). Less extensive destruction occurred to obstetrics and gynecology, neuropsychiatry, and dermato-urology clinics. In spite of this, medical training continued until March 17, 1945, although great difficulties were encountered. The enrolment of about 1,260 clinical students annually remained fairly constant to the winter semester of 1944-45. Much confusion reigned after each bombing attack, but co-operative arrangements facilitated maintenance of teaching schedules in available lecture halls. Since parts of the damaged university buildings, especially roofs, could not be repaired, the upper floors in most clinics were unusable. The Dean and the faculty had worked out a directive for air raid measures and for procedures of transferring patients which were well adapted to personnel, patient load and clinic facilities. Each university clinic was connected by special telephone lines with the city air protection office. Upon receiving the alarm signal, all patients and the most valuable instru-



FIGURE 59. *Air raid damage to Second Medical Clinic, University of Munich.*



FIGURE 61. *Air raid damage to Eye Clinic, University of Munich.*



FIGURE 60. *Air raid damage to Children's Clinic, University of Munich.*



FIGURE 62. Air raid damage to Polyclinic Building, University of Munich.

ments were moved into the re-enforced basements. The air raid cellars for the university clinics were inadequate and remained mostly of the basement type, except for the surgical clinic. One farsighted member of the faculty, Professor Pfaundler, had built an air raid cellar in 1936 in the children's clinic with room for 60 babies and 100 small children. Air raid attacks usually paralyzed the lighting system and the water supply, at times for days. The greatest difficulties were encountered with toilet arrangements, since sand or peat closets and pots had to be used; the additional strain of disinfecting and carrying was noticeable among the already overworked nurses and attendants. The damage report system for each hospital after an air raid was very efficient. Within the entire medical campus not a single physician, nurse, attendant or patient was killed by bombing. However, indirect casualties did occur, especially among infants and small children or among older people who could not endure the frequent transports from wards into the damp, dusty raid cellars and the stay there for several hours and days.

Whereas in 1939 the children's hospital had a bed capacity of 300, it was reduced by May, 1945, to only 80 beds. The reduction was due to an inauguration of transfer measures of children to out-of-town emergency hospitals, leaving only infants and the acutely sick children at the hospital.

Because of the air raids, the bed capacity of the university eye clinic was reduced from 200 to 40, the destruction of the roof and of one wing preventing all major surgery. The large number of perforated eye injuries due to splinters, glass and metal was surpassed by huge numbers of smoke injuries to eyes. Following the raid of December 15, 1943, more than 2,200 patients with severe "smoke irritation" of the eyes were treated within twenty-four hours. The university surgical clinic received a direct hit in December, 1944, and was severely damaged; however, the patient load had already been reduced from 220 to 100. The 100 patients were transferred from the burning and collapsed clinic at night into a spacious adjacent bunker without panic or confusion and without the loss of a single patient or staff member. This heavily reinforced, concrete air raid cellar, with excellent surgical facilities, equipment and electric sterilization apparatus is presented in Figure 89 (see Chapter Nine). The clinic maintained an emergency hospital at Tegernsee, located in a castle. It offered satisfactory facilities for the care of surgical patients.

Investigations during the later months of the war were conducted only on clinical projects, i.e., on pneumonia, on a type of lung disease termed "regenerative pulmonary hyperplasia," and on a hitherto unknown heart disorder, "fibrotic scarring in the heart of infants." Scientific activities in the medical clinic were confined to routine work, except for studies in sprue and its pathogenic colimitation.

University of Wurzburg: The University of Wurzburg, a charming old university located on the River Main with a history dating back to 1576, was severely damaged but less so among its medical buildings. However, much destruction was seen in the Luitpold, the main university hospital with 800 beds and 60 doctors. Normal student life, lectures and war instructions stopped with the "hell-on-earth catastrophe" in the night of March 16, 1945, which destroyed over 300 beds, killed 12 patients and necessitated evacuation of the Luitpold University Hospital to its emergency hospitals.

University of Cologne: The University of Cologne was again a picture of utter destruction, with



FIGURE 63. Air raid damage to Anatomy Building, University of Frankfort-am-Main.

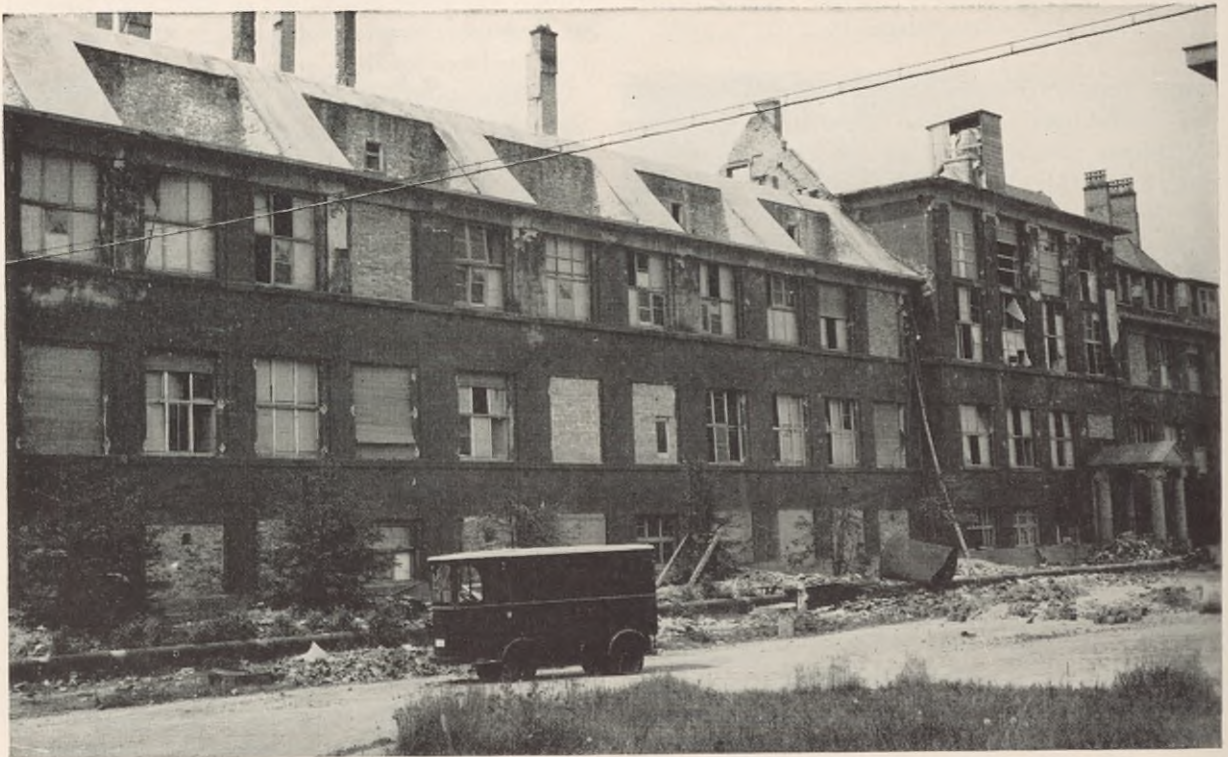


FIGURE 64. Air raid damage to Physiology Section, University of Frankfort-am-Main.

only the administration building and parts of the surgical clinic intact. The shortage of teachers and assistants was greatly felt, because of the destruction to the university hospital buildings and the tedious maintenance of the many scattered emergency hospitals in the country with only bicycles available for transportation. The various air attacks from October, 1943, to December, 1944, had disrupted teaching continuously with complete paralysis of all academic activities by March 2, 1944. The large medical clinic had but 24 beds left, an additional 16 beds being shared with the neuro-psychiatric department. The latter was greatly damaged by direct hits in June, 1943, and received its final knockout in October, 1944. No research had been done in psychiatry since 1943; however, the surgical clinic carried out clinical investigations on gastric ulcer in relation to air raids. Cologne and the surrounding territory had no brain surgeon at the time of our visit, and with the ever increasing difficulties in travel and the transportation of patients, a clear-cut result of air raids, no intervening brain surgery could be rendered except temporary relief measures to decrease intracranial pressure. No data are available as to the total number of students, as to lecture schedule changes or student activities. The University of Cologne and its medical school were considered by governmental authority a bombed-out and unusable university, in which no activities could be resumed during the war. The student body was transferred to less damaged universities, but information on the percentage of transfers and to which universities could not be secured.

University of Frankfurt-on-the-Main: This university since the first world war one of the larger city universities of Germany, was located in close proximity to the railroad marshaling yards, the city power plant, and many industrial factories producing war materials. Consequently, the medical school and the city university hospitals suffered severe damage from the air attacks on these strategic air targets. The anatomy, hygiene, pathology, and pharmacology sections were destroyed in 1943 and 1944 (Figure 63). The physiology and surgical sections were severely damaged (Figures 64, 65) at the same time. The orthopedic hospital, which originally had 700 beds for the treatment of civilian orthopedic cases and an outpatient clinic for the Army, was completely demolished. One wing of the psychiatric hospital, built in 1930, was destroyed together with records pertaining to the

effect of bombing upon psychiatric conditions. The modern X-ray clinic was partially destroyed, but continued to be used for administrative work and storage of X-ray equipment.

The medical college was closed in February, 1945, at the end of the semester. Whatever was left of the buildings was converted to the care of patients, and the staffs dealt with patients instead of with students.

The library of the city-university hospitals was completely destroyed in October, 1944. However, certain publications and a quantity of books had been preserved.

A subterranean air-raid hospital was built on the grounds of the medical center and is described in the chapter on hospitalization (see Chapter Nine). One of the largest in Germany, it permitted continuous operation of many hospital functions during air attacks, with its twelve operating rooms, extensive X-ray equipment, and obstetrical department. It was in full operation at the time of our visit, supplying badly needed hospital facilities. It will continue in use until the city hospital can be rebuilt but probably is too crowded to be of use for teaching purposes.

University of Kiel: All of the buildings and installations of the University of Kiel were completely destroyed, the first institute of higher learning to become a casualty to bombing. An early ministerial edict ordered its cessation as a functioning medical school. The student body was transferred to the two less damaged universities at nearby Rostock and Greifswald.

University of Hamburg: The medical facilities of the university are for the most part incorporated in the former city hospital, Eppendorf, located on the outskirts of the city. The pavilion system with 58 single pavilions, each accommodating 36 patients with 4 patients in private rooms, offered good dispersal against air attacks. The admission stations for internal medicine, surgery, anatomy, and pathology are located in large two-floor buildings with modern equipment and construction facilities. The student body was never closely knitted as so commonly found in other medical schools, because it was a school for middle class students, who spent little time with social activities. Eppendorf, with a patient load of almost 3,000 patients, had only two spacious high bunkers. The auxiliary air raid cellars were enforced basements beneath pavilions or buildings. The various air attacks which culminated in the catastrophe of July 27, 1943, have



FIGURE 65. *Air raid damage to Surgical Section, University of Frankfort-am-Main.*



FIGURE 66. *Damage to Surgical Clinic, University of Leipzig, by air raid of 4 December, 1943.*



FIGURE 67. *Damage to Pharmacology Building, University of Leipzig, by air raid of 4 December, 1943.*



FIGURE 68. *Damage to Children's Clinic, University of Leipzig, by air raid of 4 December, 1943.*



FIGURE 69. *Damage to Medical Clinic, University of Leipzig, by air raid of 4 December, 1943.*

left marks on every hospital unit in the medical school. A large hospital staff at St. Georg assisted in the clinical teaching of the medical students. This 2,170 bed hospital had been reduced by air raids to less than 1,400 beds, and many departments had to be removed to auxiliary hospitals by 1943. The severe bombing damage in April, 1945, suspended working facilities for several days, necessitated the permanent removal of children and women suffering with nervous and mental diseases to out-of-town emergency stations, and limited the bed capacity to 768.

Since St. Georg hospital played an important role in Hamburg's medical life and in medical teaching it had received the same attention in regard to air protection as Eppendorf. A large spacious air raid bunker was completed in 1943 with a bed capacity of 32; it contained an excellent ventilating system and was well equipped for all surgical and delivery work. The medical director related the enormous difficulties encountered during three rather severe bombings with from twelve to eighteen direct hits on burning buildings, and many more hits with fires everywhere from the catastrophic bombing attack of April, 1945. No patients or personnel were lost although over two-thirds of the hospital was in flames. Practically all upper floors of twelve buildings were destroyed and burned out, with only one safe air raid bunker at their disposal. Working facilities are limited, since

little repair work could be permitted in view of the extreme shortage of all building materials.

In 1939, 643 clinical students were enrolled in the medical school, the number declining to 123 in the winter semester of 1944-45. The shortage of medical personnel, reduced by seven-tenths, with no replacement by internes or assistants, paralyzed research and only clinical investigations have been carried out since 1943. The pavilion system at Eppendorf made it feasible to carry on group teaching after the bombing havoc; however, with the final destruction of the larger lecture rooms, replacement facilities were found in the pathology building until this building succumbed to repeated air bombing. The same story repeated itself, i.e., everything in the line of hospital equipment was short; no scientific treatment of metabolic and for most organic diseases could be carried out. The clinicians complained that the surgeons had better equipment, drugs and material, and could perform operations in safety with proper after-care. Surgical patients were much better protected in their special surgery bunkers than were the medical patients, who had to be moved with each air raid or alarm into basements or collection cellars. At Hamburg's medical school a hopeless attitude prevailed with regard to the future and progress of science in German universities. No information was available as to when teaching could be resumed.

University of Leipzig: Although the University



FIGURE 70. *Damage to Anatomy Building, University of Leipzig, by air raid of 4 December, 1943.*



FIGURE 71. *Damage to Neuropsychiatric Clinic, University of Leipzig, by air raid of 4 December, 1943.*

of Leipzig was not included among the medical schools visited by our staff, reference to a comprehensive air raid document obtained makes it possible to give some detail on the damages inflicted by air raids upon the university. Leipzig, a university famous for five centuries, is the third largest university of Germany. Many outstanding scientists of international fame have been on the faculty. The important Karl Sudhoff Institute is here which housed a remarkable collection of documents on the history of medicine and science consisting of more than 35,000 books, 11,000 antique or historical medical instruments, and of more than 3,000 portraits of the world's physicians. In the fall of 1942, the Education Department of the Ministry of the Interior ordered that in view of expected bomb raids the libraries of Leipzig, with their important and irreplaceable volumes, should be transferred to safe localities, preferably into near-by villages. The institute was bombed in October, 1943, and severely damaged by direct hits on December 4, 1943, and again in February, 1944. The ultimate fate of the libraries was not known at the conclusion of the field work.

Surprise air raids by the RAF in 1942 and in 1943 had destroyed many university and clinical buildings, but when 450 bombers blasted the town for twenty-five minutes on December 4, 1943, ruins and fire paralyzed all activities. The damage to

the Sudhoff Institute from fire, destruction, and water on this "Katastrophen-night" was severe, but the rescue work by the staff, by military students and by volunteers succeeded in transporting most of the Institute's irreplaceable treasures to adjacent safety cellars without loss of life. The fire department and the heavy anti-flak artillery had been sent to the city of Berlin for emergency aid, thus making fire fighting and rescue work even more difficult. The women's clinic received 126 incendiary and 14 phosphorous bombs; the orthopedic clinic over 200 incendiary bombs. With windows and doors blasted, with buildings in flame, the patients were removed quickly and marched in the bitter cold night, brilliantly illuminated by a burning campus, to their shelters. Pictures of the pre-clinical institutes, of clinics and of hospital buildings demonstrate the bombing damage upon medical installations as presented in Figures 66-70.

A description of this air raid in which the university neuropsychiatric clinic was hit (Figure 71) is fairly typical of those reported from other clinics and is given as a specimen of such events:

"When the night alarm sounded, we transported as usual all patients from the neuropsychiatric wards to the basement air raid cellar. Frequent preparatory exercises and constant education by lectures to patients and staff facilitated smooth transportation. The clinic is without an elevator,

therefore the majority of the paralyzed patients had to be carried on stretchers, and unruly psychotics had to be guided individually into the basement. When the last patients left the first floor, which was approximately five minutes after the alarm signal, the first bomb hits shook the clinic in its foundation and a direct hit laid the male wing of the clinic in ruin. Without consideration for their own safety or lives, nurses and some patients rescued the sick occupants amidst falling ceilings and beams. With everyone safely in the basement, it was found that the emergency exit doors could not be closed as they were covered or pushed open by debris. When the entire upper clinic started to burn, 180 mental and paralyzed patients had to be removed from the basement. There was nowhere to take them, with all adjacent buildings in clouds of dark dust or on fire. The patients were carried or forced to march into an adjacent garden and bedded on piles of leaves. There was no water to fight fires or to quench thirst. To counteract the increasing restlessness of the groaning, freezing psychiatric patients, additional sedation by morphine and scopolamin injections was necessary. In the early morning hours the patients were transferred to a rural school, including excited psychoses, depressions, paretics and paralytics, after forty hours of agony in this open garden shelter. Except for the loss of one wounded demented patient, no casualties had occurred."

Conclusions

The foregoing pages describe the physical losses endured by the medical schools of the German universities, and enough has been said to indicate the extent of the devastation to these institutions. Higher education in Germany can no longer be carried on in the facilities now existing. The supply of physicians and allied technicians is low; an increase can hardly be expected for many years, until physical plants can be built in which medical education can be pursued.

The teaching staffs of all medical schools were decimated by 1941, and it was not unusual to find reductions from fourteen to four or fewer faculty members, with no internes, assistants or research

help to bridge the shortage. The larger laboratories employed technicians only, with their work confined to routine matters; only occasionally were specific research problems found to occupy people on full time. The dire need of medical assistants in the clinics was the cause of many complaints and led to such friction that a government directive had to be issued to regulate the allotted number of physicians to clinics according to the number of operations, beds and outpatients. This, however, failed to satisfy all needs and requests. The schools were finally ordered to submit six-month lists, giving for each department the personnel by name, the number of outpatients, and the bed capacity so that continuous reallocation of available personnel could be made.

The confusion in the universities was increasingly augmented by the air raids. Vast destruction to facilities and clinics, demands from the constantly increasing number of emergency hospitals in the country, the constant improvisation of lectures and demonstrations in the available halls on the campus or somewhere in the city, and increasing transportation difficulties caused students and teachers to become more and more fatigued and discouraged. To these burdens were added the depressing surroundings of destruction, inadequate repairs of bombed damaged buildings and clinics, the shortage of food, fuel, drugs, and bandages, and the ever present alertness and fear against new raids day and night.

It is not a part of the post-war plans of the victorious Allied nations to keep the German people on a level where sickness cannot be cared for or physical health safeguarded. But until medical education can be developed again in Germany and the nation can produce her own supply of medical practitioners, nurses and public health workers, the facilities of the Allies will have to be called upon to render assistance. It seems evident that German students will have to be trained, in part at least, somewhere outside that country not only to maintain reasonable medical care in Germany, but to augment the supply of instructors and professional teachers until medical education may again become able to supply the needs of the country.

CHAPTER NINE

HOSPITALIZATION

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This report covers the direct and indirect effects of bombing on hospitals and medical facilities. In total war, hospitals are not spared as experience in Germany and Great Britain has shown. Many large hospitals have been completely obliterated and their patients with them. In the large Krupp hospital at Essen, which was regarded as one of the most modern in Europe, every building was razed to the ground in a single raid. Over 85 of the 750 patients there at the time were killed. The scene left where this institution once stood is now as bleak as a painting by a surrealist (Figure 72). Many other hospitals in bombed countries have suffered a similar fate, as is simply demonstrated by the Warwickshire in Coventry, Guy's Hospital in London, the clinics of the University of Munich, and the Insel Spital in Nuremberg (see Figure 110). Indeed, the opinion has been expressed that in total war the red cross on the brilliant white background is no longer a shield of safety on the roof of a hospital but a pinpoint for orienting pilots over a blackened city on a moonlit night. What occurs in a community, what was done when these institutions were destroyed or damaged, how they were protected, how well their vital services to the people were continued, is the substance of this report on the hospitals of Germany.

Methods of the USSBS investigation

Sample cities were selected by qualified experts so that an accurate over-all picture could be obtained without having to take the time necessary to visit every city in Germany. More than a hundred hospitals in sixteen different sample cities were visited in addition to several smaller institutions in the evacuation areas. The usual procedure in arriving at a city was to secure the names of the larger hospitals, as a rule from the health department. Occasionally, the city hospital was visited directly and names of the other hospitals secured from physicians there. The superintendent was interviewed for statistical data which was supplied in some instances on the survey forms and in other instances in a typed report. This information in-

cluded (1) number of beds available from 1938 to 1944 inclusive, and through April, 1945; (2) medical and nursing personnel for the same years; (3) type of hospital (special or general) and the number of patients in each department; (4) dates of air raids and the damage done to the buildings (using a blueprint if it was available) and the number of patients and personnel wounded or killed; (5) air raid precautions taken, including specially built shelters and reinforced cellars; and (6) the schemes for handling patients during air raids. In some of the smaller hospitals this statistical data made up the entire report but in larger hospitals it was only part of a more complete survey of the institution.

The interviews with staff members were usually with one or more members of each department, the questions being formulated with a view to evaluating the effect of air raids upon the patients, upon the incidence of various disease entities, and upon the medical aspects of the community as a whole. Where possible, nurses were also interviewed. Following this, the hospital was inspected for a better understanding of the extent of the damage, the type of air raid shelter used, the method of handling of the patients, and similar problems. All of the information obtained from the various hospitals within a city was incorporated into a single report, entitled "Hospitals in _____."

The statistical data are available in the files of the USSBS in the War Department. This chapter is a digest and summary of all of the reports on hospitals in the various areas visited.

Hospital buildings in Germany

At the beginning of the present war there were few modern hospitals in Germany as Americans know them. Many of the structures date back to the latter half of the last century. Only a few were completely constructed or enlarged as late as the 1920's. The larger hospitals and especially those a part of the universities are built on the pavilion plan, i.e., usually a system of one-to three-story buildings in an enclosure, each building housing



FIGURE 72. *Air raid damage to Krupp Hospital, Essen. This was one of the most modern installations in Europe and was completely destroyed in one raid. Hospital grounds were adjacent to main Krupp Works.*

a separate institute or clinic. Rarely were these buildings connected by passageways. What might be considered typical layouts of this type are shown in Figures 104, 105 and 106 (ground plans of pavilion-type hospitals showing bomb damage). Although considered antiquated by American concepts, those hospitals constructed on the pavilion plan were proven to have had a distinct advantage in modern warfare. Being dispersed and less intimately integrated than our towering structures their whole system was not disrupted when one building was destroyed in an air raid, even though their total bed capacity might have been lowered. There are several reasons why hospital construction had lagged in Germany but the main reason given by the Germans is war. They stated that preparation for and recovery from the first World War and preparation for the present conflict are

probably the outstanding contributing factors. There is little evidence that the Nazis made much progress in remedying this situation. Elaborate plans were made such as the proposed new home of the medical school of the University of Berlin (Figure 73), but as one German put it, these were only plans for propaganda purposes, "the National Socialist regime laid emphasis on health and not on sickness." With the extensive destruction of hospital facilities in the air war there appears to be little hope that the need for modern hospitals, which was critical even before the war, could be met for some time.

Prewar bed capacity of the hospitals

Because of the lack of new construction, the number of beds available for the civilian population was, according to most hospital superintend-

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ents, barely adequate even in 1939. Exact figures were not obtainable. One statement by Professor Karl Brandt, in an interview with a Medical Branch investigator, gave the number as 350,000, of which 72,000 were for tuberculosis patients; another figure gave the number of general beds as 353,000 or 4.6 per 1,000 inhabitants and of total beds (all types) as 663,000, or slightly less than 9 per thousand inhabitants. By 1945, the number of individuals requiring hospital care had greatly increased to over 1,000,000 military and 500,000 civilian patients, according to Professor Brandt. By comparison, the rate in the United States, according to the American Medical Association, was 4.3 general hospital beds per 1,000 population in 1941.

Before the war some effort was made to relieve this shortage by more discriminating control over hospital admissions and the duration of hospitalization. When the situation became critical, a great deal of attention was given in the literature to the subject of ways and means of reducing the patient days in hospitals¹. The culmination of this emergency is marked by a decree from Public Health Division of the Ministry of the Interior in February, 1945, which described the need for more hospital beds for civilians and ordered the use of

every available space within hospitals for placement of extra beds. In some of the larger cities, the department of health had what was known as the *Bettenachweis*.² By this system the municipal health department maintained a daily listing of the number of available beds in each hospital in the city. This office thus became the central clearinghouse for hospitalization and no patient could be admitted to a hospital in Hamburg (except for dire emergencies), without having been directed there by this central office. The attending physician would notify the clearinghouse and he would, in turn, be told he could send his patient to a certain facility. With such a simple procedure, the Hamburg officials stated they were able to cushion the impact of destruction of hospital facilities during air raids.

Within the time available it was impossible to obtain figures on the rapidly shifting bed capacity of all of the hospitals in all the cities visited nor were accurate statistics available for Germany as a whole. Where figures were obtained (as for the sample hospitals of sample cities visited), it was often found that the number of beds available for civilians rapidly decreased as the bombing offensive against German cities was accelerated. In most hospitals, the daily census showed that 90 per cent

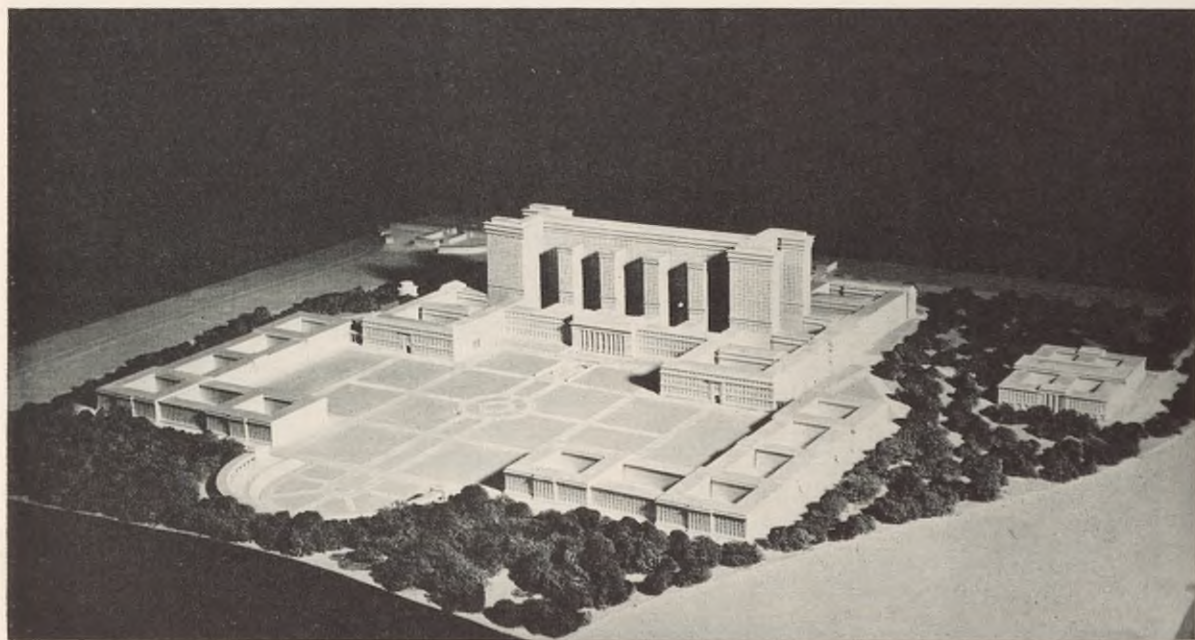
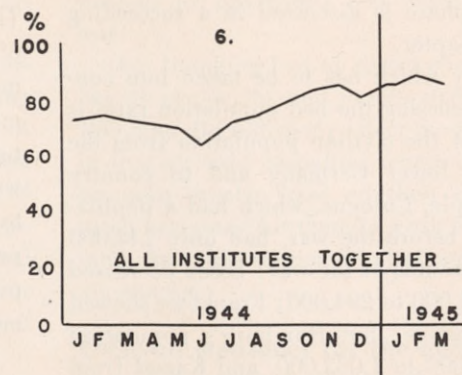
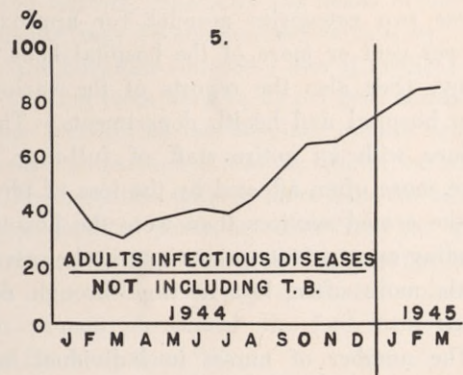
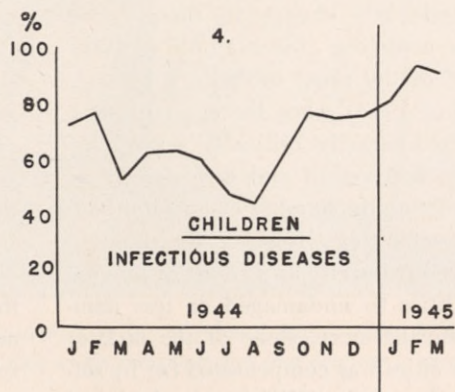
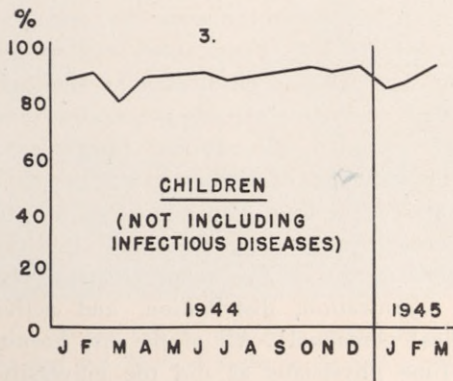
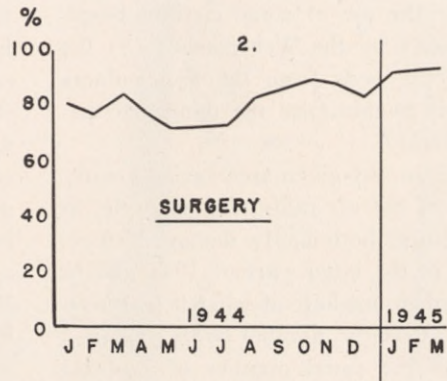
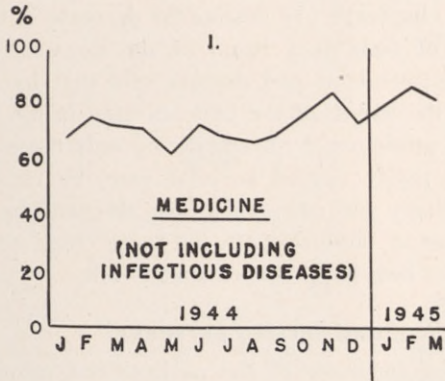


FIGURE 73. Proposed new home of the Medical School of the University of Berlin. This 23 story medical center, patterned after American medical centers, was to house hospital wards, clinics, out-patient departments, laboratories, lecture halls, and quarters for staff and nurses. It was to be built near the Olympic Stadium. Construction was approved in 1938, but was never started because of the war.

FIGURE 74

USE OF THE BEDS IN THE HOSPITALS OF LEIPZIG
INCLUDING THE OUTSIDE ASSEMBLY CENTRES
PERCENT OF TOTAL CAPACITY



1-6 COLLECTED IN ALL MUNICIPAL, UNIVERSITY AND OTHER PUBLIC INSTITUTIONS, BUT NOT THE PRIVATE INSTITUTIONS.

6- INCLUDES WARDS 1-5 AS WELL AS TB, NEUROLOGY, ORTHOPEDICS, GYNECOLOGY, EAR-THROAT-NOSE EYES, DERMATOLOGY.

or more of the beds were occupied. This is a higher percentage than is usual in peacetime and leaves very little leeway for emergencies (Figure 74). The main causes for this decrease in the number of beds were (1) destruction of hospital buildings by bombing; (2) the use of some civilian hospitals (all or in part) by the Wehrmacht; (3) the necessity of clearing beds from the upper floors of hospitals so as to minimize the danger to patients from air attacks.

The loss of beds in any given area varied greatly with the severity of the air raids; for example, in Kassel and Hamburg, both badly damaged cities, the bed capacity in the latter part of 1944 and in 1945 was one-third to one-half of what it had been in 1939 and 1940; Cologne, another badly damaged city, had one-fifth the usual number of hospital beds available for civilians; Frankfort had more or less one-half available; and Hamm, Dortmund, and Essen showed little change in their ratios. There were other occasions (for example in Hamburg, as a result of the great incendiary raids in July and August of 1943) when the available hospital beds were temporarily critically scarce. Because of building destruction and difficulty in repairing this destruction the number of hospital beds remained low for some time. However, the situation gradually improved primarily as a result of moving the hospital facilities to undamaged or less damaged buildings. Furthermore, some of the lack of beds in the larger cities was compensated for by setting up auxiliary hospitals (*Hilfskrankenhäuser*) and emergency hospitals (*Ausweichkrankenhäuser*). This phase is discussed in a succeeding section of this chapter.

Another factor which has to be taken into consideration in discussing the bed population ratio is the evacuation of the civilian population from the larger cities to lower Germany and to country areas. For example, Cologne, which had a population of 770,000 before the war, had only 144,000 during the last months of the war; Essen decreased from around 604,000 to 294,000; Frankfort showed no noticeable change; but Hamburg's population fell from 1,677,000 to 1,032,000, and Kassel from 210,000 to around 85,000. In many instances the drop in population in the larger cities was concomitant with the destruction of hospitals.

Conclusions. The over-all impression obtained was that (1) the number of beds available for civilian use in Germany was decreased as the direct result of bombing; (2) occasionally it was

possible for the hospital to rebuild and, therefore, make more space available; (3) more generally, it was necessary to move part of the facilities out of town and re-establish the hospital in a new location (see the section on auxiliary hospitals in this chapter); (4) despite the decrease in the number of beds as a result of the air war, hospital superintendents and doctors said that by decreasing the length of the patients' stay in the hospital to a minimum, by hospitalizing only those patients who really needed hospital care, by establishing auxiliary and emergency hospitals, and by the decrease in population in the large cities, the shortage of beds had not been acutely felt.

Medical and nursing personnel

The adequacy of the medical and nursing personnel with which the hospitals were staffed varied greatly during the war years, varied in the different hospitals within the same city, and varied also from city to city. From interviews with hospital superintendents and physicians the Medical Branch received conflicting reports concerning the specific policy set up by the national government regarding the induction of permanent staff physicians into the armed services. The allocation of physicians in general (not only in hospitals) is discussed in another section of this report (Chapter Seven on the organization, distribution, and activities of medical personnel). All of the city hospitals had full-time physicians as did the university hospitals, which often functioned as the municipal hospital for the cities in which they were located. These two categories account for approximately 65 per cent or more of the hospital beds in Germany. (See also the reports of the various German hospital and health departments.) The institutions with an entire staff of full-time doctors were more often affected by the loss of physicians to the armed services than were the hospitals depending upon private practitioners; the private hospitals more often lost doctors through displacement.

The number of nurses in individual hospitals fluctuated less than the number of physicians and was occasionally found to have been higher during the war than preceding the war. This is largely accounted for by the fact that propoganda was effective in persuading many more young women to take up nursing.

The general feeling among hospital superinten-



FIGURE 75. Air raid hospital bunker. (Concrete air raid shelter). Gas lock in entrance hall to wards. Note ventilation openings above the door and electrical wiring on the wall. German sign on the right indicates that doorway is an emergency exit, and a passage to the surgical clinic.

dents and doctors, especially the heads of various departments, may be summarized as follows:

(1). The hospitals suffered a loss of medical personnel varying from none to 40 per cent depending upon the location of the hospital, on the ages of the permanent personnel, and on similar variables.

(2). The hospitals suffered more from the lack of quality in medical personnel than from the quantity of personnel. Many hospitals had inexperienced medical help such as recently graduated women or men or women physicians who had been out of practice for some time.

(3). There was no acute lack of nurses.

(4). By working longer hours and going without vacations, the hospital physicians were able to supply fairly adequate medical care for their patients.

(5). Hospitals which had suffered loss of beds through air raids were often able thus to maintain their doctor-patient ratio even though the actual

number of physicians was lower than before the war.

(6). Bombing had no direct effect upon the number of physicians and nurses staffing the hospitals. Bombing did indirectly affect the professional staffs in that air raid casualties received in hospitals put an even greater load on their shoulders. It was often necessary for them to work with inferior assistants, but this cannot be attributed directly to the air attacks.

Over-all measures for the defense of hospitals against air attack

Early in the air war the various sections of Germany were classified into "zones of air raid danger", as they were called, and graded from one to four according to their anticipated danger from Allied air attack. The purpose of this was to establish a basis for determining the extent of air raid

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FIGURE 76. *Air raid hospital bunker (concrete air raid shelter). Infants' ward. Note arrangement of cribs. Towels are to prevent light shining in the infants' eyes.*

precautions to be taken. These precautions were supervised and controlled by the chief of the medical service of the German Air Force (*Chef des Sanitätswesens der Luftwaffe*). He issued specific directives regarding allocation of materials for shelters and other defense measures to be taken to the air raid precautions chiefs in the air commands (*Luftgau Kommando*) from where they were disseminated to the institutions affected. These were frequently mere affirmations of the information and guidance given civilian hospitals by the Ministry of the Interior.

The adequacy of the precautions taken by hospitals to protect their patients during air raids was found to have been directly associated with the rating given their area when the zones of danger were originally established. The most extensive and thorough precautions were taken in the obvious zones of danger, such as the industrial districts of northeastern Germany. Until the combined Allied air

offensive got fully under way it was not expected that the bombers would reach southern Germany in force and by the time they did it was too late to take the elaborate precautions necessary for the protection of hospital facilities. In fact, until early in 1944, Bavaria was frequently referred to as the "Air Raid Cellar of the Fatherland."

Hospital air raid shelters

The air raid precautions which were suggested to hospitals by the Ministry of the Interior covered most eventualities, such as: when and where to build shelters, and what type; the best methods for supporting and reinforcing cellars; the necessity for supplying sufficient water in air raid shelters; when to shut off the boilers; setting up an emergency operating room; arrangement of exits and entrances; when to bring patients into the shelters; and the conduct of doctors and nurses in the shelter.³

HOSPITALIZATION



FIGURE 77. Air raid hospital bunker children's ward. Notice how close the beds are placed together, the use of double-decker bunks and the crowded washing facilities.

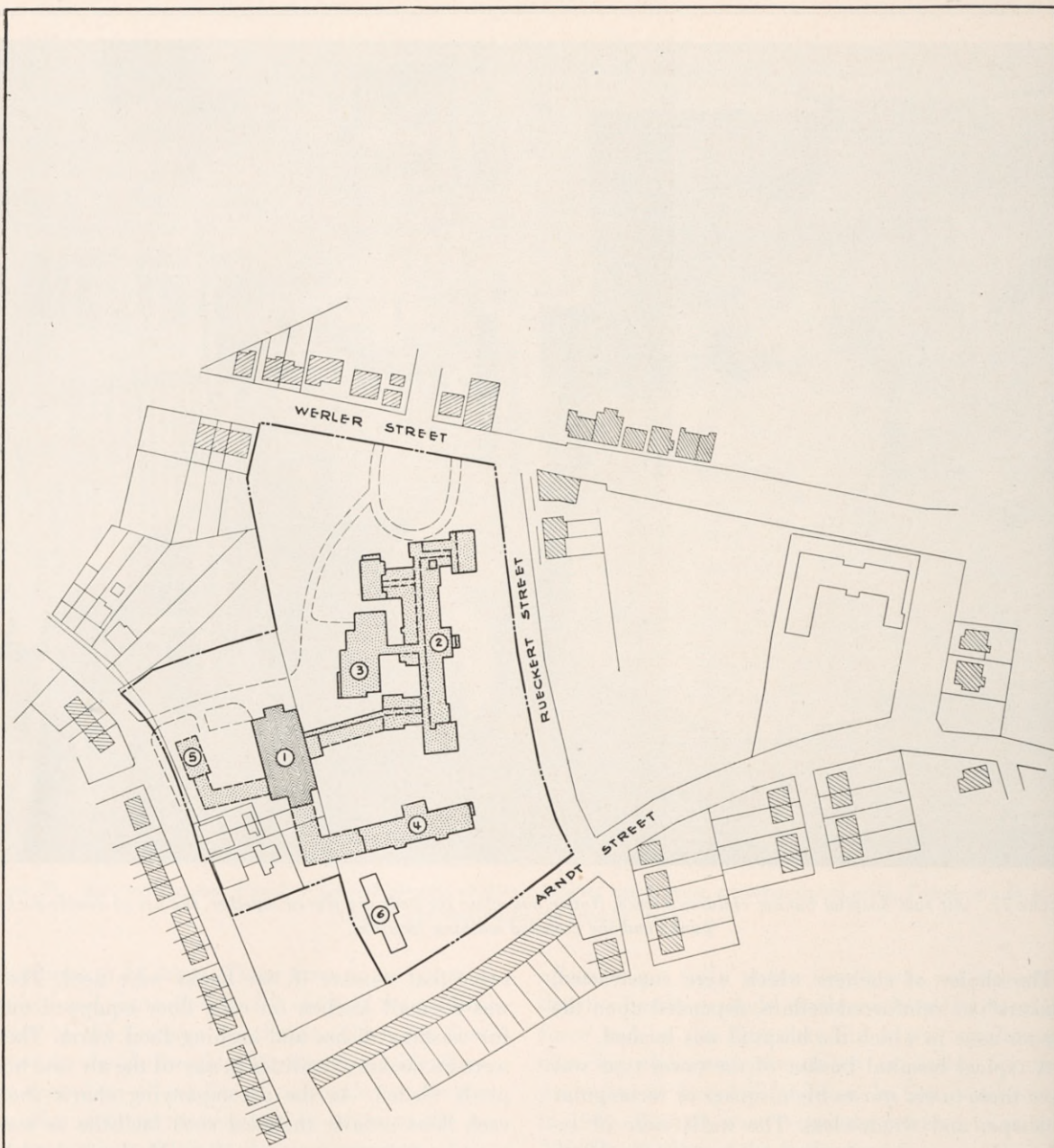
The choice of shelters which were constructed, bunkers* or reinforced cellars, depended upon the danger zone in which the hospital was located.

A typical hospital bunker of the tower type was from three to six stories high, square or rectangular in shape, and windowless. The walls were of reinforced concrete and stone approximately 2.3 to 2.7 meters thick. The roof, also of reinforced concrete, varied in thickness from 3 to 5 meters. These bunkers were usually connected to the hospital by several ramps and, in addition, there were also auxiliary underground passageways leading to the outside. The doors were double with a vestibule between, the so-called "gas lock" (Figure 75). Each floor had a central corridor into which the rooms led. The patient room held from 6 to 8 patients, or

* The German term *Bunker* was used to denote a type of shelter which was of permanent construction. It can be distinguished from the improvised type built in cellars or by reinforcing ordinary buildings. Bunkers were of two types: underground and tower.

twice that number if tier bunks were used. There was a small kitchen on each floor equipped only for washing dishes and keeping food warm. There were no cooking facilities in any of the air raid hospitals visited. As the accompanying charts show, each floor usually included such facilities as wash rooms, service rooms, and toilets. Mechanical equipment such as storage batteries, pumps, diesel engines for emergency lighting and water, the heating systems, all these were situated in the underground floor of the tower-type bunkers. Not all bunkers had their own water supply, some of them having to rely solely on the city system. All of them did have their own stand-by lighting systems. The so-called "tower" bunkers ordinarily had one story fully underground, one partially underground, and the balance above ground; the subterranean bunkers ordinarily had all floors except the top one underground. The actual size and bed capacity of these massive structures varied with the size of the

FIGURE 78



LEGEND-

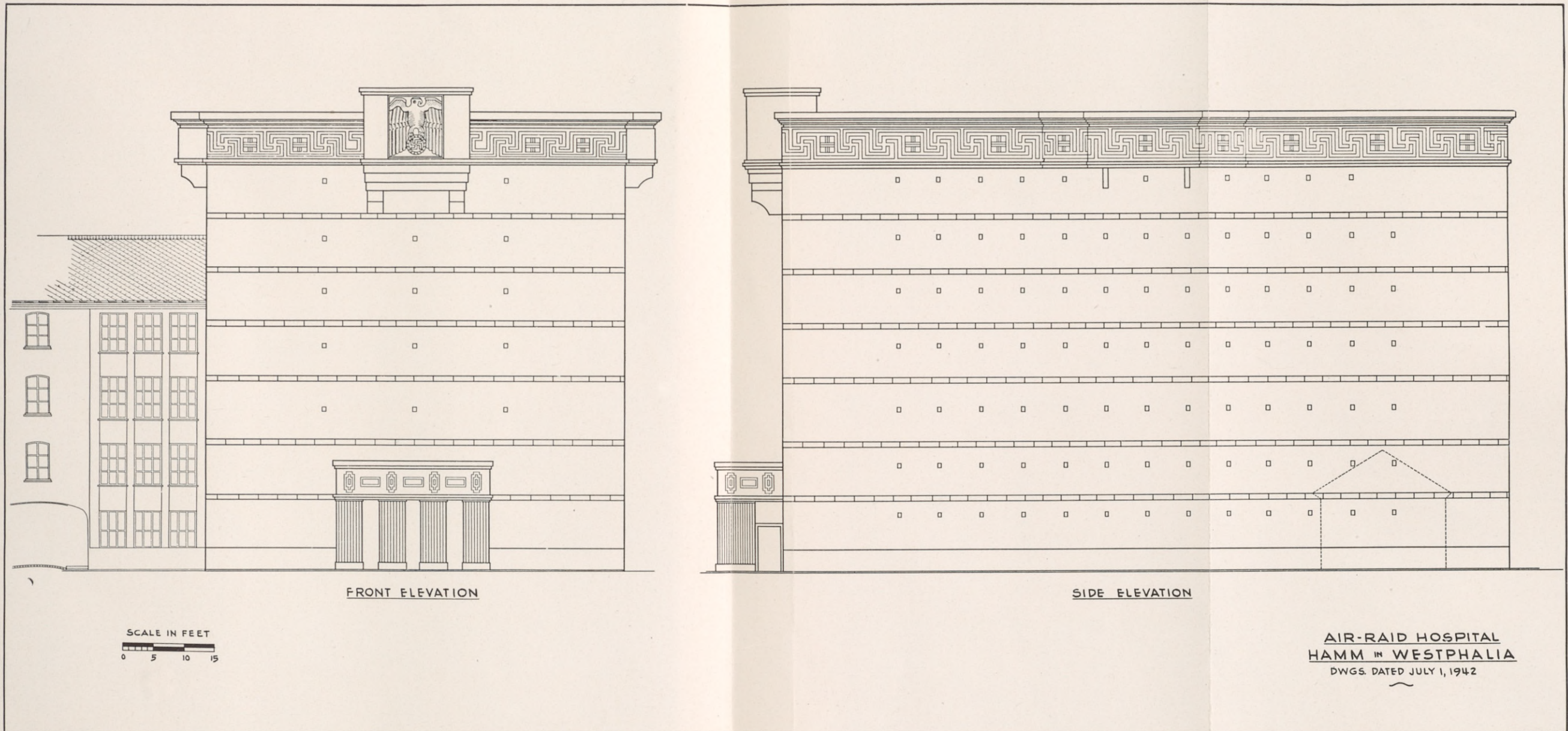
- 1.- AIR-RAID OPERATIONS BLDG.
- 2.- MUNICIPAL HOSPITAL
- 3.- KITCHEN & LAUNDRY BLDG.
- 4.- ISOLATION HOUSE
- 5.- MORGUE
- 6.- BARRACKS

PLOT PLAN

SCALE IN FEET
0 50 100 150

**AIR-RAID HOSPITAL
HAMM IN WESTPHALIA**

FIGURE 79

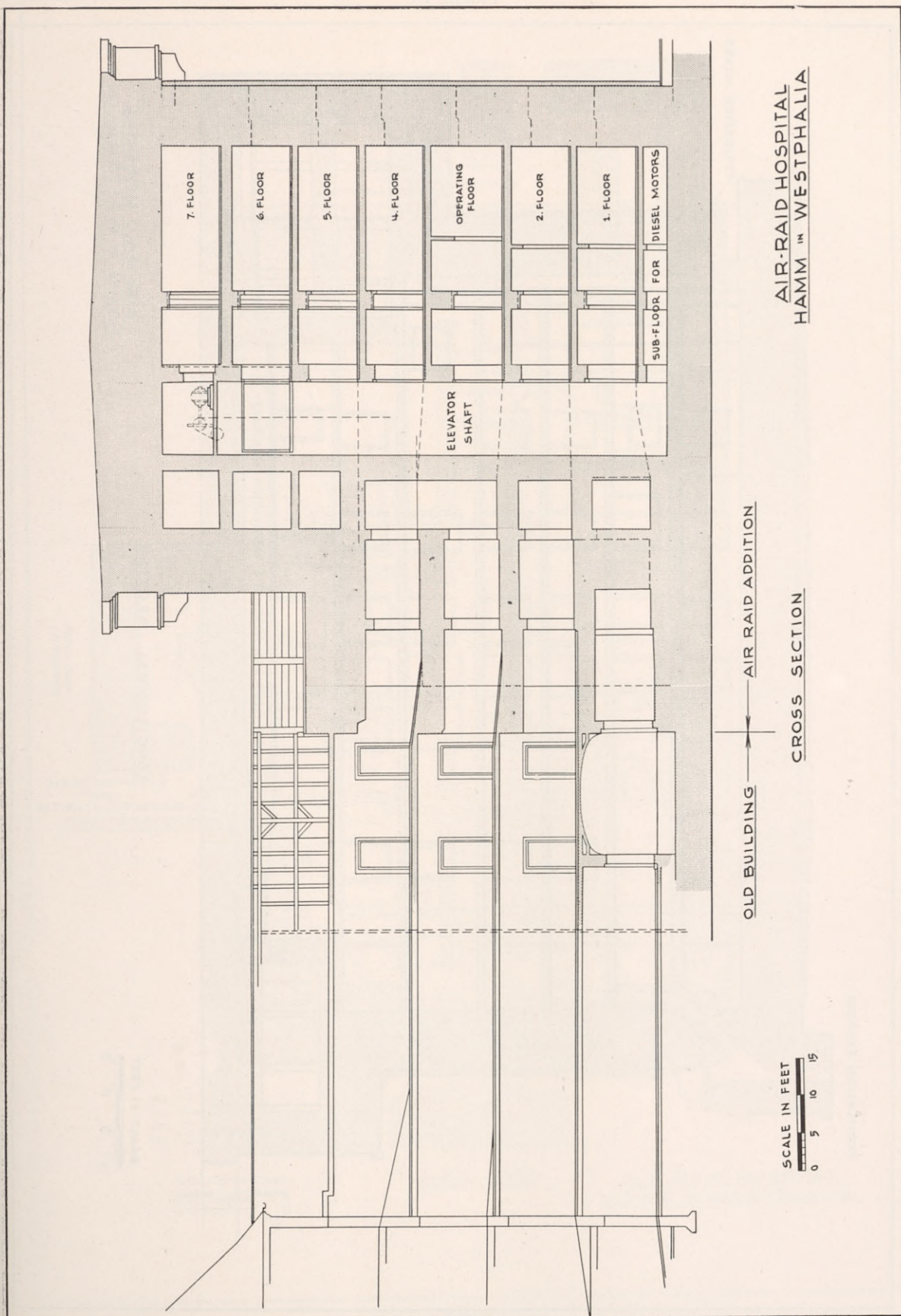


FRONT ELEVATION

SIDE ELEVATION

AIR-RAID HOSPITAL
HAMM IN WESTPHALIA
DWGS. DATED JULY 1, 1942

FIGURE 80



SCALE IN FEET
0 5 10 15

OLD BUILDING — AIR RAID ADDITION

CROSS SECTION

AIR-RAID HOSPITAL
HAMM IN WESTPHALIA

FIGURE 81

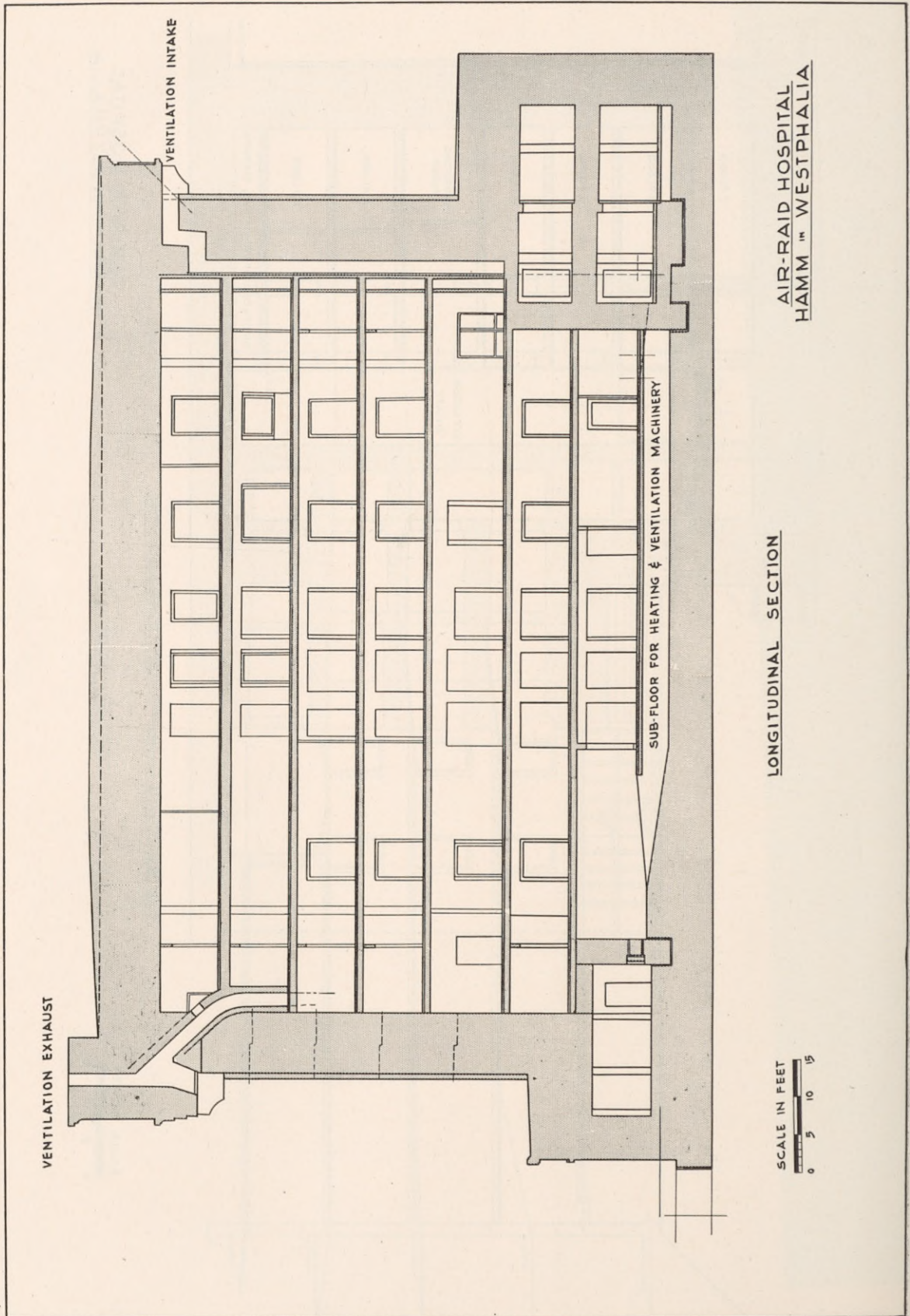


FIGURE 82

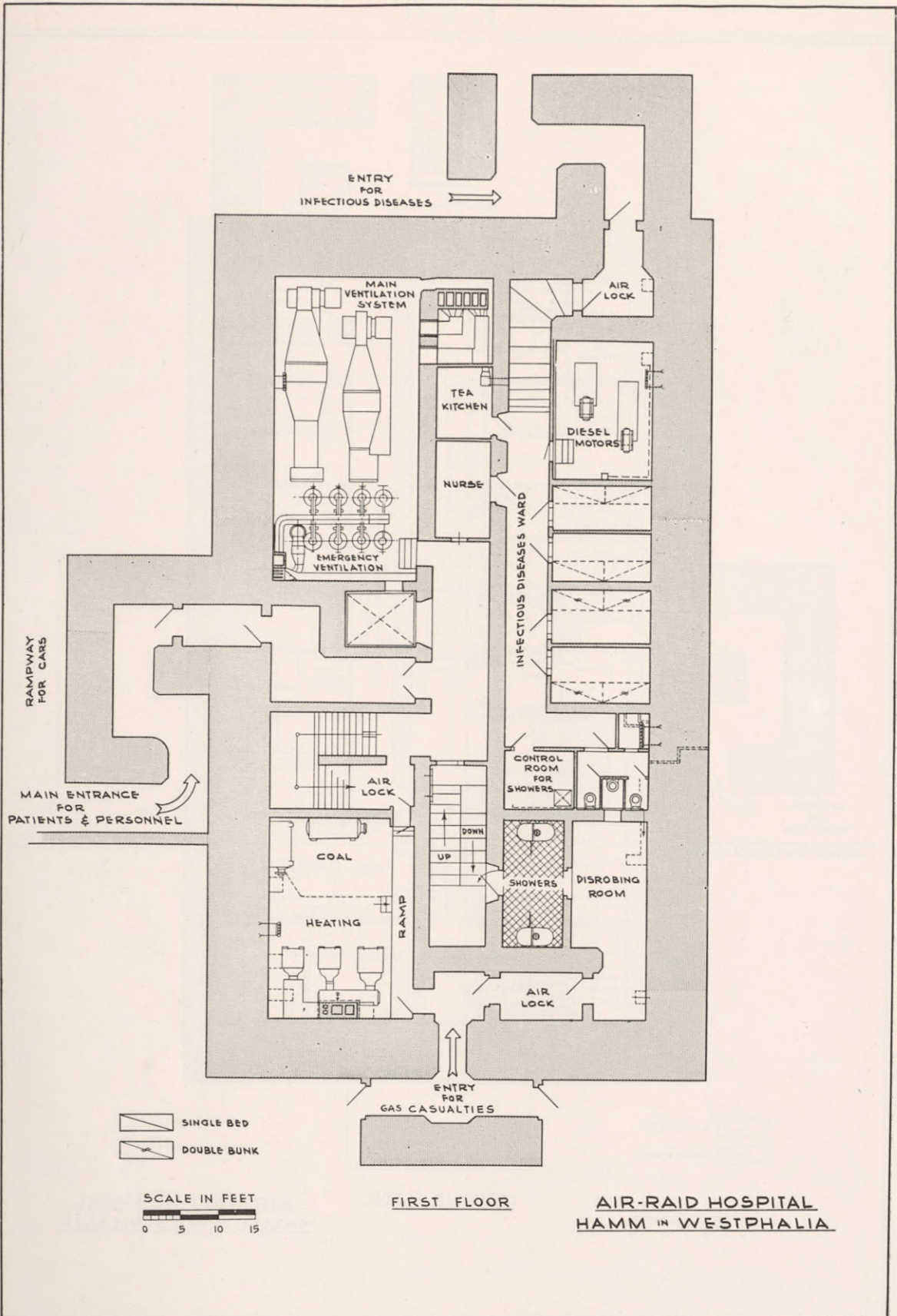
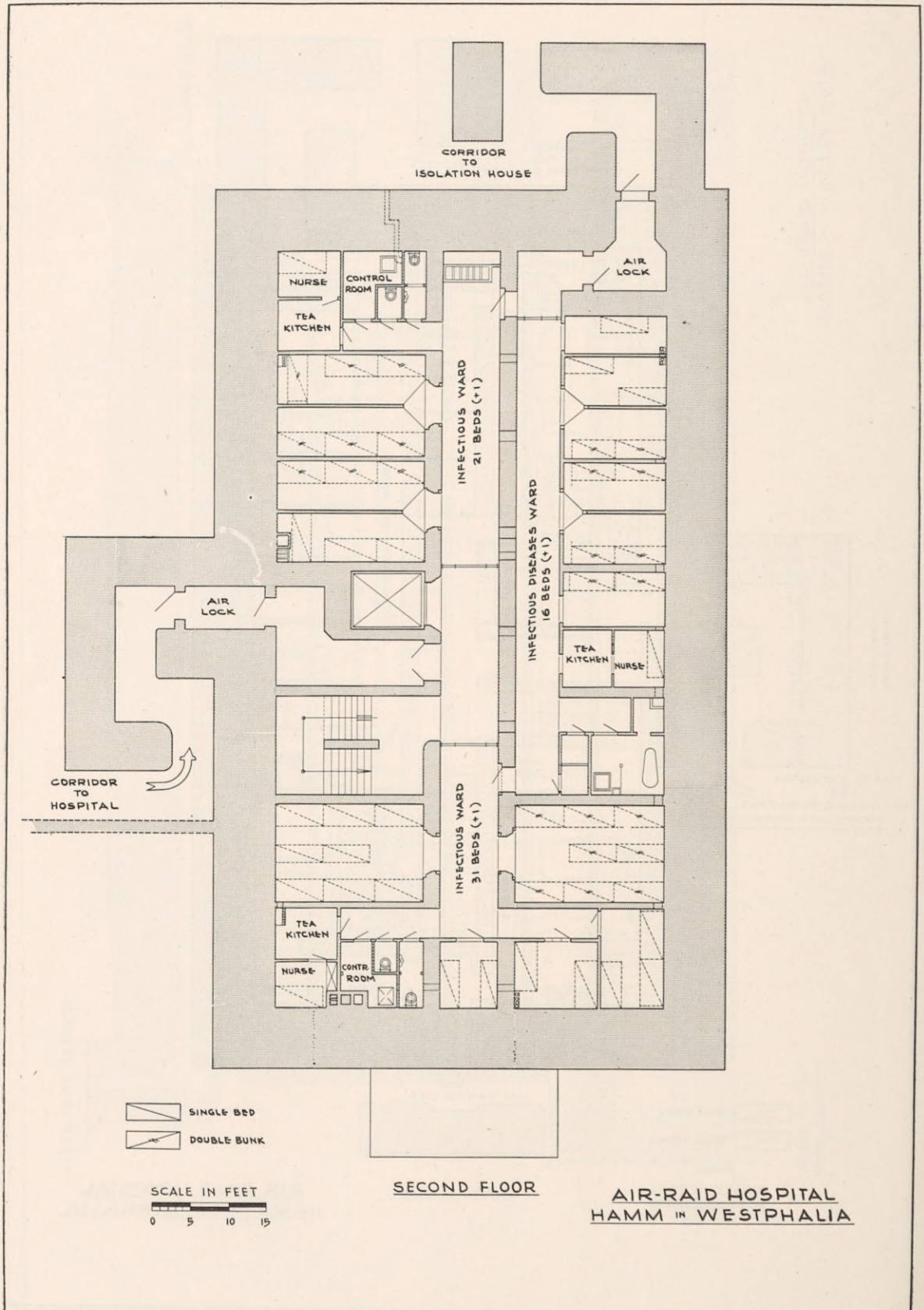


FIGURE 83



CORRIDOR
TO
ISOLATION HOUSE

NURSE
CONTROL
ROOM

TEA
KITCHEN

INFECTIOUS WARD
21 BEDS (+1)

AIR
LOCK

AIR
LOCK

CORRIDOR
TO
HOSPITAL

INFECTIOUS DISEASES WARD
16 BEDS (+1)

TEA
KITCHEN
NURSE

INFECTIOUS WARD
31 BEDS (+1)

TEA
KITCHEN

NURSE
CONTR.
ROOM

SINGLE BED
DOUBLE BUNK

SCALE IN FEET
0 5 10 15

SECOND FLOOR

AIR-RAID HOSPITAL
HAMM IN WESTPHALIA

FIGURE 84

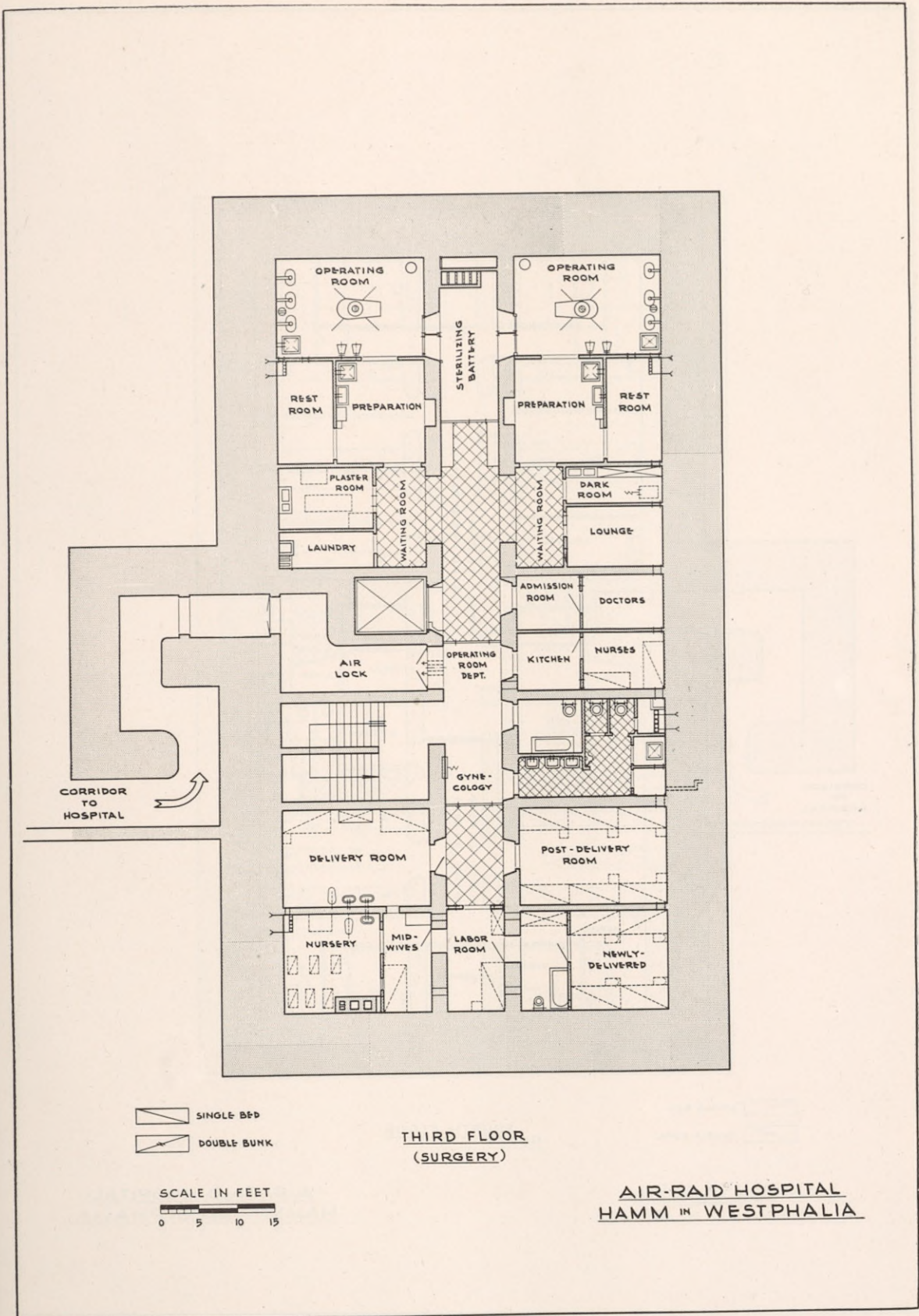


FIGURE 85

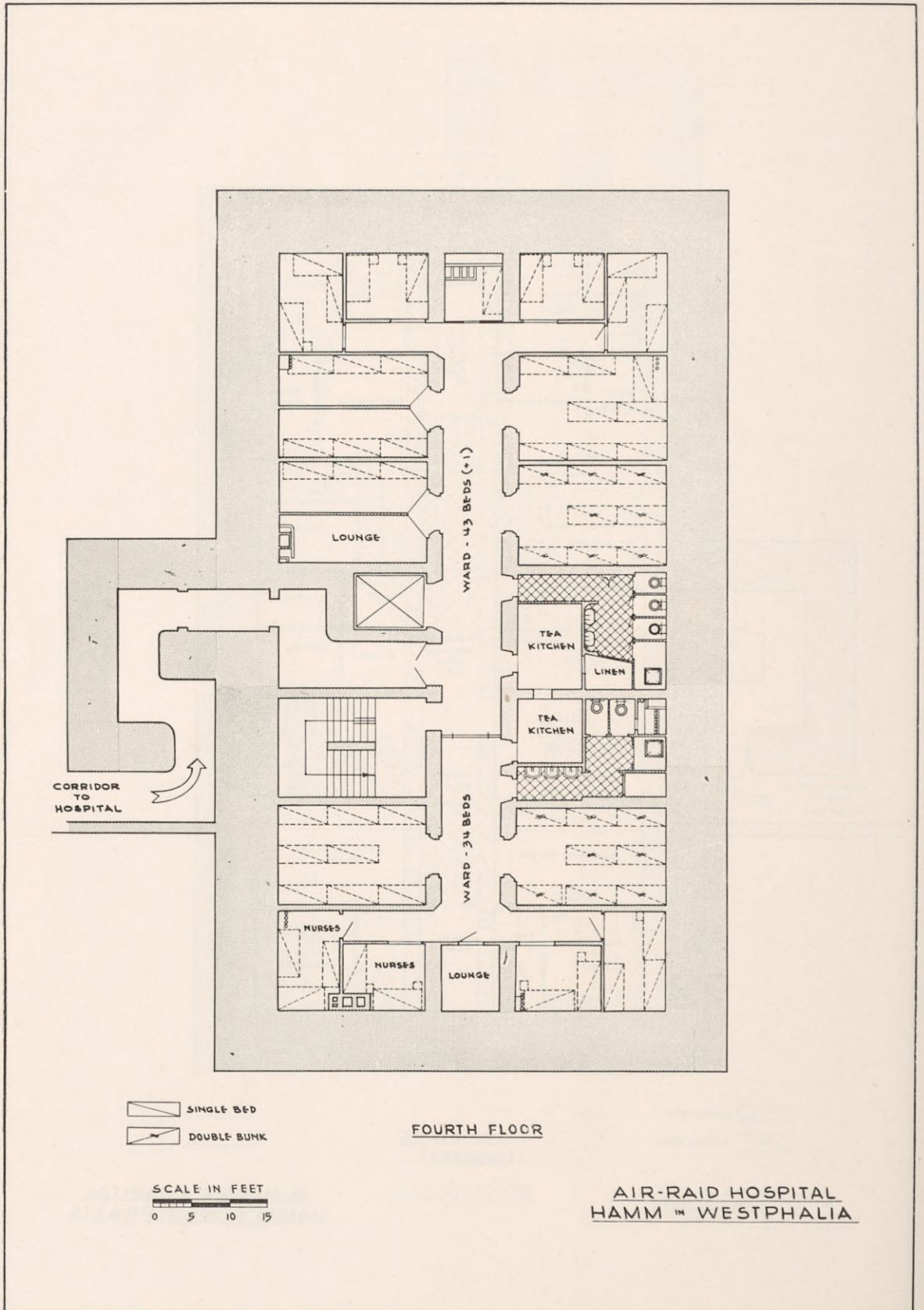
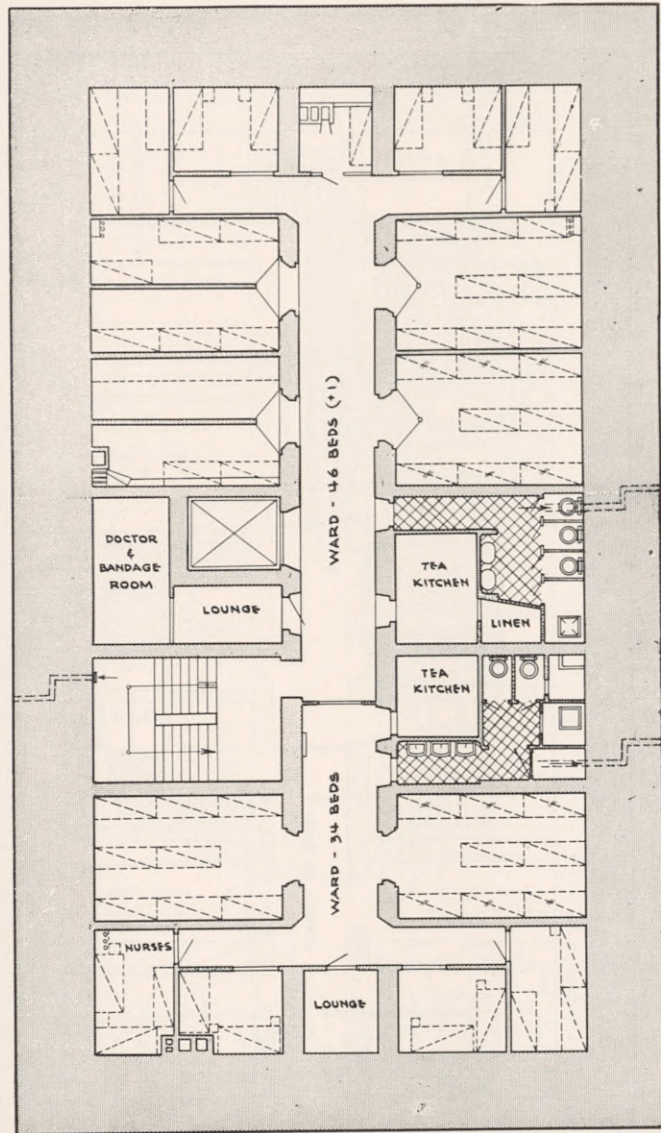


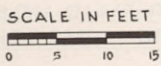


FIGURE 86



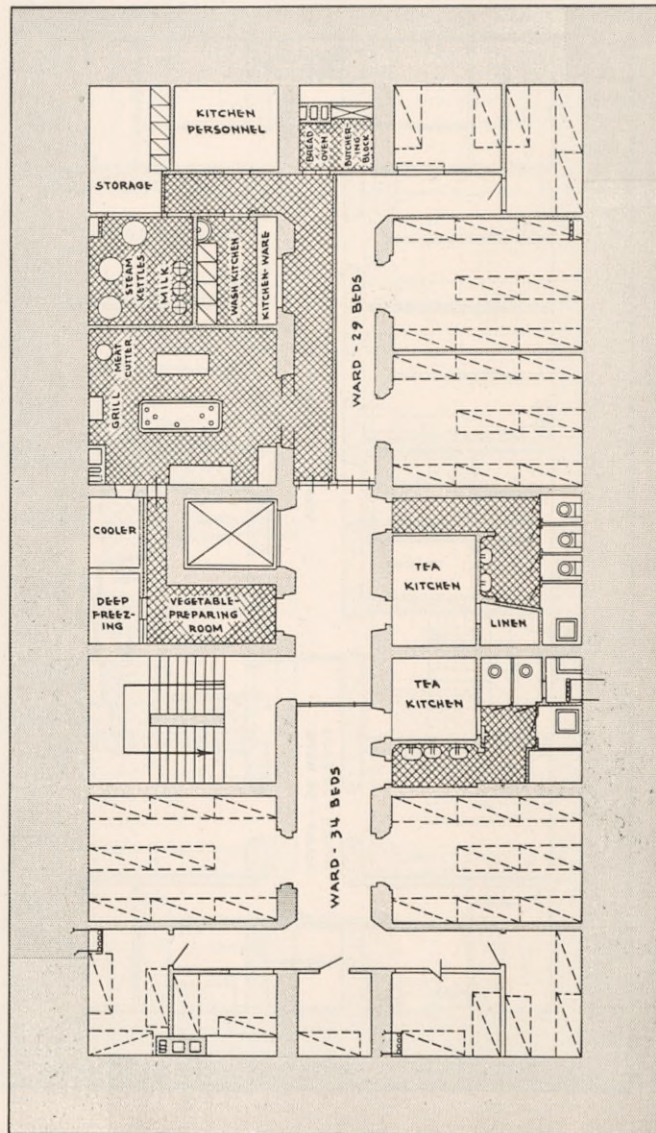
-  SINGLE BED
-  DOUBLE BUNK



FIFTH FLOOR



AIR-RAID HOSPITAL
HAMM IN WESTPHALIA

FIGURE 87



-  SINGLE BED
-  DOUBLE BUNK

SIXTH FLOOR
(KITCHEN)

AIR-RAID HOSPITAL
HAMM IN WESTPHALIA

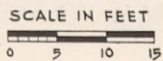
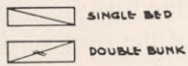
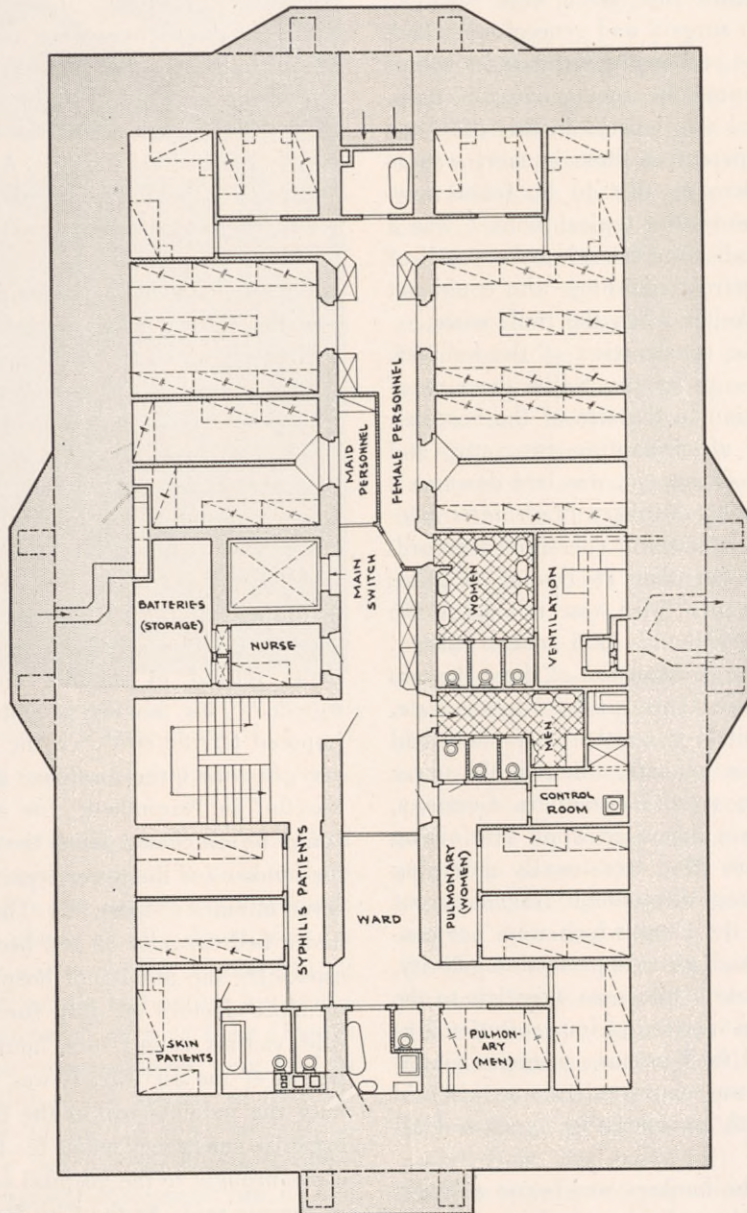
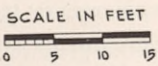


FIGURE 88



SEVENTH FLOOR



AIR-RAID HOSPITAL
HAMM IN WESTPHALIA

hospital of which they were a part. A few could accommodate as many as 300 bed patients but most were smaller, with a bed capacity of from 100 to 200 patients. Each section of the hospital usually had its own floor with precedence being given to surgery, obstetrics and pediatrics in that order (Figure 76, 77). As a rule, there were complete operating rooms for surgery and gynecology. There were delivery rooms and emergency surgery rooms and in many instances the roentgenologic equipment of the hospital was located in this protected building. The equipment in these bunkers was as complete and modern as that to be found anywhere. In other words, the typical bunker was a self-sufficient hospital, large enough to house all of the patients in its parent buildings who could not get themselves to shelter when the raids came.

The details of the construction of the bunkers, such as the dimensions of the walls, the size of the bunker in relation to the size of the hospital, the construction of air-circulating apparatus, and all such pertinent information, was laid down in a guide of the Reichs Air Ministry (*Luftfahrts Ministerium*) in 1944.⁴ A hospital constructed according to such lines was that at Hamm (Figures 78-88). These basic principles were relayed to the city architects through the air raid control system. The materials for the construction of these shelters and the construction itself was paid for by the state.

Most of the hospitals in northern Germany had one or more of these bunkers, either of the tower or the subterranean type. In southern Germany, most of the hospitals depended upon reinforcing their cellars, (Figure 89), occasionally enlarging them first and making them bomb fragmentproof and shockproof. In the areas which were not considered to justify a high air raid protection priority, most air raid precaution measures were left to the local authorities. An interesting improvisation was found in a hospital in Wurzburg where a subterranean wine cellar was converted into an air raid shelter complete with an operating room and all other facilities.

Construction of the bunkers was begun as early as the summer of 1940 and progressed according to need. In some communities of the north, such as Hamburg, the local public health department started protecting hospitals by having them reinforce the ceilings, balconies, and cellars with concrete, even before the national program was inaugurated. All government-supported construction of air raid shelters stopped, however, on January 1,

1944, because of shortage of building materials. It should be noted that this preceded by many months the climax of the air attacks.

Most of the air raid shelters in hospitals, whether of the bunker type or the cellar type, had emergency operating rooms and after air raids had become very frequent, these emergency operating rooms in the shelters were used constantly in preference to those in the exposed buildings. The capacity of the air raid shelters was usually less than the total bed capacity of the hospital and was primarily for bedfast patients. All those patients who, because of the nature of their illness, could not readily help themselves were to have this fact stated on their temperature chart or, if no temperature chart was kept, on the name plate on the bed (this was the subject of a special decree). During the earlier phase of the air war, all bedfast patients (those either too sick to move themselves or whose illness was such that it made quick moving difficult) were brought to the air raid shelters on the first alarm. As the air war intensified, the hospitals were ordered by the civilian defense leader to move such patients into the shelter each evening and have them taken back to the hospital again in the morning. Still later they were ordered to be kept in shelters all the time. The ambulatory patients retired to shelters only when the alarm sounded. This moving of patients back and forth imposed terrific strain on the personnel who, however, became quite proficient at the job. In a large hospital in Nuremberg, for example, all patients could be evacuated from the hospital building to the bunker (of the tower type, four stories high) in seven minutes (Figure 90). That particular hospital had a bed capacity of 160 beds. In most hospitals, especially the municipal hospitals, there were one or more doctors on duty for the reception of air raid victims twenty-four hours a day during the height of the air war. It was this doctor's duty to help the patients within the hospitals and also to organize emergency teams for the treatment of casualties brought to the hospital with wounds resulting in the air raid. At the City Hospital at Dortmund, the assistant chief of the surgical department lived in the hospital for over two years and there set up three teams for the emergency treatment of air raid casualties; one for organizing and directing the patients; another, usually a head surgeon with two assistants, to do the major operative work; and a third to handle minor injuries and give transfu-

HOSPITALIZATION



FIGURE 89. Reinforced basement-type air raid shelter. Neuropsychiatric clinic, University of Munich.

sions, infusions, and medications. This setup was fairly typical.

Most bunkers were self-sufficient, in that they had an auxiliary water supply, usually from a well, to be used when the city water system was disrupted; an auxiliary power plant, usually diesel, for use when the city power was disrupted (Figure 91); a heating system; and an air circulating apparatus and so-called "tea kitchens" on each floor (Figure 92). Medical Branch representatives were told in many cities that, owing to the scarcity of fuel oil, the diesel engines could only be run part-time, so that in many instances, when it was necessary to depend upon the emergency equipment run by the diesel power, there might be many hours in the day when the hospital was without its facilities and could get no water, lighting, or heat. In most of the air raid shelters, members of the survey were struck by the lack of adequate facilities for feeding the patients, other than the small "tea kitchens." In one hospital (Nuremberg) all the food for the whole hospital and its two bunkers was prepared

in a central kitchen and had to be carried to the shelters through the open.

A splendid example of an underground hospital which was well conceived and organized was the subterranean section of the university hospital at Frankfurt. Blueprints and photographs were made of this institution and are shown in Figures 93-97, inclusive.

The subterranean section of the municipal hospital at Ludwigshafen (Figure 98), contained several features which are of interest. It was built in 1937 in the central courtyard of the hospital and provided space for 160 patients with a space allowance of 35 square feet per patient. The walls and roof are of reinforced concrete, $8\frac{1}{2}$ feet thick. Atop the roof is a $6\frac{1}{2}$ foot dirt fill. In water, lighting and heat the hospital is completely independent. The ventilation system is gasproofed and there are emergency stand-by units for all services. Power was received from three sources. Under normal conditions it came from the city facilities from which they had a number two priority, which is to say, that in an emergency the hospital was the first to receive power after the powerhouse itself. If this power failed, it could cut in on the lines of the big I. G. Farben chemical plant. Should this also be cut off, the hospital was able to maintain low wattage illumination in the hallways with the diesel unit in the shelter. And, as a final safeguard, the walls of the operating, sterilizing, and instruments rooms were painted with fluorescent paint. The chief surgeon demonstrated this novel idea by extinguishing all the lights in the operating room. The light then given off by the walls and ceiling was fully adequate to permit the surgeon operating when all power failed to tie off the blood vessels and close and dress any wound or incision thus interrupted. The chief of staff stated that the room would remain light for as long as the electric lights themselves had been on.

The patients in this underground section were usually 4 to a cramped, low-ceilinged room, in double-decker beds. The acutely ill, including those with traction splints and pneumonia patients, remained in the subterranean section during their entire illness. Other patients returned to their beds in the main hospital after each raid. In the dim light of this underground fortress the general psychologic atmosphere was unpleasant but the facilities provided were sufficient for the essentials of medical care. No odors could be detected.

It is interesting to note, as a side observation,



FIGURE 90. *Bunker hospital at Nuremberg showing connection to main building. The obstetrics and gynecology clinic on the left had been damaged by a bomb hitting in the courtyard on the other side of the building. Appendage atop the five story windowless hospital is a fire watcher's shelter. Walls, roof and floors are nine feet thick.*

that in some hospitals the facilities in the newly constructed bunkers were much more modern and efficient than were the facilities, especially the operating rooms, in the hospitals themselves (Figure 99). On the other hand, those hospitals which had to resort to their own reinforced cellars as air raid shelters, often had to put up with dark, unhygienic, uncomfortable quarters. The degree of preparedness of the individual institution appeared to be a direct reflection on the amount of initiative and foresight displayed by the hospital's chief of staff and superintendent, rather than of the force of the directives emanating from government quarters.

The Ludwigshafen subterranean hospital was inspected by a Medical Branch investigator while the area was under artillery fire and the threat of air

attack was imminent. The crowding together of the patients must have made hospitalization extremely unpleasant. Despite this and despite the experience of being bedridden during an attack in the deep, dank, dimly lit cellars of these hospitals, that did not possess a formal air raid annex, patients and physicians reported that such an underground life was preferable to the patients to being sent to the emergency or to the Brandt hospitals where they would be separated entirely from their home community.

Wartime and auxiliary and emergency hospitals

In order to have as few patients as possible remaining in the larger hospitals subject to the dan-

HOSPITALIZATION

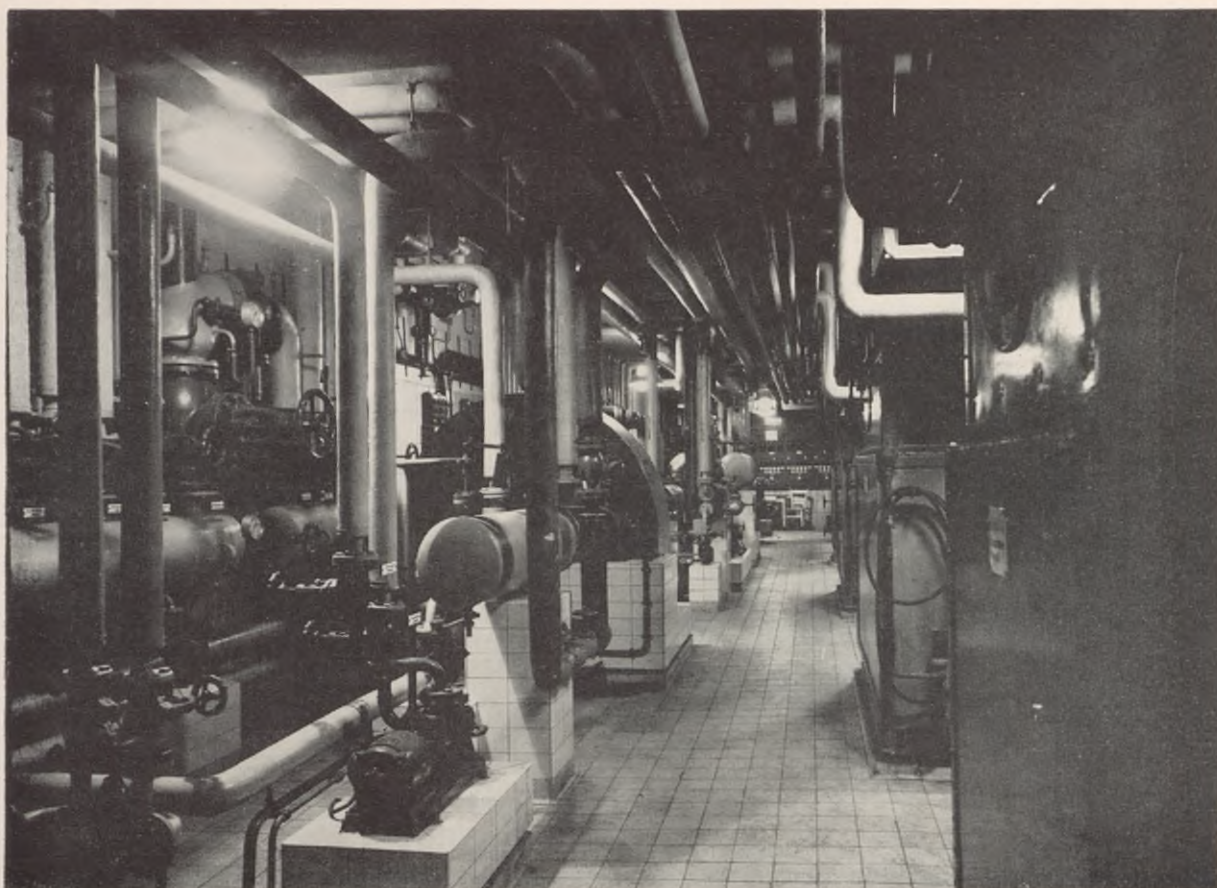


FIGURE 91. *Air raid hospital. Engine room for light, water and heat, municipal facilities were also available, but each air raid bunker had its own independent facilities, including sewage system.*

ger from air raids, and to compensate for the loss of beds resulting from the precautionary evacuation of patients from the upper floors of hospitals, the destruction of buildings by bombing, and the use of beds by the Army, two types of auxiliary hospitals were set up. These were the auxiliary hospitals proper (*Hilfskrankenhaeuser*) and the emergency hospitals (*Ausweichkrankenhaeuser*); each type of auxiliary hospital with its particular function will be referred to hereafter as HKH or AWK.

In the fall of 1939, the Reich Minister of the Interior issued a directive ordering all cities to set up auxiliary hospitals, partially to compensate for the loss of beds taken over by the Wehrmacht. The basic standard set up for air raid cities of the first priority was one hospital bed for each 1,000 inhabitants. These auxiliary hospitals were usually located within the city limits but as far removed as possible from the center of the city and the industrial sections. In most instances they were under the control of the district administrator (*Landes-*

rat) or the mayor. According to the routine procedure the city would take over a school, pension, or small sanitarium, recondition it as much as possible for use as a hospital, and lay in stocks of necessary supplies. The latter were drawn from the inventories of various hospitals in the community. Every effort was made to retain these auxiliaries as dependent adjuncts of the main hospitals. The primary function of these HKH was of an emergency nature, i.e., they were to be prepared to take air raid casualties after initial treatment at a regular hospital or air raid first aid station. They also received a few Army casualties and "slave" laborers as ordinary admissions providing a sufficient number of beds were kept available for use in catastrophes.

The number of these auxiliary institutions to be found in a given municipality was seldom that required by the government's decree. Like so many other accomplishments in the dire national emergency confronting these people, whether these hos-



FIGURE 92. Air raid hospital bunker, Frankfurt on Main, typical compact diet kitchen. Note exterior installation of electrical facilities, and water and sewer pipes. Small general utilities closet in rear. Electrical stove on the right. Electrical refrigerator on the left.

pitals were established beyond the danger area depended upon the ability of the responsible medical personnel. Some cities had an inadequate number while others, like Nuremberg, which had fifty auxiliary hospitals, had small hospitals set up in schools and large houses.

The emergency hospitals, on the other hand, were a function and a responsibility of the individual hospitals, and were staffed and supplied by the hospital solely for its own use. Their primary purpose was to relieve congestion in the parent hospital. This was accomplished by sending to the AWK those patients who were readily transportable and those whose illness was such that they were likely to need hospital care for more than a week or ten days. Transportation, by a law promulgated in 1941, was accomplished by auto, truck, bus, or railroad, usually, under the auspices of the German Red Cross. Army hospital trains were also made available in emergencies. Every large hospital, especially hospitals in the larger cities and congested areas, had one or more of these AWK's, and not infrequently a large general hospital or a uni-

versity hospital would have an AWK for each division, i.e., one for surgery, one for medicine, one for pediatrics, etc. While transportation to the AWK was at the hospitals' expense, patients had to pay their own fare to their homes after discharge. The AWK were usually located in the open country or in villages as far removed as possible from targets of aerial attack. They were frequently 50 to 60 miles from the parent hospital and were in buildings such as castles, cloisters, pensions, hotels, and schools. Patients talked to stated that the light, airy, pleasant atmosphere provided a welcome relief from the depressing conditions in their home cities. (This opinion was contradicted by others, as seen in the following paragraph.) The staffs of these emergency hospitals were usually made up of assistant physicians from the main hospital. This is probably where most of the women physicians on hospital staffs were utilized in Germany during the war. Every effort was made to maintain intimate professional liaison with the chiefs of staffs at the main hospital but this was extremely difficult. Lack of gasoline and the pressure of overwork sometimes severed the contact between the two facilities for months at a time. This lack of contact was repeatedly referred to as one of the greatest handicaps in the auxiliary hospital system.

Patient reaction to being sent to hospitals developed into a problem fundamental to this system. The reaction of hospitalized patients to evacuation to a distant city or even to a hospital in a nearby village was an important consideration in determining the type and location of air raid hospitals. It was repeatedly asserted by hospital superintendents and staff physicians that patients resented being moved away from their communities and that worry over their families and their own intense loneliness—no visits were possible because transportation and communication was spotty and unreliable—caused impairment in the recovery of many patients in evacuation hospitals. As careful examination of the diagrams show, even in the best of air raid hospitals there was crowding. Most of these were visited after the war had ended when the constant threat of air attack had passed and patients could again be distributed as in normal times.

The Brandt hospitals for air raid casualties

In addition to the HKH and the AWK discussed, there was still another type of auxiliary hospital, the so-called *Sonderlage der Aktion Brandt* or the special facilities of the Action Brandt. These

HOSPITALIZATION



FIGURE 93. Air raid hospital bunker, four-bed ward. Notice proximity of beds which are placed end to end. Space between bedside tables so small that nurse has to turn sideways.

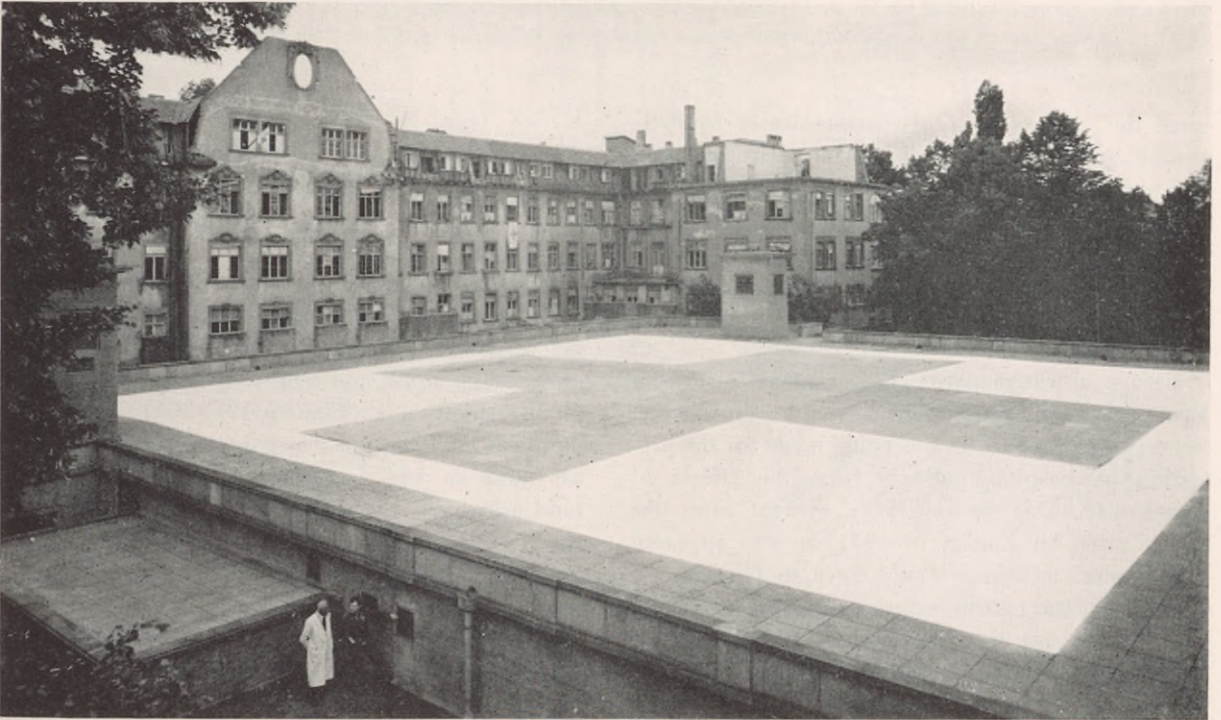


FIGURE 94. Hospital bunker of the subterranean type, Frankfort on Main. View showing well marked roof of the air raid hospital bunker. The bombed and fire gutted surgical pavilion of the university hospital is shown in the background. The small towers shown to the right, and left are principal air intakes; 25 such air intakes were provided. Officer in foreground is inspecting ventilator filter outlet. Construction of this two story 300 bed hospital bunker took 20 months.

HOSPITALIZATION

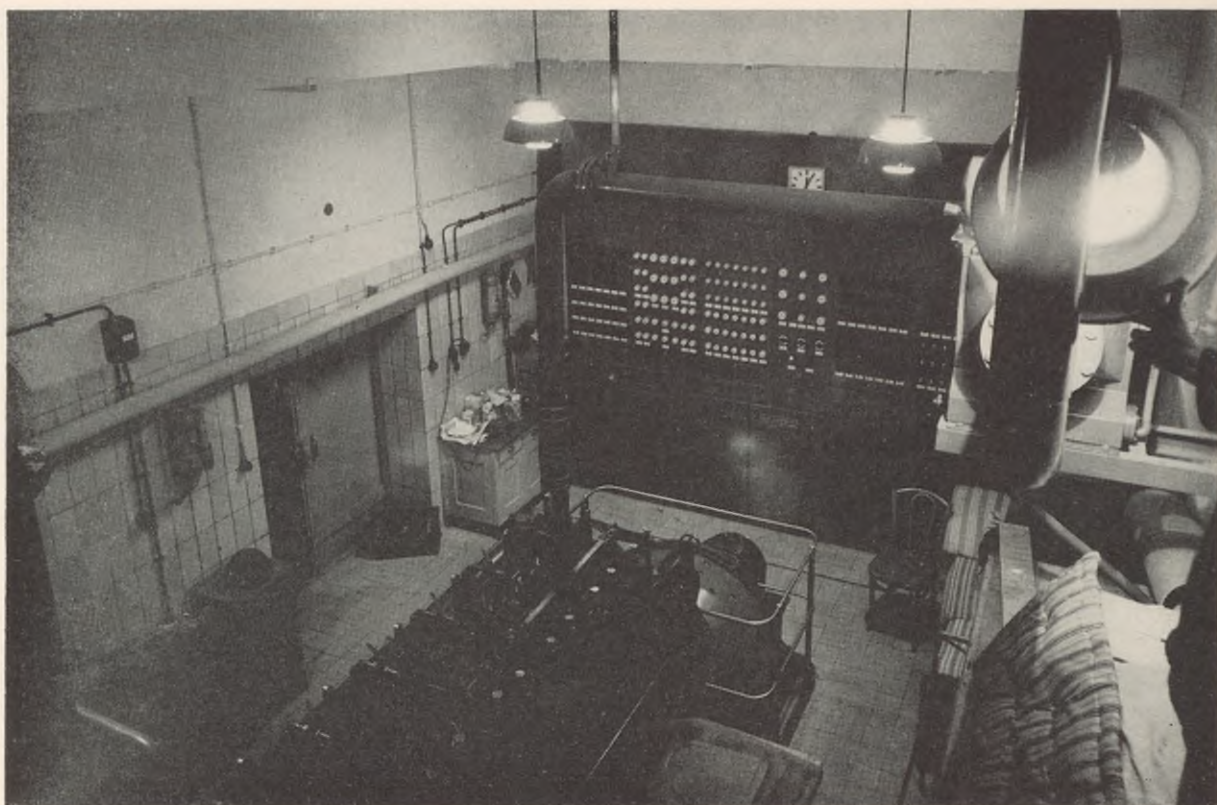


FIGURE 95. *Air raid hospital bunker in Frankfurt on Main. Engine room and underground power house. This was an emergency unit available if central or municipal power failed during or following an air raid.*

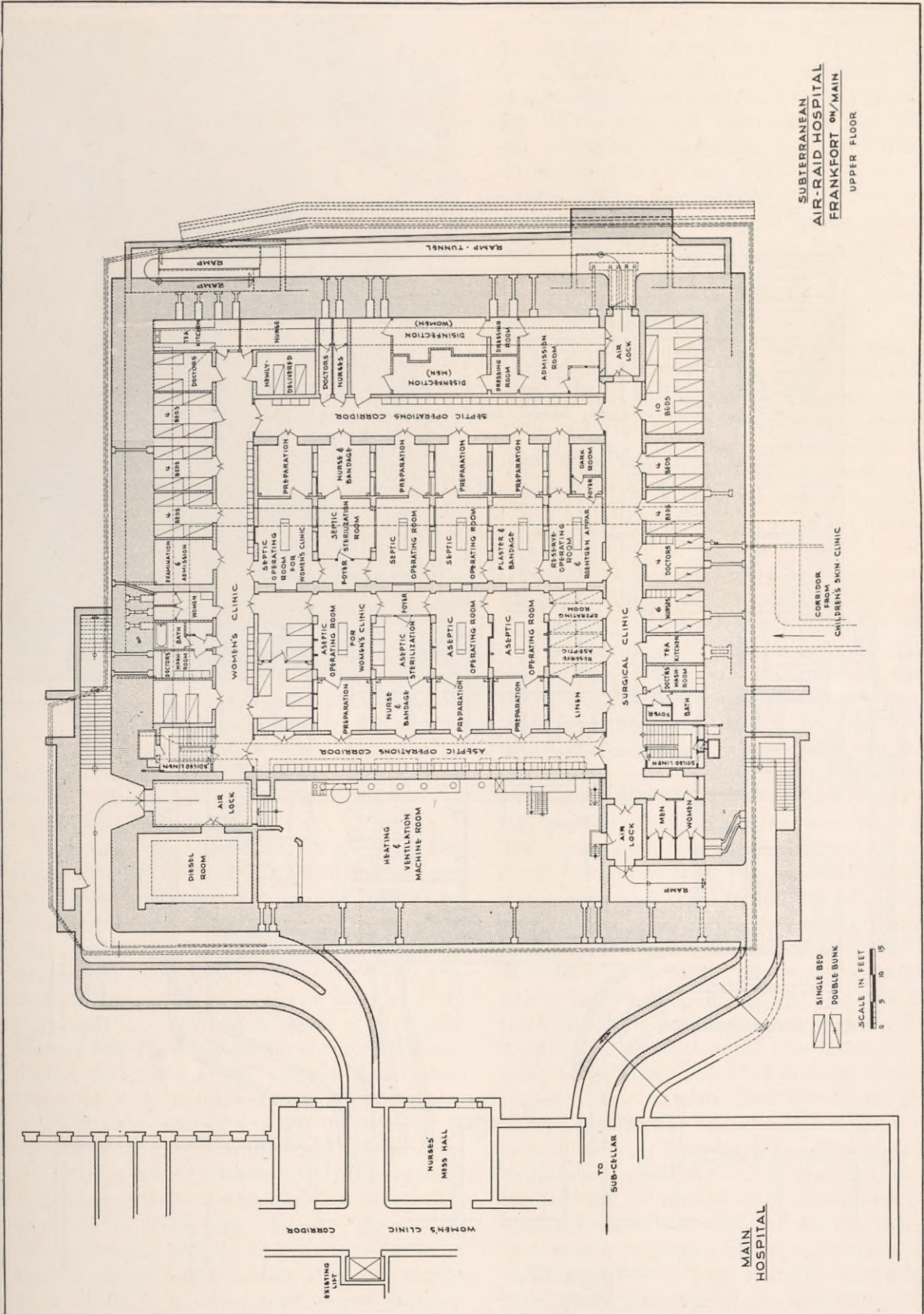
were the unique hospitals "strategically located" throughout Germany to care for air raid casualties for whom prolonged hospitalization was necessary. These hospitals were planned and constructed according to certain basic principles that would assure uniformity, economy, and, while doing away with the fortresslike nature of the air raid hospitals, would assure protection from bombings.

Before he was made Reich commissar for health, Professor Karl Brandt came to the conclusion that not enough preparation was being made for the protection of hospital patients from the effects of aerial war. This became very evident after the heavy raids on Emden in 1941. It was apparent that special measures would have to be taken in the north and northwestern areas of Germany where there was the greatest concentration of industry and population. Therefore, in 1942, when Brandt took office, he started the organization of a group of German officials, the *Aktion Brandt*, whose mission was to be the construction of this network of hospitals. Besides Brandt and his two deputies in charge of the actual work, the group in-

cluded Todt, the famous chief of war construction for the Nazis, Reichsminister Albert Speer, who controlled the allocation of all materials, and an architect named Diestal to make the basic design, Figure 100.

The master plan they evolved provided for a semicircular main hall with wards extending from the outer circumference of this semicircle, preferably facing south and with the windows primarily on the sunny side (Figures 101, 102). The entire unit was a one-story construction and conformed as much as was feasible to the contour of the land on which it was built. The floors and foundations were of concrete, and it was hoped that all the structures could be of poured concrete or cement brick as they were planned as permanent installations. However, as the war progressed and materials became more scarce, the construction had to be simplified, the superintendent of the hospital at Eisenberg (which the American investigators visited in a search for the secret files of Commissar Brandt) stated that at one time a mill in Leipzig was commissioned to prefabricate these

FIGURE 96



SUBTERRANEAN
AIR-RAID HOSPITAL
FRANKFORT ON/MAIN
UPPER FLOOR

SINGLE BED
DOUBLE BUNK
SCALE IN FEET
0 5 10 15

HOSPITALIZATION

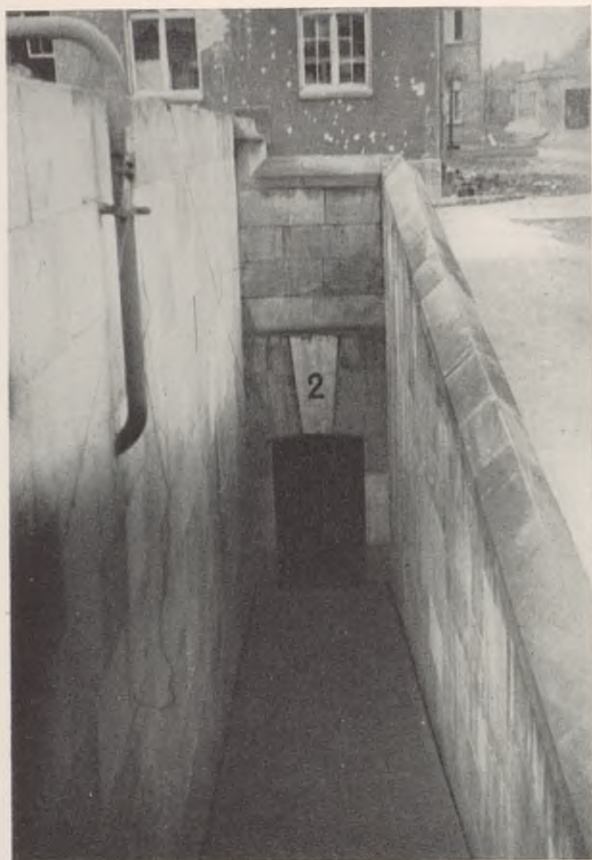


FIGURE 98. *View of the entrance to the subterranean section of the Ludwigshafen municipal hospital.*

hospitals "mail-order house" style, but that a bomb dropped on this mill demonstrated the lack of wisdom in such a plan.

There was a good deal of variation in these hospitals although they all conformed to the basic plans. Each was designed to provide for 800 patients, but because of scarcity of equipment, a hospital was initially equipped to care for 500. When the institutions were complete they were to provide all the services of a general hospital at an anticipated cost of from 4,500 to 6000 Reichsmarks a bed. The handbook for architects and contractors and a set of the German government's blueprints of the fundamentals of design and construction were captured and may be inspected in the files of the USSBS at the War Department.

As far as could be learned, forty-four of these hospitals were built of which only six were true to model design. They were centered in the areas of western Prussia, Westphalia, and the lower Rhine, but one was south of Frankfort. They were usually to be found in a dense wood several miles re-

moved from an unimportant town possessing good rail and highway communications. Upon inspection they appeared to be adequately staffed and somewhat better equipped than the ordinary city hospital. The location and surroundings provided a very satisfactory impression. The only criticism elicited from the patients and staff was that the patients felt lost and isolated so far away from their homes. Staff members and members of their families remarked that being stranded there, families soon began to get on each other's nerves and the resulting difficulties affected the harmony among the professional staff.

For administration, half of the Brandt hospitals were under the control of the central government. The remainder were controlled by the provinces in which they were located or the city they served, or the states shared the control with one of the two. It was originally planned that the central government would give all these hospitals to the various provinces but many difficulties arose that made this impractical.

Perhaps the principal reason the government directly administered half of the Brandt hospitals was that by such control it was enabled to maintain a better balance of occupancy than might otherwise have been possible. It is known that in all those government-controlled hospitals the patients were allocated to them by the Brandt office in Berlin. For example, when most of the hospitals in Trier were destroyed, several Brandt hospitals were notified that they would receive a certain specified number of patients on a specific date. The notice given was usually not in excess of twenty-four hours and the respective hospitals would receive a hospital train of the patients allocated to them according to the vacancies in each of the different medical services reported in their daily telegram to Berlin. The initiative of evacuation of patients to the Brandt hospitals came from the local city health officer when he felt that the number of available hospital beds in his city was going below his minimum requirement. He would request a hospital train from the central health office of his district (*Bezirk*), which in turn would request the train from the Army. Each train was completely staffed with Army personnel despite the fact that the patients to be moved were civilians. Evacuation was organized by the allotment of a certain proportion of the space available to each hospital in the city. The cases were selected from among the surgical and chronically ill pa-

HOSPITALIZATION



FIGURE 99. *Air raid hospital bunker, Frankfurt on Main. Operating room. The operating rooms were connected by the hallway shown through the doorway in rear. This hallway provided access from all rooms, to the central sterilizing room. There was one scrub room for each operating room.*

tients at the discretion of the individual hospital director in filling his quota. The type of patients to be evacuated was restricted only insofar as to rule out infectious or contagious cases, and the anticipated duration of hospitalization was required to be in excess of eight weeks. The patients were transported without cost to themselves, the charge being borne by the local health insurance exchange.

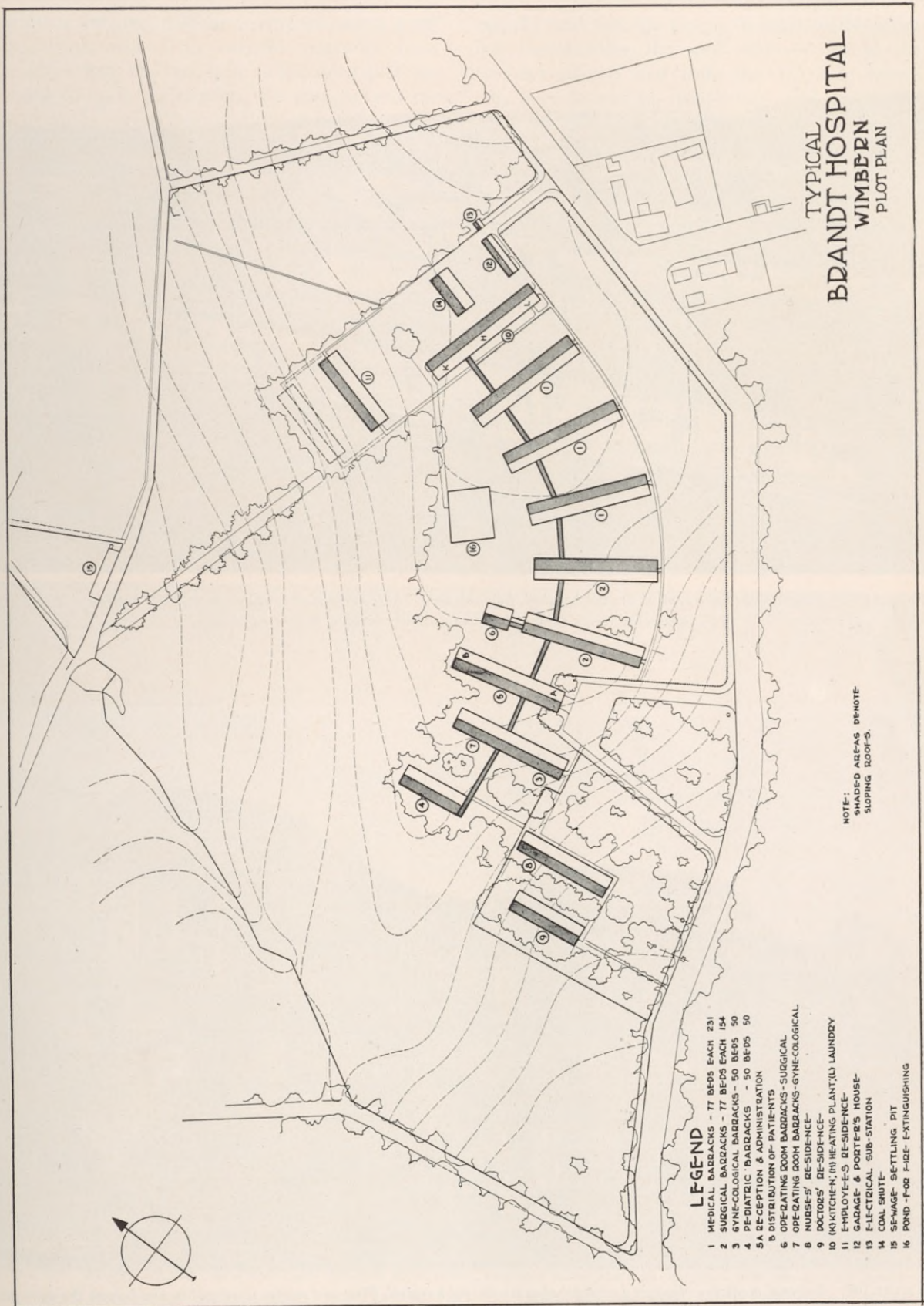
Effects of hospital evacuation; medical effects of individual and mass evacuations

In the cities bearing the brunt of the aerial offensive the policy of evacuating the patients to the outlying hospitals (other than those evacuated by rail) made it possible to maintain surgical facilities and services and to take care of semiambulatory medical cases in the established hospitals within the city for as long as bed space remained available. The evacuation system also met the ne-

cessity of maintaining a complete staff of surgical personnel near the scene of anticipated bombing attacks. The litter type of surgical cases were also retained in order to maintain an even distribution of patients, for most of these could be considered as ambulatory when it came time for them to seek the safety of air raid shelters. People suffering from infectious diseases (who could not, therefore, be properly placed in the crowded shelters), all maternity cases, and hospitalized children were usually moved to the auxiliary institutions in the outlying districts immediately upon admission to the hospital near their homes.

Just as in England, so it was in Germany that as food became more difficult to obtain in the cities, as the air war gradually turned from precision targets to city areas, and as the impact of total war began to impress itself on the delicately balanced economy of large German cities, the trickle into the country of the women and the

FIGURE 100



HOSPITALIZATION



FIGURE 101. *Exterior view of a typical Brandt hospital, Barrack type. These expansion hospitals were built outside cities which were subjected to air raids. They were usually located in a wooded area.*



FIGURE 102. *Internal medicine clinic at Ludwigshafen municipal hospital. First two stories were still in use despite the damage.*

HOSPITALIZATION

children, the aged and the infirm, became a great flow. By the end of the war, this migration from the cities had reached such proportions that the overcrowding in the hamlets, the villages, and the resort towns was as bad as what one would expect to find in a tenement district. This shift in population was such that the census of many German cities was reduced by one half and that of most country districts was doubled or tripled.

This direct consequence of the Allied strategy to knock out Germany from the air, this breaking-up of the German family, this dislocation with its certain, though not yet statistically apparent, impairment of the national health, was one of the severest hardships the average German had to face during the war.

The location, administration, and organization of the evacuation areas is the subject of discussion in the report of the Civilian Defense Division of the USSBS. The writer is concerned here only with the effect this evacuation had on the health of the evacuees and the permanent residents. In short, it

may be said that the people brought to the farming communities the city diseases. From the crowded shelters and from the destroyed homes they brought scabies, tuberculosis, and diphtheria. None of these are recorded to have assumed the proportions of an epidemic in the evacuation areas but they were a constant source of worry to the physicians. The other problem in the evacuation area was that of providing adequate hospitalization and medical care.

The greatest migration was into the resort region of Upper Bavaria, into the section of Greater Germany bounded by Munich, Constance, Innsbruck, and Salzburg. The total population of this area was approximately three times its peacetime norm. In the official migration which was arranged by the government but actually administered by the Nazi party welfare agency because of its propaganda value, those coming from a certain area in the Rhineland or Rhur or elsewhere in the north were dispatched to a specified area in the south. For example, the people of the Rhineland were



FIGURE 103. *Brandt hospital ward with eight patients. Note sunny, spacious atmosphere as compared with the air raid bunker type hospital. In European hospitals patient's name goes on chart over head of bed, and fever chart is kept near foot of bed.*

sent to the Lake Staremburg area south of Munich; Salzburg received the people from Westphalia, and so on. It should be remembered that this designation of the place to which the individual citizen was sent was followed only if he participated in an official mass migration party. If the evacuation was wholly individual and independent of any party assistance, as most of them were, then the person went to near-by farmers, relatives, or resorts where they might be fortunate enough to find accommodations.

The demand for hospital beds created by this influx of people into the rural areas was usually met by establishing small hospitals in available buildings or by building a small addition to the local hospital. For example, in Garmisch-Partenkirchen, the bed capacity was increased from 106 to 270 beds; in Weilheim from 380 to 438 beds; and in Schongau from 103 to 198 beds.

There was but one Brandt hospital in southern Germany and it was soon taken over by the Army. In traveling through these areas one is impressed by the apparent inattention of the national government to the health and medical care of these evacuees. No one was permitted to leave his home city regardless of the severity of the bombing if he was old enough and physically able to do any type of work. In the lack of adequate medical care as demonstrated by the failure of the government to provide an increase in physicians and hospital beds which would even approximately correspond to the increase in population in the evacuation area, may be seen a demonstration of the Nazi tendency to regard such people as "nonessentials."

Some help was obtained from evacuated doctors, but, on the whole, the local medical profession had to handle the situation. There were very few instances of deferment from military duty because of the need for physicians in these areas receiving evacuees. Our informants (doctors and officials in the area) said that by working extra hours and by discharging patients from the hospitals a little sooner than they ordinarily might, and by seeing only the acutely sick people, they were able to handle the situation.

Kinder Land Verschiebung movement to send children to the country

In order that children might be protected from the dangers of air raids, and also that they might continue their education (many schools in the north had been damaged), the *Kinder Land Ver-*

schickung under the Nazi party evacuated children from whole areas in the north to the south. This movement included especially youngsters between the ages of 10 and 15 (*Realschule* and *Gymnasium* age) with their teachers, camp leaders, equipment, doctors, and so on. Schools were set up in the towns of Kochel, Bichl, Garmisch-Partenkirchen, Toelz, and Tegernsee which served the district of Westphalia, the Rhineland, and Hamburg. In this way, education was not interrupted except for occasional periods of work on the farms which all of these youngsters had to do. The Nazi party welfare agency usually took over pensions or hotels for the purpose, set up one or two small hospitals with their own professional staffs, and, in many instances, allowed extra food rations. The children were examined before departing from their homes and were again examined upon their arrival at the evacuation area. No epidemics were reported, many of these youngsters gained weight, and their general health was good.

There was no evidence that parents were forced to evacuate their children although many stated that the program was conducted along the lines of National Socialist *volunteering* in which any suggestion carried a sharp point. When the bombings began in some cities (Stuttgart, Essen, and others), the primary schools were closed in order to force parents to send their children into the country or with a KLV mission. The parents were allowed to visit them at periodic intervals and on rarer occasions, the children were allowed to visit their parents, provided the latter were in an evacuation area.

Air raid shelters, auxiliary hospitals, emergency hospitals; conclusions:

The establishment of auxiliary hospitals (HKH, AWK, and Brandt hospitals) was a direct outcome of the bombings that created an additional financial burden upon the communities and hospitals, and an added strain on their medical and nursing personnel resulting from the scattering of patients.

The construction of air raid shelters was an added expense and the necessity of using them so constantly caused a strain upon the personnel and in many instances hindered the recovery of patients (see a following section of this chapter on the effects of bombing on hospital medical care). However, the efficient use of these facilities (air raid shelters, AWK, etc.) probably accounts for the extremely low number of casualties among both patients and personnel in hospitals (see the following section).

HOSPITALIZATION

The Brandt hospitals were well equipped and generally satisfactory, but it was felt by many physicians that they were too far removed to be used efficiently.

Hospitals and hospital personnel

Casualties among hospital patients and personnel. Despite the extensive damage to many of the hospitals in Germany the casualties among patients, doctors, and other personnel was remarkably low. There were many instances when half of a hospital was destroyed with only a negligible number of casualties to the patients. Even when hospital buildings suffered direct hits, no or few casualties resulted. Our informants were unanimous in agreeing that this was attributable to keeping the patient load in hospitals at the number which could be taken care of in the shelters, to efficient (and semipermanent) use of air raid shelters, and to "luck."

In some instances, the patient casualties were the result of nonco-operation on the patient's part, as, for example, when a psychotic patient refused to budge and there was no time to get help to move him; some doctors were killed because of a false sense of duty keeping them unnecessarily exposed (as at a hospital in Hamburg, where two women doctors remained out of the shelter and were killed); occasionally a nurse would be trapped in her sleeping quarters which were usually on an upper floor. On the opposite side of the ledger are the following examples of pure luck. In one of the hospitals at Augsburg, a child was thrown from its bed when a bomb exploded just outside the hospital walls and was tossed through a doorway and landed unharmed on another bed; in the Altona hospital at Hamburg, two patients had returned to their beds, the first to enter the building after a raid, when an unexploded bomb was noticed embedded in the foundation. This went off before they could be warned and the two patients in their beds "slid" down the collapsing floor into the basement on their beds, with only a few scratches and bruises from falling debris. In another hospital at Hamburg, the Hafen Krankenhaus, which suffered severe damage in twenty raids, there were no patients killed or wounded and only two employees were killed and two wounded. In Stuttgart in a hospital which was totally destroyed in two raids, no patients were lost and only one doctor and two employees were killed. Data for

the city of Essen are presented in Table 33 as being a fair representation of what happened. All statistics from the hospitals are in the USSBS file in the War Department.

TABLE 33. MORTALITY AND PHYSICAL DAMAGE FROM BOMBING IN THE HOSPITALS OF ESSEN

<i>Institution</i>	<i>Total Damage</i>	<i>Occupants Killed</i>	<i>Shelters Available</i>
Staedtisches Krankenhaus	Serious	10 children (1942)	Yes
Krupp (Lazarett Strasse)	Totally Destroyed	Unknown (85 estimated)	No
Krupp-Altenhof	Moderate	None	Yes
Lambertus- Recklinghausen	Undamaged	None	No
Huyssenstift	Slight	None	Yes
Elizabeth Krankenhaus	One wing destroyed	1	Yes
Franz-Sales Haus	Serious	30	No
Knappschaft-Stehle	Slight	None	Yes
Laurentius Hospital	Slight	None	Yes
Evangelisches-Stehle	Slight	None	No
Josephs-Kupferdreh	Slight	None	Yes

Some hospitals, of course, were not so fortunate as Essen, but when the degree of destruction is seen it is amazing how few patients, doctors, nurses, and personnel were killed or injured. The figures collected were usually obtained from the hospital superintendent and were checked in interviews with doctors and nurses as well as with the local health departments.

Damage to hospital buildings and facilities. Inasmuch as hospitals were not a direct target for air attack the degree of damage to them varied with the intensity and frequency of the bombing raids upon the cities and with the location of a hospital within the city, i.e., whether it was close to a railroad, a factory, or other military target. Most of the hospitals in the cities visited by the Survey investigators were damaged to some extent. In some only the windows were shattered or the roofs were torn away by blast concussion. Many received damage which was measured from moderate to severe, while some were completely destroyed by incendiary and high-explosive bombs. Where it was possible, a ground plan of the buildings showing the damage inflicted was se-

FIGURE 104

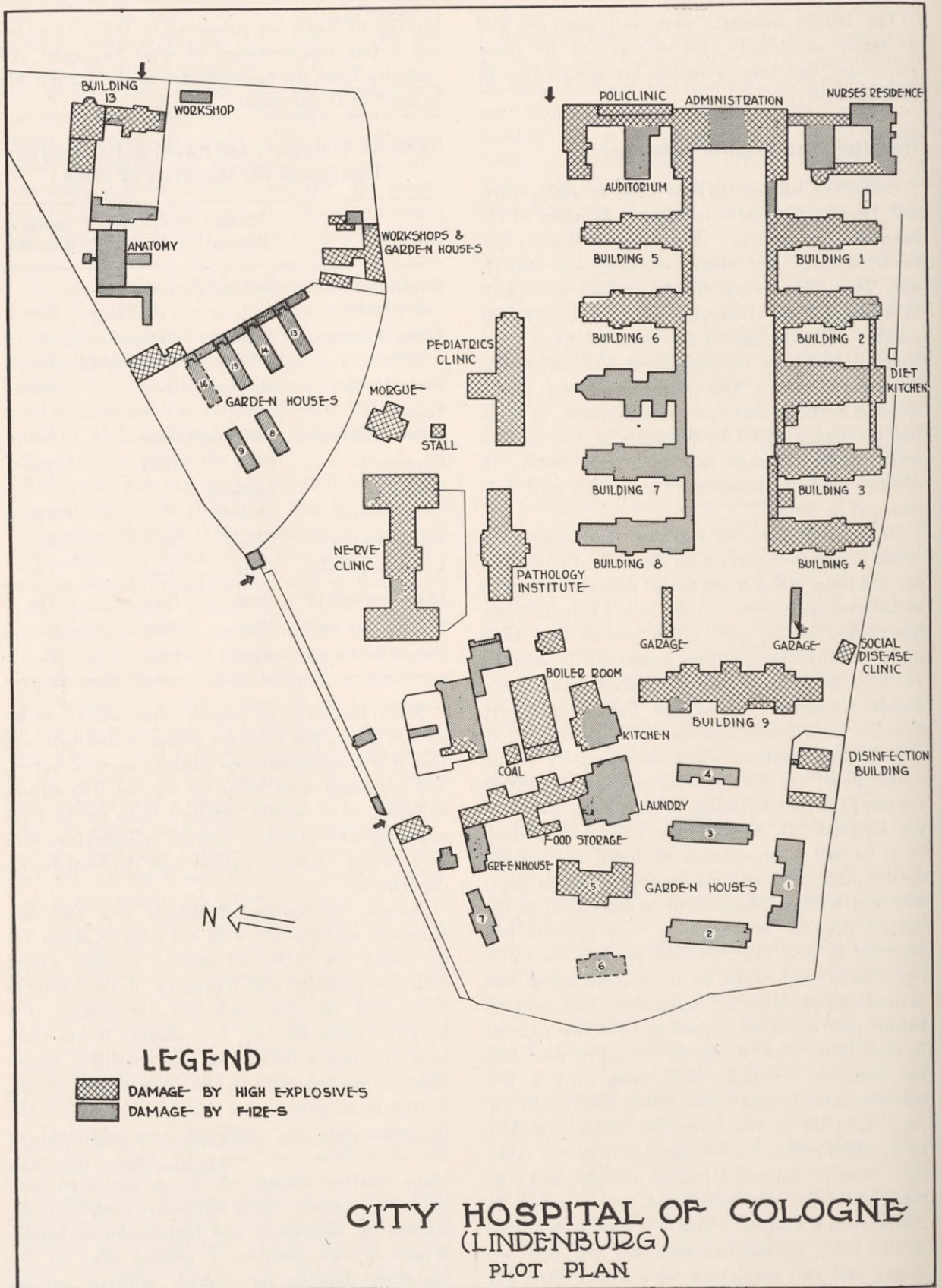


FIGURE 105

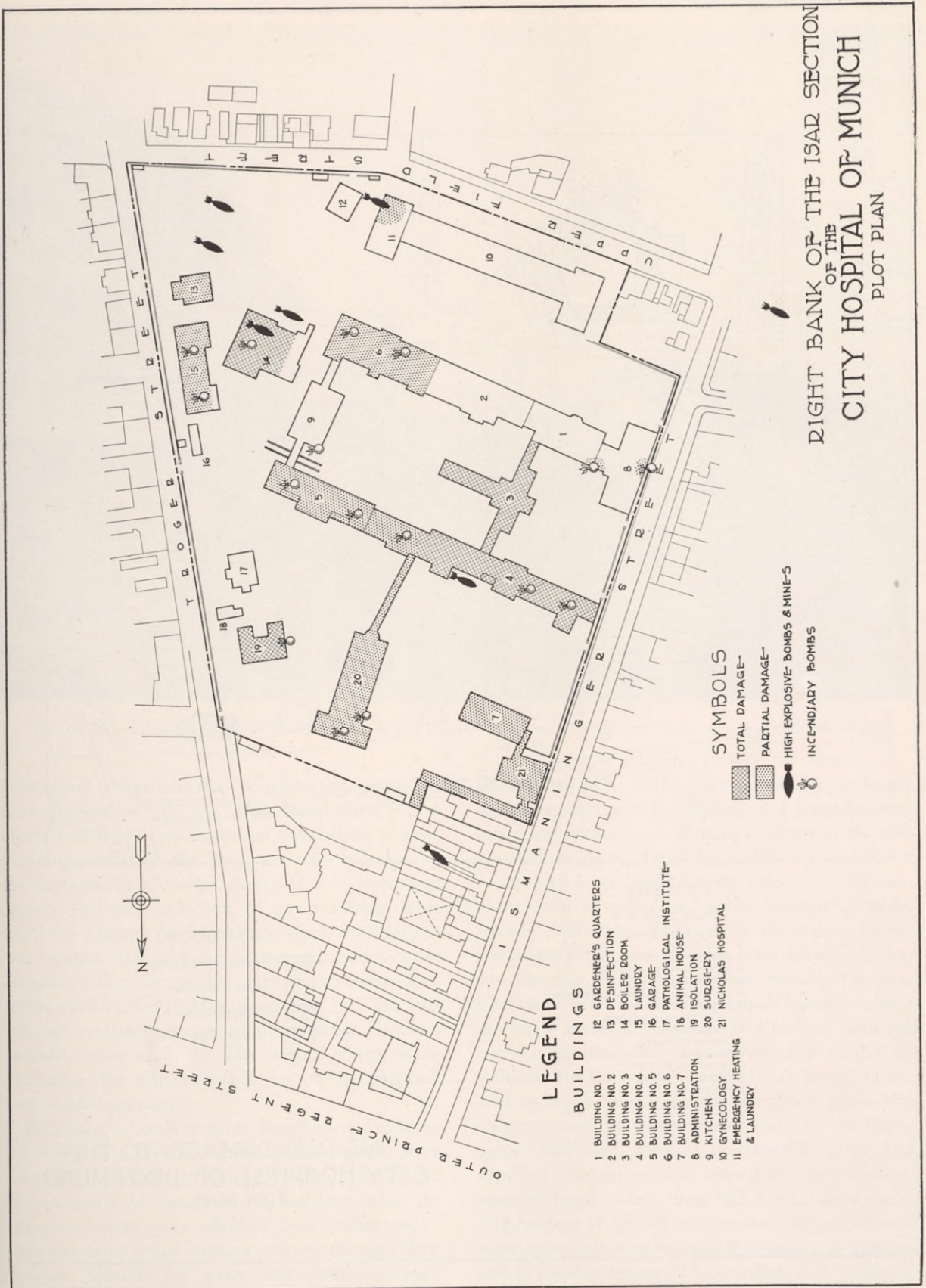
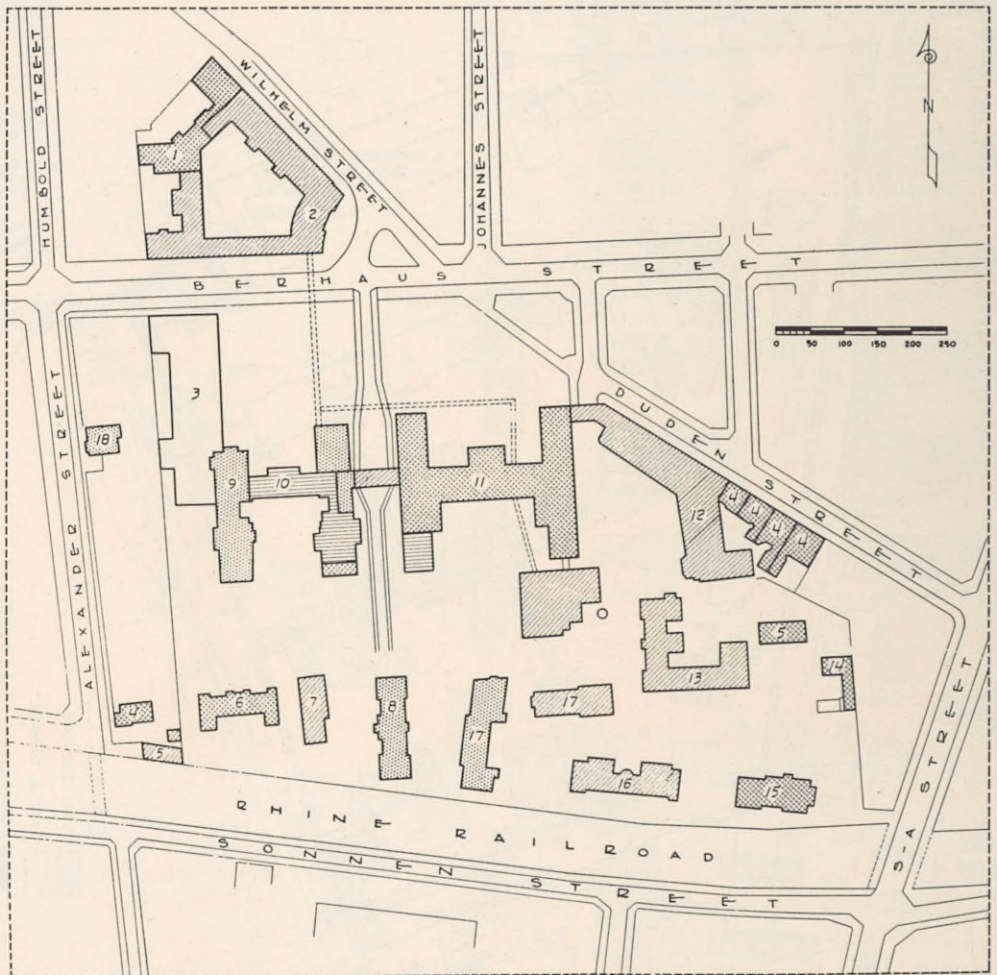


FIGURE 106







LEGEND

BUILDINGS

- 1 PEDIATRICS CLINIC
- 2 EYE CLINIC
- 3 SURGERY BUNKER
- 4 PERSONNEL QUARTERS
- 5 WAREHOUSE
- 6 RESERVE-INFECTIOUS BARRACKS
- 7 NURSE INFIRMARY
- 8 INFECTIOUS DISEASES
- 9 SURGICAL
- 10 ORTHOPEDICAL
- 11 MEDICAL
- 12 ADMINISTRATION
- 13 WOMEN'S CLINIC
- 14 GARAGE
- 15 PATHOLOGY
- 16 NEUROLOGY
- 17 DERMATOLOGY

SYMBOLS

-  TOTAL DESTRUCTION
-  HEAVY DAMAGE
-  MEDIUM DAMAGE
-  LIGHT DAMAGE

AIR RAID DAMAGE TO THE
CITY HOSPITAL OF DORTMUND
PLOT PLAN

HOSPITALIZATION



FIGURE 107. Photograph showing destruction of the hospital building, Frankfurt on Main, due to aerial bombings.

cured, and a representative selection of these is included (Figures 104, 105, 106). In addition to and entirely distinct from the actual destruction of their buildings, most of the hospitals were affected by the curtailment of power, destruction of water and sewage facilities and lack of gas resulting from bombing damage to the city in which the hospital was located. Although the strategic air attacks were discontinued prior to V-E day, when these hospitals were visited in May, June, and July gas still was not available in most of them except for short periods during each day. The lack of power, while disrupting the efficient operation of the hospital, was usually temporary.

Perhaps the most serious handicap to running a hospital is a lack of water. Some hospitals were foresighted enough to drill their own wells and have a source of supply in the buildings when the city water lines were affected. Some made provisions for using small streams running through their grounds. Usually all water from such auxiliary

sources had to be boiled. The outstanding example in the experience of the Survey of a large hospital operating without any running water was the city hospital in Ulm. Here in a 250-bed institution which had a 450-bed capacity before the air war, every drop of water had to be brought in pails, barrels, and water wagon from the valley below. Fortunately the sewage lines were intact but one can imagine the problems thus created. The hospital had relied on the municipal system entirely and their mains in that area of Ulm had been out for two months when the hospital was visited. In Cologne the University Hospital was forced to obtain its water from taps on emergency pipes laid above ground in its section of the city. As previously mentioned, most of the large hospitals had supplied themselves with emergency power units, usually diesel; when these did not function (usually because of lack of oil) or where there had been none set up, it was necessary to resort to candles and to hand pumping of well water. It is estimated

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FIGURE 108. Obstetrics and gynecology clinic of the Krupp sanatorium which was taken over when main hospital was destroyed (Fig. 72). Land mine hit just this side of building doing all damage shown. Two nurses were killed. Building is regarded as "moderately damaged."

that 45 per cent of the beds in Germany's permanent, peacetime, general hospitals were destroyed by Allied bombing. The Krupp hospital at Essen, the ancient Insel Spital (see the frontispiece) in Nuremberg, and many other famous institutions are completely wrecked and no longer function. The Barmbeck Krankenhaus at Hamburg, the Charité at Berlin, the university clinics at Munich and Frankfurt, are only partially intact while a few escaped unscathed. What has happened may best be told by the accompanying photographs, Figures 107-110.

Damage to hospital equipment. As soon as space was available in the air raid shelters much of the hospital's valuable equipment was moved there for safety. Despite this, many specialized instruments, such as cystoscopes and the like, and much laboratory material and roentgenologic equipment was destroyed by exploding bombs. As discussed in another section of the report (Chapter Twelve, on the development, production, and dis-

tribution of medical supplies), the replacement pool for this type of material was not great. It was therefore not at all unusual to find a hospital without some of its vital equipment. When replacements were available from the government, it took months of effort, correspondence, and red tape to secure them. In most instances great care was taken to protect the equipment so that when the war ended the German hospitals were in a less serious position concerning their equipment than they were concerning their housing.

Reconstruction of bombed hospitals. Because of the scarcity of material and labor, most of the reconstruction work was necessarily confined to emergency measures, i.e., patching roofs, plugging gaping holes in walls and windows with tarpaulins and boards, removing debris, and repairing plumbing, power lines, and boiler rooms. When a portion of a building was destroyed beyond the point where these emergency repairs would suffice, it

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FIGURE 109. *Municipal hospital, Essen, showing what was left of administration building and out-patient clinic. Half of this structure was functioning when visited. 116 high explosive bombs fell within the grounds of the hospital, of which this hospital is a part, during a single raid. Bed capacity was reduced from 700 to 120.*

was shut off from the remainder of the hospital. When a whole building was so damaged, it was abandoned. Practically no major reconstruction or rebuilding of damaged hospitals was done during the last three years of the war.

Air raid damage to hospitals; conclusions: (a) Bombing by high-explosives and incendiaries did a tremendous amount of damage to hospitals and hospital facilities. The degree of bombing corresponded to some extent with the target value of the various cities and the location of the hospital within the city. (b) Considering the extent of damage done to hospital buildings, the number of patients, doctors, and personnel suffering casualties within the hospitals was amazingly low. (c) Very little except emergency reconstruction of damaged hospitals has been possible. (d) It was often difficult or impossible to replace destroyed equipment such as roentgenologic apparatus, laboratory material, cystoscopes, etc. As a result, it often became necessary to forego certain types of investi-

gative or therapeutic procedures. (e) The efficiency with which hospitals had been taking care of the sick within a community was lowered by the damage to the hospitals resulting from air attacks. Despite this, the quality of medical care within hospitals was maintained fairly well.

Hospital medical care

The incidence of disease in Germany and the effect of bombing on the various diseases in the country as a whole is the subject of Chapter Four, on "Diseases and Other Disorders". The present chapter deals entirely with the effects of air raid warnings and bombings upon the hospital population.

Medical care. The frequent and later almost continuous use of hospital air raid shelters had an effect upon patients which varied considerably from place to place and with the seasons. Infections and infectious diseases presented a perplexing problem. Experience soon showed that it was

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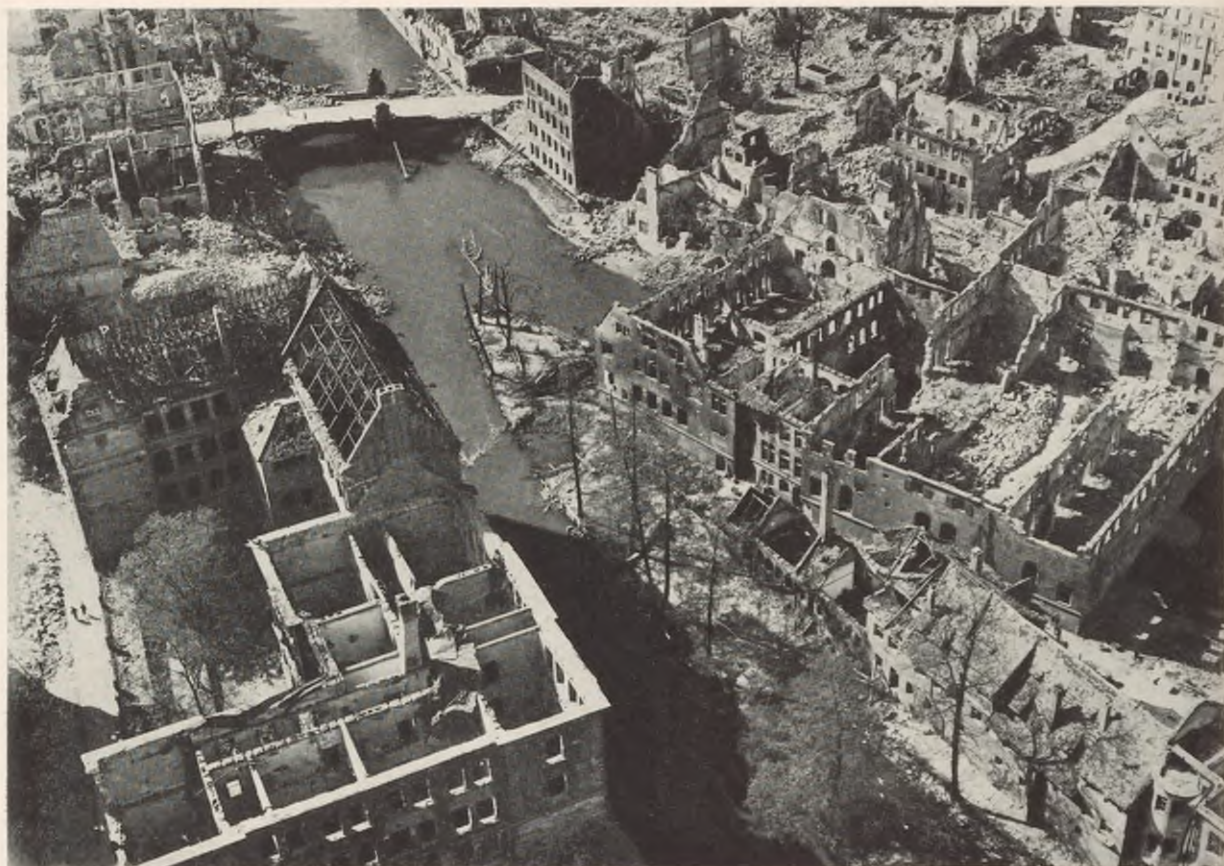


FIGURE 110. Gutted building in right foreground is famous old Insel Spital at Nuremberg which was one of the famed old hospitals of Europe. It is located in the center of the old walled city. Photograph courtesy Miss Margaret Bourke-White, Copyright, Time, Incorporated.

necessary to isolate patients with infectious diseases in a separate air raid shelter, often using cellars for them and bunkers for the other patients, or keeping patients with infectious diseases in the cellar of one building while the other patients were kept in the cellars of the other buildings. Some hospitals stopped taking infectious disease cases altogether while many evacuated such cases to their auxiliary institutions immediately upon admission. A pediatric hospital at Augsburg claimed to have had very little cross infection, but only after they had developed a good technique of how to space the patients and where to place them. In another hospital (Nuremberg), a number of deaths resulted which were traceable to infection in infants located on an upper floor of a tower bunker attached to the gynecology clinic. Upon investigation, they found that instead of only clean surgical cases on the first floor of this bunker, they had a number of badly infected cases of open suppurating wounds, draining ears, and the like. When these

were moved out of the bunker, no further infants became infected. Their *theory* was that the forced draft circulating the air from the bottom to the top of the bunker, coming through open spaces under the doors, carried bacteria from the first floor to the upper floors. On the other hand we were informed that despite the fact that obstetric and surgical patients were intermingled in this same hospital bunker (a bad practice in general), and although the sanitary facilities at times were none too good, they had no cases of puerperal sepsis.

Upper respiratory infections were more prevalent among patients retained in air raid shelters. When they were too ill to be moved on each alert or to be transported to auxiliary hospitals, confinement in these dim dank cellars greatly impeded the progress of patients suffering with pneumonia or influenza. It was difficult to control the temperature of the circulating air, and people who perspired (such as postoperative patients, postpartum patients, patients with menopausal symptoms) very easily

caught cold from the drafts and developed pleurisy or pneumonia. This was such a factor that the use of the so-called "bunker-towel," to be wrapped around the patient's head and shoulders, was quite common. Another reason patients with upper respiratory infections, including asthma, did not do well in air raid shelters was because the air was often "heavy," especially when the circulating apparatus did not work satisfactorily. Some underground shelters inspected were very warm. These same conditions also worked against the cardiac patients. Crowding, with too many patients in a room and patients in corridors, contributed to the development of these diseases. Small children and old people were more susceptible than others. It is interesting to note that when a hospital in Hamm added oxygen to the circulating bunker air for the infants, its previously high infant mortality rate decreased.

Surgical care. Until postoperative patients were kept in the air raid shelters all the time, the frequent transportation back and forth because of air raid alarms hindered their satisfactory recovery. One hospital (Augsburg) estimated that over a period of two years death occurred in 15 patients which was directly attributable to this type of handling. Other hospitals felt that the morbidity and convalescence of surgical cases were increased but that there was no increase in mortality. Whether or not wound healing was delayed is not definitely known since the reports which were obtained are conflicting. Suture abscesses were quite common and usually were due to Staphylococci or Sarcinae. Patients with peritonitis more frequently complained of hunger while in bunkers than when in the hospital proper, but no explanation of this could be obtained. It was soon found that lung surgery could not be done in the confines of an air raid shelter, as these patients did very poorly indeed.

General impressions of the effects of bombing on hospital medical care. Bunker life had a general depressing effect upon patients and professional personnel alike. As one physician said, "The psychological influence was terrible." (*Die seelische Beeinflussung war furchtbar.*) The lack of fresh air and sunshine; the crowding with its consequent lack of privacy; the almost universal presence of bedbugs and roaches, all had their effect on the desire to get well. Many nurses developed anemia because of constantly working in these shelters. Another common complaint among doctors

and nurses was of sore eyes, which unquestionably developed after working under artificial light for too long periods. The intense heat and poor air, even when the air-circulating apparatus was functioning, made for excess of fatigue among the personnel. The general effects were usually worse when reinforced cellars were used as air raid shelters instead of the regular specially constructed bunkers.

Effects of bombing on hospital medical care: conclusions. It was soon found that the necessity of keeping patients in air raid shelters (cellars or bunkers) was not an unmixed blessing. It saved very many from being killed by bombs, but it definitely increased the morbidity of patients in hospitals and decreased the efficiency of the professional personnel working in these shelters.

Hospital nutrition, medications, instruments

The discussion of the over-all question of nutrition is the subject of Chapter Eleven of this report and of the over-all question of medical supplies of Chapter Twelve. The present section deals entirely with the effect of bombing on medical and surgical supplies and food within the hospital itself.

Effects of bombing on hospital nutrition. The general food situation in Germany and its effect upon the people is, of course, reflected in the response of the hospital patients to their illness. There was an almost universal loss of weight, and although there was no evidence of starvation or even nutritional imbalance, many if not most of the people seen in hospitals were on the borderline of that state. When they became ill, especially with febrile conditions, they were less able to withstand the ravages of disease and recovery was impeded. Here again children and older individuals suffered most. Hospitals had a regular quota of food from which they had to supply their general diets but in addition to this they had additional *Zulage* or ration points to supplement and make up special diets for such illnesses as diabetes mellitus, peptic ulcer, renal conditions, and tuberculosis. Furthermore, many hospitals, availed themselves of the open ground around their buildings to grow fresh vegetables, even to raise chickens, and, in rare instances, other livestock. Despite the *Zulage* and the extra food which they could supply themselves, and despite many dietary substitutes, it was almost impossible to provide all of the necessary

special diets. The general diets with but a few exceptions were adequate. The poor food delayed the healing of peptic ulcers, lengthened the convalescence from debilitating illnesses, and, together with the shortage of insulin (see the following paragraphs), often proved fatal to the more severely ill diabetics.

Effects of bombing on hospital medications and instruments. Most of the larger hospitals in Germany, especially the municipal hospitals and university clinics, had their own pharmacies. When one considered the condition of medical supplies in general throughout the country (see Chapter Twelve), it was astonishing to see how well-stocked were most of these hospital pharmacies. At the time the medical investigation was made some items were becoming scarce but not to the extent noticeable in the community as a whole. It could not be learned why so many pharmacists of the larger hospitals had been so forehanded. This matter is discussed in detail in a later chapter (again see Chapter Twelve). Another precautionary measure frequently taken was to disperse the stock of drugs and materials in caches in several places throughout the hospital so as to reduce the danger of total loss from a single hit. Where no reserve stocks existed or where the pharmacy had been bombed out the resulting shortage of many medications made substitutes necessary. The general opinion among staff members was that, except for some drugs to be mentioned separately, with care in dispensing no patient had to go without medication (or a workable substitute) which he needed. Several doctors did mention that in obviously moribund or hopeless cases, medications which were scarce, but which might have been indicated, were withheld.

The lack of insulin was probably the most acute and most complained of, and also the most dramatic among the scarce drugs. In many hospitals, the supply was so short that it was necessary to reserve it for use only in comatose patients. Parenteral liver was available only in small quantities, making the treatment of pernicious anemia difficult. Circulatory stimulants and cardiac drugs were the other group, the lack of which was outstanding but here it was frequently possible to substitute an available drug without harm to the patient and with moderately satisfactory results. During the closing months of the war even such substitution was difficult as more and more drugs became scarce. Surprisingly enough, the supply of sulfon-

amide derivatives was as a rule adequate. None of the hospitals had penicillin. As a matter of fact, only a few medical men in the university hospitals knew what it was. Fats and ointments were very scarce, as was alcohol. Some hospitals regularly redistilled their alcohol, in order to reuse it. Washes had to be used instead of salves.

On the investigative side, in distinction from the therapeutic, many laboratory procedures had to be dispensed with because of the lack of reagents. Test sera for blood typing was almost nonexistent, as were sera used for the various agglutinations. Developer and fixer for roentgenograms was also scarce in many instances and consequently the use of the apparatus was limited.

Despite the increased over-all use of sedatives, most hospitals felt that they had all they needed. Narcotics, on the other hand, were getting more and more scarce; the same must be said of anesthetics. The variability of the supply of medications encountered in different localities depended upon the proximity of the sources of supply (pharmaceutical houses or depots), and the forehandedness of the head pharmacist in the hospital.

The supply of surgical instruments and rubber gloves was adequate but not plentiful in most hospitals. It was necessary frequently to use instruments after they would ordinarily have been discarded. In no hospital did we hear about or notice an acute shortage of linen. Frequently bandage material had to be washed and resterilized. The chief complaint along these lines was that, on occasions, owing to the destruction of facilities (power, water, steam, etc.) no water or heat was available, and the laundry, therefore, being unable to keep up with the demand put upon it made use of paper substitutes temporarily necessary. Again, these statements do not apply where the pharmacy storeroom in the hospital had been bombed out and all stocks were destroyed. The difficulties of supply were much more acute in the smaller private hospitals where intimate contact with city officials was lacking.

Effect of bombing on hospital nutrition, medications, and instruments; conclusions: (a) Most large hospitals, with their own pharmacies, felt only a partial hardship (or lack) of essential supplies (food and medical), while smaller hospitals felt it more acutely. (b) A few drugs, such as insulin and liver, and also sera and biologicals, were definitely scarce. (c) Hospitals on the whole did not suffer as much from the shortage of essential

medical supplies (either medical or surgical) as did the community at large.

Summary and general conclusions

Hospital facilities in Germany were antiquated and barely adequate at the beginning of the war. The air war against German cities greatly exaggerated this condition through partial or complete destruction of the buildings and interruption of essential services such as power, lighting, heating, and water. Of the steps taken to mitigate these conditions the construction of the elaborate bunkers was the most successful. Because of the heavy cost in material and manpower, they could be built only before the air offensive. Prior planning therefore is absolutely essential to continued availability of adequate hospital care when civilian populations are the subject of hostile air attack. The Brandt hospitals, the emergency hospitals, and the auxiliary hospitals were responsible for reducing the deficit in beds resulting from the destruction of permanent institutions down to the minimum ration possible. They relieved congestion and contributed to the remarkably low casualty rate among hospital patients. The professional staffs were forced to work under trying conditions and with meager supplies of drugs, dressings, and equipment. Confinement in the shelters often had a deleterious effect on the recovery of patients, but there was no report of a patient being injured or killed in a formal shelter in Germany although several of these structures suffered direct hits by the heavier bombs.

Evacuation of large numbers of women and children and of the aged and infirm did not materially affect the health of these individuals. It placed a severe strain on the medical organization in the areas to which they moved but there is no indication that they received less than the minimum essentials of care and treatment. Their emigration and the resulting decrease in population also contributed to the maintenance of a relatively satisfactory ratio of beds to the resident population of most cities.

The ability of a large municipal hospital to maintain its essential functions in modern aerial war is dependent upon:

- (1). its proximity to more important targets;
- (2). the foresight and initiative of the superintendent and the chief of staff;
- (3). the degree to which it is independent of all

outside help for lighting, heating, power, water, food, and medical supplies and

(4). the extent of its construction for the special protection of its patients.

Maternal and infant care

CAPTAIN ASHER S. CHAPMAN

Maternal and infant care in Germany before and during the war was for the most part, maintained through a public organization which was formed before the advent of the Nazi regime. In May, 1934, the organization was taken over under the direction of Hitler by Reichsleiter Eric Hilgenfeldt, and since that time has functioned under the authority and direction of the Nazi party under the name of the National Socialist Public Welfare organization (referred to here as the NSV).

Funds for the work of this organization, obtained entirely from voluntary contributions, were collected by means of tag days and other public money-raising schemes. The broad aims and purpose of the organization were those of protection of the family, mother, and child. The activities which will be considered here are those concerned with the care of the pregnant woman and her infant.

Practically all documents and information concerning the functioning of this organization had been destroyed because of its Nazi party affiliations. However, sufficient material was obtainable to reconstruct a fairly accurate picture of the services it rendered. This information was obtained by means of interviews with several prominent local members of the NSV organization and from pamphlets prepared by them.

The local NSV activities were under the direction of a chief and a small administrative staff, and were paid for by the organization. All other workers were volunteers. Fees for services rendered were extremely low and were scaled on a basis of the client's ability to pay.

Cities were subdivided into small sections and in each section an office of the organization was located. These offices were staffed by volunteer mothers who were well acquainted with the problems of the expectant mother. Also there was a midwife and a nurse in attendance. Before the war, obstetric cases requiring special care where delivery in the home was impractical, were admitted to the various obstetrical facilities in the cities with which the organization had special contracts. During the war when the need for evacuation of

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patients to outlying areas became necessary the organization purchased, built, or rented housing facilities suitable for conversion or use for their needs.

A description of the services rendered to the expectant mother can best be outlined by following her experiences from the time of conception to the completion of her postnatal period and the cessation of lactation.

Functioning of NSV in the prewar years. Upon discovery that she was pregnant, the expectant mother was sent by her doctor to the local public health office where she was examined by the city physician. He advised her regarding the expected time of delivery and referred her to the local NSV office in her neighborhood. Here, she was seen by the midwife, the nurse, and the volunteer mothers, who discussed with her the various problems confronting her during her pregnancy. She was given various pamphlets to read regarding maternal and infant care and was required to make frequent periodic visits to the office in order to determine the progress of her pregnancy and to discuss any problems which might arise.

A school was maintained by the NSV organization for the instruction of young girls of high school age in the rudiments of maternal care, of infant care, and in the care of the home. This was a rigid course and the girls were well trained. During the latter months of pregnancy, as the need arose, one of these girls was sent to the home of the expectant mother in order to assist her in her home and family duties.

About the sixth month of pregnancy, the expectant mother returned to the city health physician for a thorough medical examination to determine the progress of her pregnancy and the presence of any possible abnormalities. If no difficulties were anticipated, the delivery would be done at home by the midwife. If an abnormal birth was expected, arrangements were made for the mother's entry into a hospital (under contract by the organization) at the time of her delivery.

The household helper remained at the home of the mother after delivery as long as her assistance was considered necessary in order to aid in the care of the postpartum mother, the newborn infant, other children in the home, and the household duties. Furthermore, the mother was required after delivery to make periodic visits to the local office of the organization for advice and examination.

Advice for the parturient and lactating mother, and for the care of her newborn child, was adequate from a medical and a lay standpoint.

Functioning of NSV during the war. The same general arrangements for the expectant mother's care continued during wartime. However, certain adjustments to the program and added facilities were made. This change started in 1939 and functioned successfully throughout the years of the bombing of Germany. It is remarkably similar to the arrangements made in England for the evacuation of expectant mothers. There were two outstanding differences, however, for in Great Britain the program was not the instrument of political propaganda and was without even the implication of force and duress.

Buildings and grounds were purchased in localities 20 to 30 miles from the large cities which were suitable for conversion into maternity homes. These centers included dormitories for housing of the expectant mothers, delivery rooms and labor rooms, infant hospitals where the newborn were kept, and schools and housing facilities for the other children of the mother's family if she had any. These centers were staffed with competent help, including an administrative staff, nurses, teachers, midwives, and an obstetrician who either lived on the premises or was within easy reach.

Upon her initial visit to the city physician, the expectant mother was given a special ration card, which provided her with additional food, including a half liter of milk daily, one quarter pound of butter weekly, and additional foodstuffs totaling 500 grams a month. These additional food rationing points were retained as long as she was nursing the child, up to a six months' postpartum period.

If the mother resided in an area where bombing attacks were expected, she was evacuated during the first trimester of her pregnancy into chosen areas where bombing was not expected, such as Bavaria, Saxony, Mecklenburg or eastern Hanover, where she was quartered, by prearrangement, in a private home. She was transported to these areas by special train or automobile. For each six mothers, a midwife was in attendance and her care of the same mothers continued through the period of gestation. During the periods of bombing, facilities for the evacuees in the recipient areas were available to her as has been described.

Six weeks before the expected time of delivery, the mother was taken to a maternity center where

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she awaited the coming of her child. If there were other children in the family and means for their proper care and welfare were not available, they accompanied the mother to the maternity home where they were cared for during her stay. If the delivery was normal, she was attended by a midwife; if complications were expected or developed, an obstetrician was available to assist in the delivery. She remained abed the customary nine or ten days and thereafter remained at the maternity home for six weeks.

The newborn infant was placed in an infant hospital and cared for by a nursing staff supplemented by young girls who were especially trained in infant care in a school maintained by the organization for this purpose. The mothers were permitted free access to their children during this six-week period, and special rooms were provided in the infant hospital for the mothers to nurse their babies.

At the end of the six-weeks' period, the mother and infant were released to return to their homes. Equipment needed for the proper care of the mother and child was given to the mother if she needed it. This included bedding, infant clothing, diapers, cribs, and even money.

As stated elsewhere, a young girl, properly trained, was placed in the home of the mother as long as her assistance was required in the care of the house, the family, the postpartum mother, and the newborn infant.

Functioning of NSV during emergency periods. During and after the "great catastrophe" of Hamburg, incident to the bombing from July 24 to August 1, 1945, the NSV played an important role in the evacuation and care of women and children. Plans for such an emergency had been prepared but were inadequate in view of the magnitude of the catastrophe, and had to be revised. Eighteen trains had been prepared for departure from as many different stations to evacuate the population. Fifteen of these eighteen trains were destroyed. Water and gas and other cooking facilities were destroyed or not available. Stores of food, blankets, and emergency equipment were destroyed. Communication by means of telephone was impossible. Hundreds of thousands of people were in need of evacuation, and tens of thousands were dead, dying, or wounded.

Food was prepared and distributed by means of emergency Army equipment through 340 emergency kitchens. A total of 1,200,000 people were

evacuated from the city during the seven-day period. Among these were over 1,000 expectant mothers and 3,000 to 4,000 children.

Evacuation was accomplished by the following methods: Trucks equipped with loud speakers toured through the city streets announcing the location of various collecting areas, usually large open fields. From these areas, the evacuees were transported in any type of vehicle available to outlying areas around the city. A record was kept of the destination of these people in order to facilitate the reunion of families. Women, and especially mothers and children, were given preference.

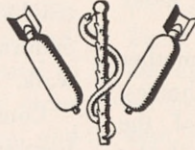
Evacuation was complicated by the presence of many injured, lack of dressings for the wounded, and the irrational state existing in many mothers who had witnessed the loss of their children by violent death. During the latter days of the catastrophe women and children were fatigued beyond endurance and frequently could neither stand nor walk.

Considering the severity and magnitude of the bombings, the work carried on by this organization during the catastrophe was admirable.

A typical maternity home operated by NSV. Inspection of the Wentoff Maternity (Kriegs-Mutter und Kind) Home can be reported briefly: The home was located in a wooded, hilly area 25 kilometers from Hamburg. It comprised a tract of approximately 30 to 40 acres. In this area were six large private homes with a capacity for 130 mothers. Labor and delivery rooms occupied one building. Another building was used as a home for children who accompanied their mother to the home. There was a hospital for infants, of entirely modern construction, which was built in 1943 with a bed capacity of 42 infants. There were eight wards of five beds each, and each ward was equipped with the necessary facilities for infant care, including bathing facilities, scales, etc. Clothing for the individual child was contained in a small bag hung on each crib. There was a two-bed isolation ward, linen room, kitchen, and all necessary modern hospital facilities. A well-lighted, pleasant dining room and living room for the hospital personnel was located on the ground floor. On the second floor were living quarters for the personnel. Eighteen people were in attendance: six nurses, including a head nurse, six apprentice nurses, and six other miscellaneous help.

REFERENCES

1. Kulenkampff, D.: in Deutsche med. Wchnschr. 50: 35-36, 1944.
2. Letter, signed Schwarke, Dept. Pub. Health, Hamburg, June 22, 1945.
3. Erfahrungen mit Luftschutzmassnahmen in Krankenhaeusern, Berlin, July 29, 1944.
4. Mitteilung Nr. 3, Aerztliche Erfahrungen im Luftschutz, Oberkommando der Luftwaffe, Berlin, July 29, 1944.



CHAPTER TEN

ENVIRONMENTAL SANITATION

CAPTAIN LAWRENCE S. FARRELL, SANITARY CORPS, AUS

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Sanitation facilities, consisting essentially of an adequate supply of potable water and a system of sewage and refuse disposal, are the principle planks in the platform supporting good health and a high standard of living. Most people in the civilized cities of the world are accustomed to such facilities in the course of every-day life. They take them for granted. Take them away suddenly and there is cause for immediate concern, not particularly with their origin and disposition, but with the dread of disease and the hardships involved.

Aerial bombing of German cities had a devastating effect upon water supplies and waste disposal facilities. Much damage resulted from direct hits; additional damage resulted indirectly from the destruction of supplies and equipment necessary for maintenance and operation. The extent of damage, together with a description of the situation in general and the ways and means of preventing the spread of disease, will be presented in this chapter.

Water supplies

Sources of public water supplies in Germany are classified according to Sierp¹ as surface waters, ground waters, and deep wells. The surface supplies are similar to those in the United States in that they are derived from rivers, lakes, or impounded reservoirs and are adequately treated to remove objectionable organic material and harmful bacteria. Ground water supplies are derived from the alluvial sand and gravel deposits located in the valleys of larger streams. These deposits receive water by percolation from the stream above and act as underground rivers or storage reservoirs. The water is collected by means of horizontal pipes or infiltration galleries laid in the sand and gravel and connected to a collection well from which it is pumped into the system (Figures 111 and 112). Deep well supplies are, as the term implies, vertical shafts sunk into the subterranean water-bearing strata from which the water is released from pressure to flow or to be pumped into the system.

One of the principal advantages of the ground water supply is its freedom from dissolved and suspended matter which necessitates extensive purification before use. Consequently, throughout Germany this type of supply is developed wherever possible. Sierp¹ estimates that 77 per cent of the public supplies are from ground water sources and states that every effort is usually extended to secure this source of supply, particularly for the larger cities. In those cases where the quantity of ground water is insufficient to supply the needs or where surface water supply is polluted with domestic sewage or industrial wastes, the ground water supply is augmented with surface water by the construction of "accumulation or filter basins" (Figure 113).

These basins consist of excavations penetrating the impervious soil above the water-bearing strata and having an artificial sand and gravel bottom. Surface water pumped into the basin from the adjacent river is strained of suspended matter as it percolates into the ground water supply below and in most cases further treatment is unnecessary.

This type of supply is used extensively in the Ruhr Valley² but since river water there is grossly polluted with domestic and industrial wastes, the supply must be disinfected with chlorine before distribution to the consumer. The supply for Munich³ on the other hand, collected by infiltration galleries located in a sparsely inhabited mountainous area, is not chlorinated.

Deep well supplies are rarely treated except to remove iron and manganese, or for the control of corrosive constituents. The usual treatment includes aeration and rapid sand filtration. Surface water is in most cases treated with chlorine and alum followed by filtration through slow sand filters. The slow rate of filtration gives almost 100 per cent removal of bacteria and requires little chlorine (0.1 ppm) for final disinfection. Only two rapid sand filters were found in the cities visited, one at Hagen and the other at Stuttgart. The surface waters

coming from lakes in both cases were relatively free from pollution.

Stuttgart⁴ (Berg plant) takes part of its water supply from the Neckar River. The Neckar water is first filtered through rapid sand filters, then through filters of the slow sand type. The rough filtration achieved by the rapid sand filters diminishes the amount of suspended matter and bacteria to be removed by the slow sand filter, giving much longer runs between cleanings. Although the slow sand filters occupy a large area and require time and manpower to clean, they produce a relatively safe water without depending on alum for coagulation and chlorine for disinfection.

As a general policy water supplies in Germany are selected on the basis that chlorination is un-

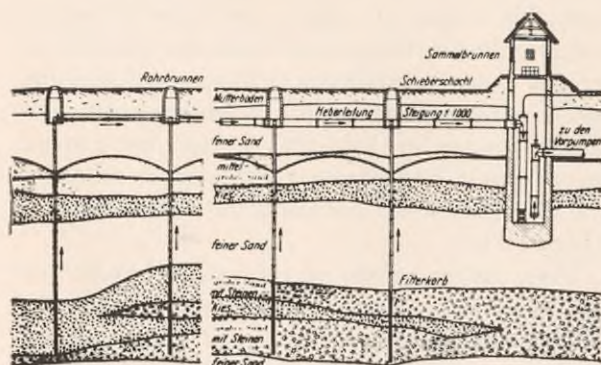


Abb. 19 Wassergewinnungsanlage, bestehend aus einer Rohrbrunnengalerie und einem Sammelbrunnen.

FIGURE 111. Typical ground water collecting system showing suction line (Heberleitung) to pump pit. From Sierp (18).

desirable unless proved necessary by frequent bacteriologic examinations. When chlorination is employed, only a minimal dosage (0.1 to 0.2 parts per million) is applied. No attempt is made to carry a chlorine residual in the distribution system. The various water department officials interviewed were proud of the fact that it was not necessary to treat the water supply under their supervision.

Emergency supplies: Few German cities are dependent entirely on one source of water supply. Where wells are the only source of supply, the wells and pump stations are so spaced that damage to any one station or group of wells will not shut off the entire supply. Electric pumps are usually augmented by diesel or steam standby units. Only one city, Hamburg,⁵ was entirely without water for any length of time (three weeks) as a result of air raids. Power lines are connected in networks such that electricity is usually available by some route. Munich³ depends entirely on gravity flow,

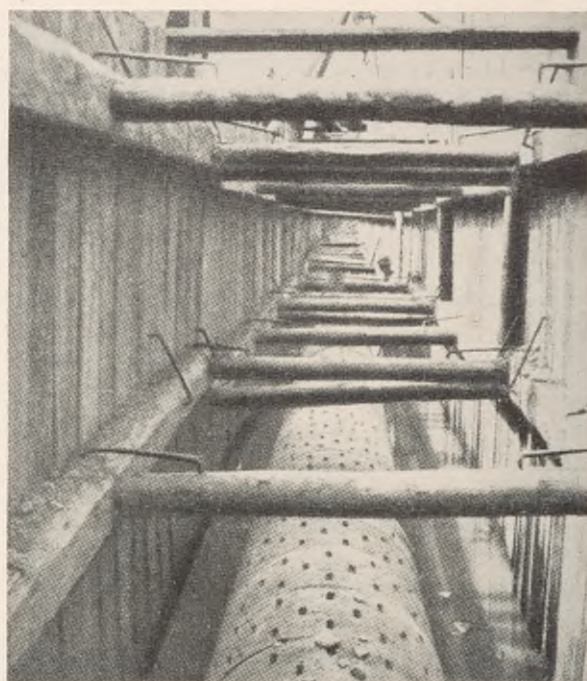


FIGURE 112. Typical installation of infiltration gallery pipe before covering with gravel, for collecting ground water. From report by Imhoff on the Ruhr Association, dated July, 1930.

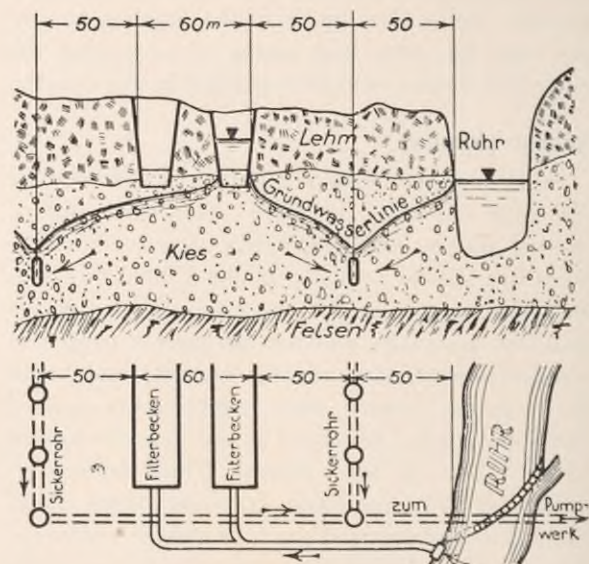


FIGURE 113. Cross section and plan of typical installation for collecting ground water by infiltration galleries (Sickerrohr) and method of augmenting supply by "accumulation or filter basins" (Filterbecken). From report by Imhoff on the Ruhr Association, dated July, 1930.

so power failure after bombings had no effect on its supply.

By operation of pumping stations, even after



FIGURE 114. *Wine cask used for emergency water storage. Placard on cask contains notice to boil water before using.*

numerous breaks occurred in the distribution system, water was often available at the basement taps for drinking. People were advised by radio and newspapers always to keep their bath tubs and all possible containers full of water. At Ulm⁶ arrangements were made with local breweries to store drinking water in large barrels and other containers (Figure 114). The water was chlorinated immediately after the containers were filled, and samples of the stored water were examined frequently during the storage period. Tank trucks and wagons were used to furnish areas where the public supply had failed because of broken mains. These were filled from hydrants in undamaged sections of the community or from emergency or existing private and industrial wells. In areas where housing facilities were destroyed, but pressure existed in water mains, emergency taps were installed in the mains and at fire hydrants (Figures 115 and 116). In Ulm⁶ street cisterns were filled with fire hose and emergency lines. Buckets were utilized to dip out the water to be used for drinking and cook-

ing purposes. Either the people were advised to boil all drinking water from emergency sources or city officials provided chloride of lime to treat the water in tank trucks and stationary tanks. Due to the general shortage of chlorinated lime, boiling was the usual treatment recommended, except where poisoning by chemical warfare agents was suspected. In these cases sole dependence was placed on stored emergency supplies, as announced by leaflets (Ulm).⁶

Emergency repairs: Various decrees, laws, and instructions were promulgated by the Reich Ministry of the Interior, Chief Inspector for Water and Current, and other government agencies, which defined the responsibilities of water works officials and Air Raid Protection personnel in protecting water supplies and making emergency supplies available. In addition, the German Association of Gas and Water Experts published a comprehensive set of recommendations for the repair of air raid damage to water supplies. Briefly the scheme was as follows: The gas-water-supply economy

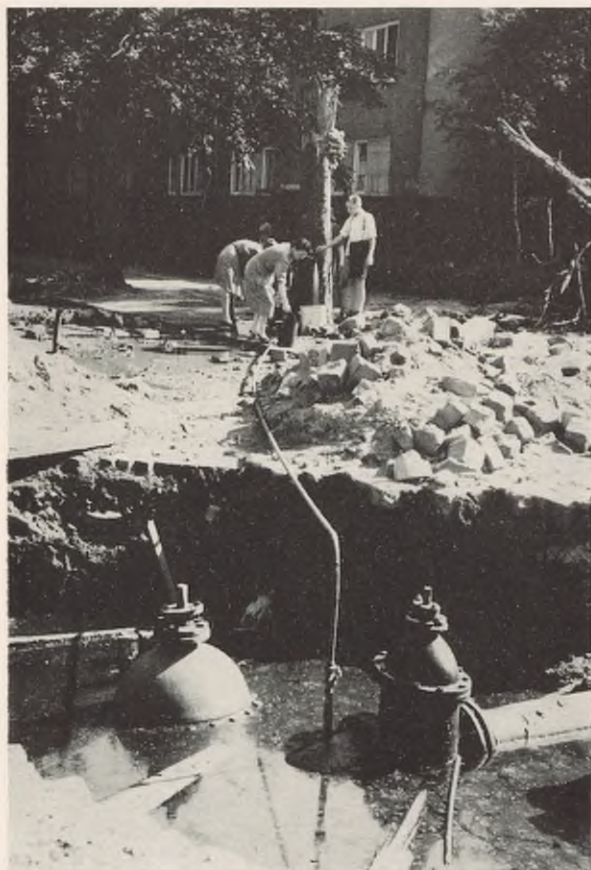


FIGURE 115. *Emergency water supply line installed by repair team following air raid.*

group was entrusted with the supervision of protective measures carried out by the manager of the water works in collaboration with the Commissar for Water Ways. All expenses for the installation of protective measures were borne by the water works except where special measures were necessary for protection beyond the water supply. The water economy authorities were responsible for investigating, identifying and registering all emergency sources of supply such as wells, cisterns, brooks, rivers or lakes. It was the duty of the local health department to judge whether these supplies could be used for drinking purposes and also to maintain careful observation of the main supply after damages had occurred.

The organization for repair of damages was uniformly adopted in most of the cities. Pipe line wardens were located at or near air raid police headquarters. During a raid, as high explosive bombs hit on or near water mains the pipe line wardens were advised by the police of the exact

location of the hit. The wardens hurried to the spot and immediately closed the gate valves to stop water loss. After closing valves on all damaged lines, the warden returned to his post. The foreman in charge of the "first aid" repair crew was notified and rushed to the scene with the necessary men and materials to repair the break if possible, or to provide emergency connections. As the intensity of air raids increased, immediate repairs became impossible while the night raids were in progress. The director of the distribution system then had to allocate repair crews according to importance. The larger water mains were repaired first, and smaller ones in accordance with area or industrial needs. For example, repairs to the system in an area near an industrial or private well were delayed until other areas with no water available for drinking or fire-fighting were supplied (Figures 117 and 118).

The labor for repairs was provided mainly by prisoners of war and foreign laborers and the supervision by special repair foremen from the water department.

Material, vehicles, and tools were decentralized into outlying districts to speed repairs and lessen the chance of large scale destruction of equipment during the raids. Although prohibited by law, Hamburg⁵ maintained a large reserve stock of pipe near the city. Material, valves, iron and steel pipe were purchased by cities under a ration stamp system (Figure 119). Cast iron appeared to be preferred for distribution mains, due to the ease and limit of fracture, usually two or three lengths. Steel pipe when hit by a high explosive bomb would twist and become distorted for a considerable distance, requiring extra labor for excavation and material for replacement (Nuremberg).⁷

After mains were repaired, if other drinking water was available to the area, they were flushed until bacteriologic samples showed no *B. coli*, before again being placed in service. If there was a general shortage of water (Cologne)⁸ the line was placed in service with only a short dirt flush out, and the public was advised to boil all drinking water until further notice. When chlorine was available, as in Hamburg,⁵ Stuttgart,⁴ and Dortmund,⁹ the repaired mains were disinfected as a further protective measure against intestinal pathogens entering the distribution system.

Protective measures: Aside from the steps taken to maintain an adequate potable water described in

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FIGURE 116. *Emergency pipe line laid on air raid rubble, with hose connection and branch pipe. Note faucet welded directly into pipe.*



FIGURE 117. *Multiple valved distributor hose used by water line wardens and repair teams following air raid.*



FIGURE 118. Emergency water line—spare stub and valve used by repair team following an air raid. Note quick coupling device—annular rubber gasket used between sections. Line withstands a pressure of 150 pounds per square inch.

the previous sections, which in themselves are protective measures, certain other steps were taken, or were inherent, to protect the water supplies of Germany from air raid damage. The filtration plant (*Gallenklinge*) at Stuttgart was well camouflaged and protected by anti-aircraft guns. The collecting well house for the infiltration galleries of the Munich water supply was covered with camouflage nets (Figures 120 and 121). The main reservoir (*Hochbehälter Deisendhofen*) for Munich was a well constructed concrete underground structure covered with a natural landscape of trees and shrubs. Until going underground, one would never recognize the presence of this installation (Figure 122).

The distribution systems in all cities visited were so constructed (looped) with interconnecting mains that water could be brought into any district from several directions. While this "looping" was designed primarily to prevent stagnation (dead ends)



FIGURE 119. Ration stamps used for procurement of iron and steel pipe (from Hamburg Water Department) for replacement of damaged and destroyed water lines and sewers following air raids. The municipalities presented these stamps to the National War Allocation Board.

in areas of low water consumption, it was invaluable as a protective measure against failure of supply. Any one feeder main put out of service by a bomb hit could be easily by-passed and service maintained to other residential or industrial areas by means of the "loop" or "ring" type of distribution system.

The use of the slow sand type of filter instead of the rapid sand type is an inherent protective measure of importance. The rapid sand filter as used in numerous cities in the United States is of little value in water purification without chemicals for coagulation and disinfection. In case of shortage of these chemicals due to inadequate storage or lack of manufacturing or transportation facilities, which is an inevitable consequence of present-day warfare against civilian population, a city depending on rapid sand filtration could not be supplied with a safe drinking water. During the last weeks of the war a definite shortage of chemicals existed in Ger-

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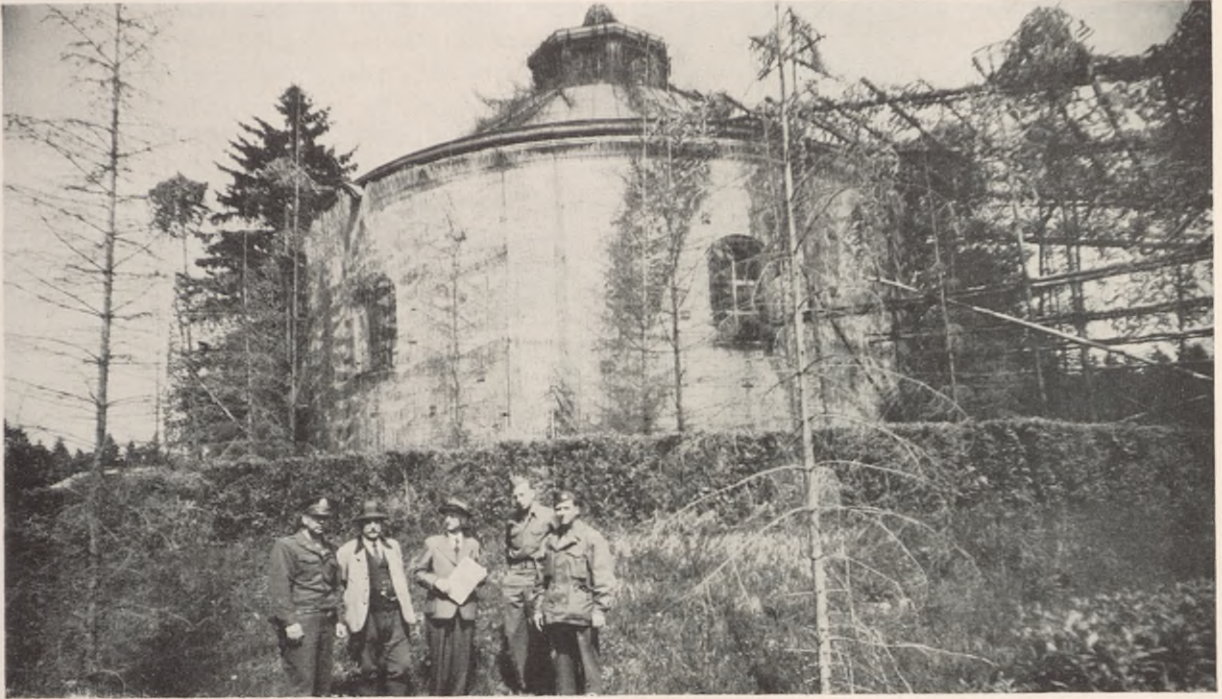


FIGURE 120. *Munich infiltration well house showing natural camouflage nets used to protect installation from air attacks.*

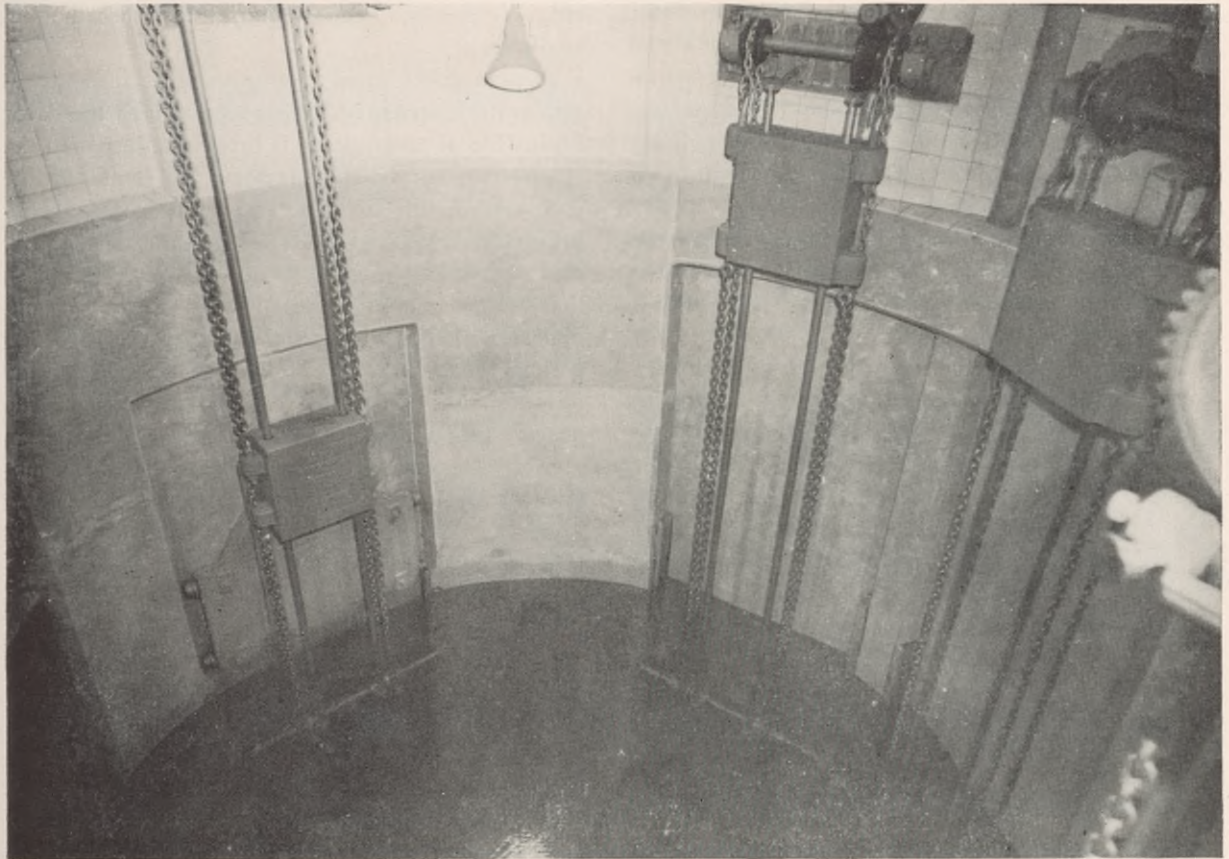


FIGURE 121. *Munich infiltration well—interior.*



FIGURE 122. Interior of underground water reservoir—Munich. Capacity—185 million gallons. Covered with artificial landscaping to conceal its location and identity.

many, but this had little effect on the quality of the drinking water due to the use of slow sand filtration for purification of polluted surface water.

Increased personnel and laboratory facilities for collection and analysis of bacteriologic samples are an excellent protective measure. The Hygienic Institute in Hamburg attributed the freedom from water-borne epidemics to close supervision of water quality. Control of quality was aided by a new method for the detection of typhoid and paratyphoid organisms in drinking water by combining the methods of diaphragm filtration and culture on bismuth-sulfide agar.¹⁰

Physical damage: Damage by bombing to the water works in Germany was extensive, as indicated by the following information obtained from several cities.

*Frankfort:*¹¹ Source of supply: wells and springs for domestic use and a separate system for sprinkling and fire protection utilizing river water. The latter has not been in operation since the raid of January 29, 1944. Treatment: 5 per cent treated with liquid chlorine, about 25 per cent treated for corrosion control by aeration and application of chemicals, and the remainder untreated. Consumption: between April, 1938, and March, 1939, 9,017 million gallons equivalent to 43 gallons per capita per day.

Little damage was done to the water works until October 4, 1943, when the city area, industries and railroad yards were attacked by 482 aircraft carrying 1,446 tons of bombs. From this date to March 25, 1945, water mains and feed lines 3 inches to 40 inches in diameter were broken in approximately

4,000 places; 2,000 of these breaks occurred on January 29, 1944, when 2,014 tons were dropped on the city by 814 planes of the Eighth Air Force. Two pump stations were hit, destroying the buildings, but only one pump was hit and this was repaired within a few days. One reservoir of 3.7 million gallons capacity was hit and had to be isolated because of the damage. Although the supply of water was appreciably curtailed after the air attacks the entire city was without water on only one day, March 29, 1945, presumably because it was necessary to shut down in order to repair damage incurred during previous raids. By May 22 water pumpage had risen to 60 per cent of normal.

Treatment for corrosion control was interrupted because of loss of chemicals by fire, inadequate transportation facilities and lack of electric power. Even the limited extent of chlorination had to be discontinued because of the unavailability of chlorine. City officials stated that the water had always been bacteriologically satisfactory; nevertheless, the people were instructed to use only boiled water after air attacks. When breaks were repaired the pipe lines were flushed and disinfected with chloride of lime until this material also became unavailable.

*Augsburg:*¹² Source of supply: wells and infiltration galleries from two fields located near the River Lech. One of these fields is located adjacent to the Messerschmitt airplane factory and suffered the consequences of being in the target area of an important enemy war plant. Each field has a pumping station, the distribution mains being connected so that water can be supplied from either or both fields simultaneously. A storage reservoir of 42,200 gallons capacity located on high ground at the opposite side of the city floats on the system. The near-by communities of Goggingen and Haunstetten are also served by this supply. Total consumption for 1944 was 4,844 million gallons. The water works at Lobach (near the Messerschmitt plant) were damaged several times during 1944. On February 25 of that year, when 710 planes dropped 2,404 tons of bombs on the city and industrial area, one of the wells, the suction basin, pump and transformer house were destroyed. On March 16 another well was destroyed and pressure lines were damaged. Repairs to the pressure line were completed within a short time.

On April 13 the pressure line was again damaged but was repaired shortly afterward. On July 19 damage was incurred to the pressure main and



FIGURE 123. "Scorched earth" destruction to transportation and water supply lines. Remains of Reichsautobahn (Highway) bridge over Mangfall river destroyed by the Germans after American troops had crossed. Broken water supply line to Munich lies under steel wreckage in foreground.

connecting line bridges. These were also either temporarily or completely repaired within a short time. The works at Hochablass (other well field and pump station) were not severely damaged at any time.

The distribution system within the city was damaged in about 300 places between February 25, 1944, and March 1, 1944. All breaks except about 25 which required extensive labor and materials were repaired by the early part of June. All pipe lines were thoroughly rinsed before being placed back in service. Emergency supplies consisted of connections to privately owned industrial wells of which there were many in this highly industrialized city, and distribution by trucks conveying tanks of water to stricken areas. Boiling of all water from private supplies was mandatory.

*Karlsruhe:*¹³ Source of supply: well water col-

lected in basins located near railroad yards at edge of the city which were under heavy attack by the Strategic Air Forces during the last phases of the war. Storage consists of a reservoir with a capacity of 800,000 gallons. The normal water consumption was from 6.5 to 7.5 million gallons per day.

A total of approximately 400 breaks occurred in the distribution system as a result of bombing and artillery fire. Several of these were in the main distribution lines from the pumping station and were repaired by emergency crews immediately after the raids. Pipes were thoroughly flushed, but chlorine was not used as a disinfectant. The bacterial quality was checked after breaks had occurred. The water was found to be free of pathogens and safe for consumption.

*Munich:*³ Source of supply: wells and infiltration galleries located in the foothills of the Alps about 30 kilometers (18 miles) south of the city. Flow is by gravity to reservoirs located near the southern edge of the city. During periods following damage to the gravity supply lines, shallow wells were constructed within the city. These wells were equipped with fire fighting pumps and the water was made available for drinking with the warning that it should be boiled before being consumed.

In preparation for air raids, all privately owned wells were examined "from a hygienic point of view" and their owners were ordered to have necessary workmen and equipment on hand for delivering water to designated areas. The German Army furnished about 100 water tanks while breweries supplied vats with a total capacity of 450,000 gallons. These were conveyed to stricken areas and re-



FIGURE 124. Wreckage of pump station—Cologne. Direct hit during air raid.

filled by special water lorries consisting of city-owned watering carts, gasoline tank wagons, etc. A total of 7.1 million gallons was distributed in this manner, with a daily maximum of 300,000 gallons. Intact pipe lines also were tapped at various places. Warnings to boil all water not taken from pipe lines were announced by posters and the press.

The air raids against the city area during July and August, 1944, when 9,500 tons of bombs were dropped, caused severe damage to the gravity feed lines and the distribution system. All five feed lines running into the city from mountain reservoirs were broken and the mains within the city were severed in approximately 850 places. The city was without an adequate supply of water for several days as a result of these raids. Total damages after the 37 raids in August, 1944, resulting from 9,063 tons of bombs dropped, caused 1,850 breaks in mains of which 62 were on lines from 20 inches to 48 inches in diameter. Repairs required a total of 6.5 miles of pipe and at times 400 workmen were imported from various industries, the Army, the Bavarian civil service, and military prison camps to restore the system. Two major supply lines were damaged in April, 1945, when the Reichsautobahn bridge over the Mangfall River was destroyed by the retreating German Army (Figure 123). Regardless of pleas on the part of water works officials to the Army officers to avoid damage to the piers near which 30 and 40 inch water lines were laid, the entire structure was destroyed. As a result, the water lines were cracked and water poured out at the rate of approximately one half million gallons per hour. The water system to Munich was thus seriously affected and it was estimated that the repair work would require several months since a temporary military road was constructed on the debris covering the damaged sections of pipe.

*Cologne:*⁸ Source of supply: wells approximately 50 feet deep located in four scattered areas near the edges of the city. The supply is not usually chlorinated but equipment for emergency use was installed at two (Zugweg and Weiler) of the four pump stations, and one of these (Zugweg station) was in operation at the time of this visit. Normal water consumption was approximately 24 million gallons per day.

Destruction of this city was so complete that the total number of breaks in water mains could not be estimated. Damages to the pump stations were as follows: Two of five steam pumps at the Zugweg station were destroyed on October 14, 1944 (Fig-



FIGURE 125. Bomb damage to 2.5 million gallon reservoir—Cologne.

ure 124), and on October 17 two of four boilers were destroyed. On December 18 one of the two reservoirs, having a capacity of 2.5 million gallons, was destroyed (Figure 125). The pump station at Weiler was put out of operation October 28, 1944, by the obstruction of a gas main supplying the gas engine driven pumps. By April 1, 1945, an electric pump had been installed which could supply about one-third of the city's normal demand of 250,000 gallons per hour.

The supply of electricity to the water works was apparently always ample, although two 10,000 kilowatt turbines at the Zugweg station were destroyed. During one of the raids a dud bomb came to rest near the switch board. Had it exploded the electric pumps used to augment the steam pumps would have been put out of operation, resulting in a more serious water shortage than had occurred.

Following several of the raids the damage was so severe that only a very limited amount of water could be supplied. On such occasions emergency sources consisting of various privately owned wells were placed in service but these did not supply a sufficient quantity to meet normal demands. Auxiliary water basins (*Loeschteiche*) located in various sections of the city were also available for emergency use in fire fighting (Figure 126).

Preparatory to air raids the people were advised to fill bath tubs and all other available containers with water. Boiling of all water was recommended and the drinking of unboiled water was prohibited. Repaired mains and pipe lines were flushed but not disinfected before being placed back in service.

*Hamburg:*⁵ Source of supply: sixteen scattered

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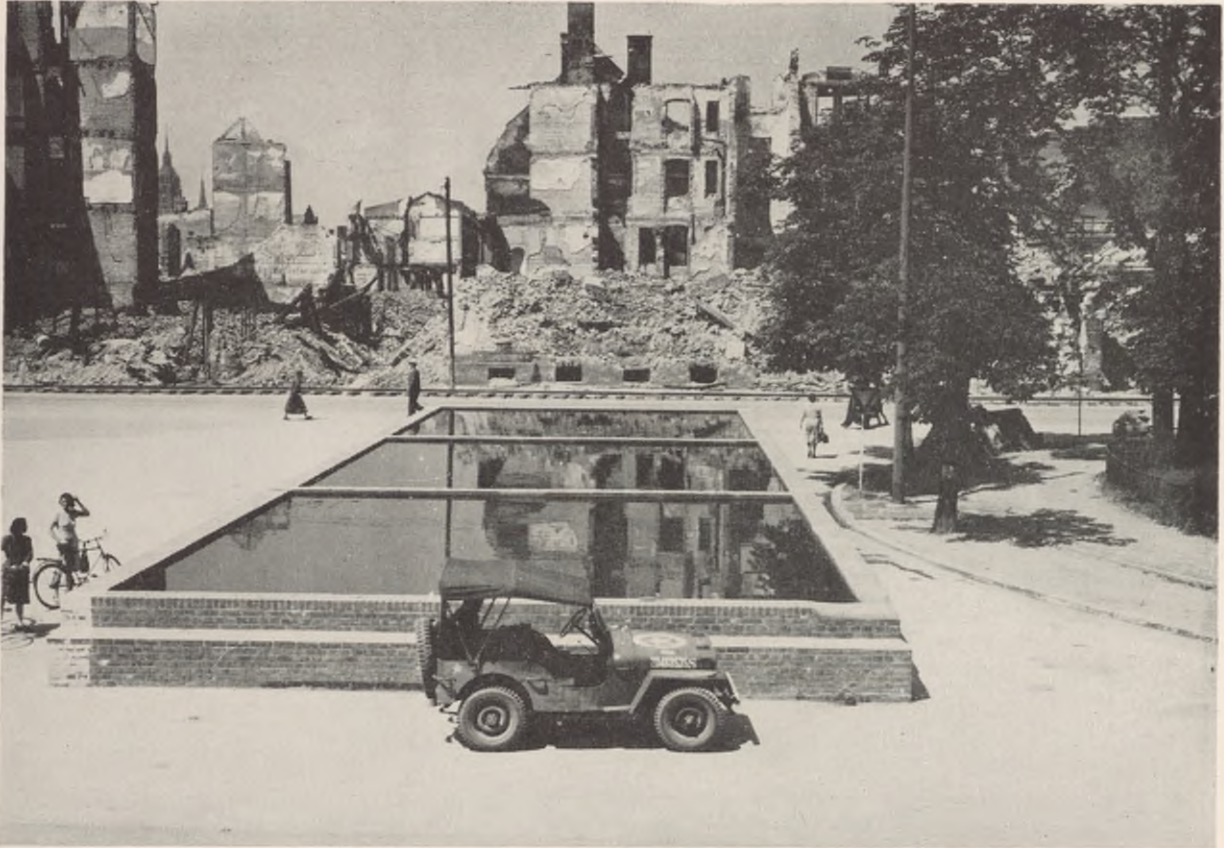


FIGURE 126. Open storage tanks built as part of the organized air raid defenses for fire fighting and emergency drinking water supply.

ground water works with a total of 450 wells (both deep and shallow); two purification plants consisting of sedimentation, rapid and slow sand filtration and continuous chlorination utilizing water from the Elbe River; one purification plant consisting of rapid and slow sand filtration and chlorination (0.2 parts per million excess) utilizing water from a lake at Grossensee (Figure 127). Water consumption in greater Hamburg before the famous fire raids and after these attacks is shown in Table 34 supplied by the Water Works Corporation.

In an effort to minimize the effects of disruption of water supply, instructions were issued to employees which were briefly as follows: During the attack, engines were to be kept going as long as possible; foremen and work shift in charge of boilers and engines were instructed to remain at their posts until bombs actually fell and were to stop the pumps when the main pressure failed because of major breaks; the plant superintendent and other workers not essential to immediate emergency work were to proceed to air raid shelters.

After the attack the first job was to determine the number and location of unexploded bombs in and about the work, and then to proceed to estimate the extent of damages and the amount of material and labor necessary for repairs, reporting these items to the municipal construction department. An application was also to be submitted to ARP headquarters for materials and assistance. Emergency labor groups consisting of foreigners and prisoners of war would then be organized for making the necessary repairs.

TABLE 34. COMPARATIVE WATER CONSUMPTION
—GREATER HAMBURG

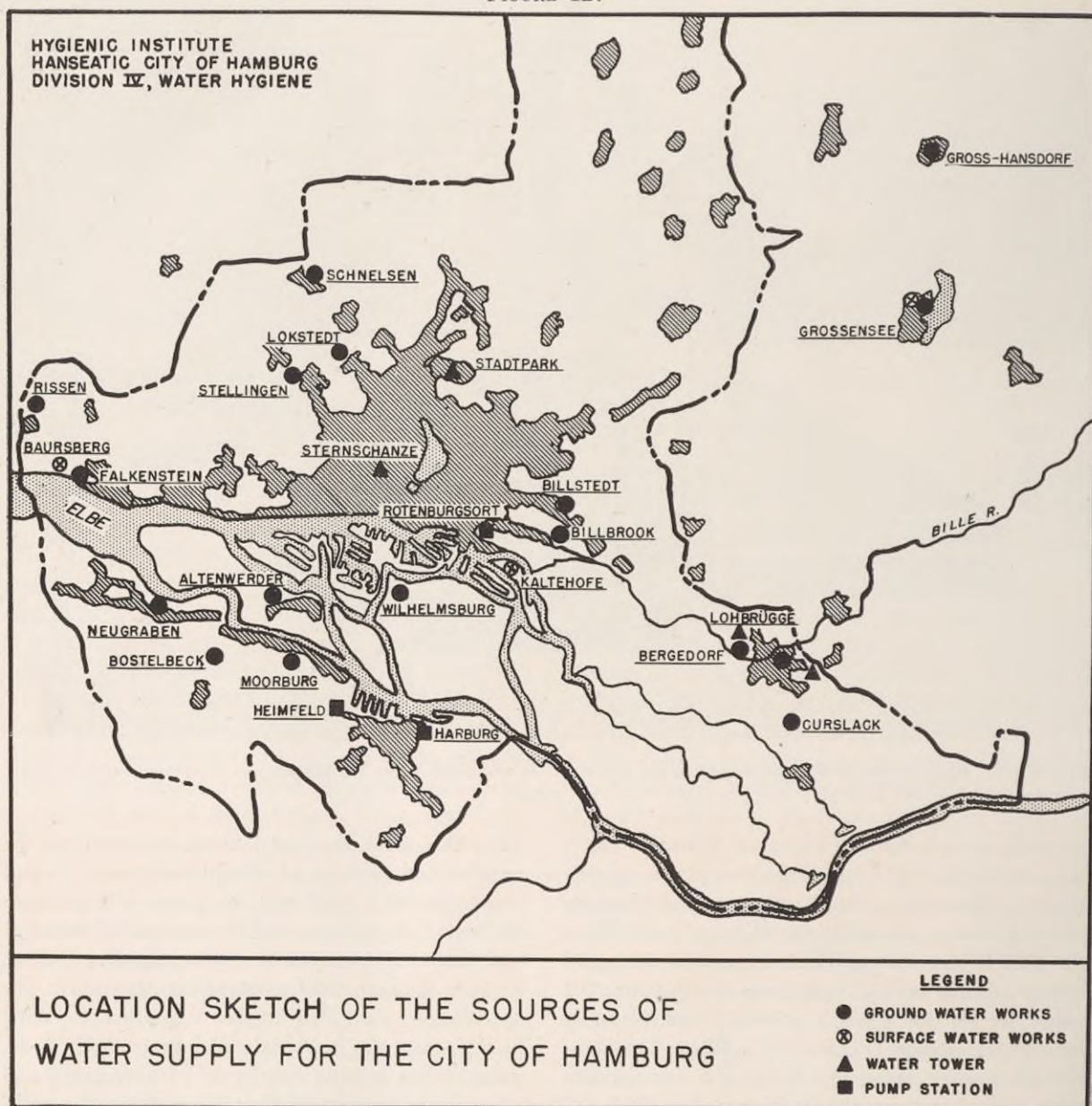
	<i>Before the attacks</i>		<i>After the attacks</i>
	July, 1943	Oct., 1944	Mar., 1945
	MGD	MGD	MGD
Consumption*	76.6	42.3	37.0†
Loss from mains	7.9	39.7	17.2
Output	84.5	82.0	54.2

* Based on water meter readings

† Corresponds to 30 gallons per capita per day including industrial uses.

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FIGURE 127



During the air raids of July, 1943, severe damage was inflicted on the central pumping station at Rotenburgsort. Two engine houses including the pumping equipment were abolished and two boiler houses were damaged by collapse of a chimney. A workshop, warehouse, workers' dwellings and recreation building were also destroyed by direct hits and fire. Several mains and pure water basins outside the buildings were also severely damaged (Figures 128 and 129). Some temporary repairs were completed immediately after the attacks but it was necessary to shut down the station for a period

of about three weeks until engines and pumps could be put into working order. The treatment plant at Kaltehofe and the ground water works at Billbrook, Curslack, and Stellingen were also hit during these raids but damage was less severe and was repaired within a few months. Breaks in the distribution system totaled 847 feet of pipe ranging from 2 inches to 36 inches in diameter.

Repeated attacks during the months between June and November, 1944, also resulted in damage to various supplies. At Kaltehofe, sedimentation tanks, filters and pipelines were hit; at Curslack, pipelines



FIGURE 128. Broken suction line (80" diameter) at Hamburg pumping station.



FIGURE 129. Bomb damaged reservoir (5 million gallons capacity)—Hamburg.



FIGURE 130. Can filling station at hydrant. Civilian population with hand carts obtaining daily water supply.

were broken, and at the Rotenburgsort pumping station a pump and pure water main were damaged. This damage, however, was relatively minor in nature and, although breaks occurred in large diameter pipes, the repairs were completed within a short time so that the quantity of water distributed was not materially affected for any long period. Damage to pipe lines in the distribution system amounted to breaks in 1,650 lineal feet during the period July, 1943, to November, 1944, and further destruction in 1945 (January to April) amounted to breaks in approximately 975 feet, making a total of 3,475 lineal feet of pipe line damaged.

During these emergencies at Hamburg, drinking water was supplied from about 100 wells constructed by the Technical Emergency Corps, from privately owned wells in the community, and from surface sources which were treated with German Army purification equipment moved into the city for that purpose. Taps were installed on undamaged parts of the system (Figure 130), and water from wells was delivered to afflicted areas by trucks, wagons and all other available means. Particular care was taken to test the water before approving

its use and to assure that no contamination occurred during the transfer from mains, wells or purification equipment to the tanks in which it was conveyed to various points of distribution. Samples were taken periodically from all wells in the community, some of which were made ready for use before the war. A card index was maintained showing the condition of each well so that its usefulness could be judged at any time. Samples were also taken from points of low pressure on the distribution mains as a check on back syphonage. Reports indicate that no objectionable conditions developed, with the exception of a few cases of sludge (mostly ferric oxide) discharge caused by oscillations in pressure. Booster pumps were installed at critical points on the system to provide pressure for fire protection. Repaired sections of pipe were thoroughly flushed with water and chlorine solution, and the line was not put into service until it was found to be in a satisfactory bacteriologic condition. Other than the one period after damage to the Rothenburgsort pumping station no serious shortages of water developed. Water works officials attributed the successful operation of the system to



FIGURE 131. Typical damaged (8") steel water line. Note distortion. Result of direct bomb hit during air raid.

the abundant reserve supply and to the fact that standbys were installed for all important pumps. The various sources of supply were so located and interconnected that many could be used to augment other damaged supplies.

During the period of air attacks, the bacteriologic condition of the public water supply was under constant observation by frequent examination of samples was examined for total bacterial count the Hygienic Institute were examined once a day, but in 1945 the frequency was increased to four times daily at 0200, 0800, 1400 and 2000 hours. During the first half of the year a total of 236 samples were examined for total bacterial count and *B. coli* content. Of these examinations, 81 per cent were found to be bacterially satisfactory with an average count of less than 10 per milliliter, except in February when the count was 25 per milliliter and in March when the highest number of colon positive tubes was 32 per cent. These unsatisfactory conditions were attributed by Dr. Mueller of the Hygienic Institute to the increased air attacks mentioned previously which resulted in widespread damage to the water system.

Samples were also taken at weekly intervals

from thirty-three points on the distribution system. Of the 428 samples collected during the first six months of 1945, 26 per cent were unsatisfactory on the basis of *B. coli* in 100 milliliter quantities. The maximal number of unsatisfactory samples occurred during the months of March and June. These conditions were said to be due to increased bomb damage in March and extensive repair work to the system in June.

Table 35 shows the bacteriologic condition of the water as indicated by samples collected during the past ten and one-half years.

From this table it will be seen that contrary to the colon content, the average bacterial counts varied considerably. They remained below 10 up to the air attacks of 1940 and dropped to less than one per milliliter during the period 1940 to 1943 inclusive. The average for 1943 is particularly striking since the supply was disturbed considerably by bomb damage during that year. The *B. coli* content, however, was more definitely correlated with bomb damage. While the number of unsatisfactory samples during the period 1934 to 1943 was less than 10 per cent and at times less than 1 per cent, there was a definite increase to 16 per

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cent during the year 1944 and to 19 per cent during the first six months of 1945. Because of this, people were warned by radio to boil all water used for drinking purposes, the warning being lifted in April when the *B. coli* content indicated an improvement in the bacteriologic condition. Slight increases in *B. coli* content were observed after that time but they were attributed to repair work on the system and not considered dangerous. The relationship between bomb damage and water-borne disease rates, such as typhoid, paratyphoid, and dysentery, could not be established because the total number of intestinal disease cases remained at the usual level for this city (see Chapter Four). It was the conclusion of Dr. Mueller that "although the bombing destruction of the Hamburg water supply, especially during the last two years, has exerted an influence on the potability of the water, it has not resulted in an increase in infectious disease transmitted by drinking water because the people were instructed in sanitary measures."

*Nuremberg:*⁷ Source of supply: three independent waterworks, two of them utilizing surface

TABLE 35. BACTERIOLOGIC CONDITION OF DRINKING WATER AT THE HYGIENIC INSTITUTE GORCH FOCK-WALL—HAMBURG

Year	Total number of examinations	Average bacterial count per milliliter	Per cent of examinations positive for <i>B. coli</i> per 100 milli.
1934	364	8.7	9.2
1935	361	3.6	1.3
1936	359	3.5	3.6
1937	358	1.7	5.0
1938	354	1.1	2.0
1939	359	1.0	0.6
1940	355	1.1	1.3
1941	354	0.4	5.3
1942	364	0.3	0.6
1943	322	0.9	0.2
1944	371	22.5	16.7
1945 (Jan. to June)	236	8.0	19.0



FIGURE 132. *Emergency water line. Hastily laid across rubble following an air raid.*

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water from the Veldensteiner wooded hill area and the third utilizing ground water from wells in the Pegnitz Valley. The surface supplies are untreated and are conveyed by gravity to the distribution system or to reservoirs floating on the system. The well water is pumped by electric power either directly into the system or to the elevated reservoirs. Emergency sources consisted of about 70 privately owned wells which generally produced a water of satisfactory bacterial quality. However, it was recommended that all water taken from these wells be boiled before using. The supply for the adjoining town of Furth was also used in emergencies after air raids. Distribution from these sources was by water carts which were registered by the town before the air attacks began. These carts, 30 to 40 in number, provided means of transporting approximately 105,000 gallons into the town daily when the normal supply was affected.

Although no damage was reported to the wells, reservoir or pump stations, numerous breaks occurred in the distribution system (Figure 131) during the air raids so that only a portion of the town could be supplied from the main source. The number of breaks was reported to have increased from approximately 150 in 1942 to more than 700 in 1945. A crew of 23 men was on twenty-four hour alert for shutting off house lines and damaged sections of mains. A repair crew of about 500 men was also available for repairing the breaks and for laying temporary pipe lines to waterless areas (Figure 132). This crew was able to make the necessary repairs so that the supply was again normal within four to six weeks after each attack until the heavy raids of January, 1945. From that time until occupation of the town by American troops, frequent alarms and strafing attacks greatly hindered the repair work. It was estimated that approximately 520 breaks were repaired up to January, 1945, but only about 220 since then. Particular care was taken to rinse thoroughly the repaired sections until samples indicated the water to be bacteriologically satisfactory.

*Stuttgart:*⁴ Sources of supply: three main sources of supply include untreated water from the state owned Danube Valley near Niedestezingen approximately 100 kilometers away; mixed well and surface water from the Neckar River treated by coagulation, slow sand filtration and chlorination. Numerous small wells located throughout the city and furnishing about 10 per cent of the supply were also connected to the system. Consumption

varied from 15 million gallons during the winter to 37 million gallons during summer with an all time peak of 8,448 million gallons during the year 1944.

Damages to the system totaled about 1,400 breaks, 200 of which were in large mains and 1,200 in smaller lines. By May 23, 1945, all except 25 breaks in the larger mains and about 300 in the smaller lines had been repaired. Pump stations, filter plants and reservoirs suffered minor damages but because of the plurality of sources the supply was never entirely interrupted.

Water was conveyed to stricken areas by trucks and carts and the people were advised to boil all water used for drinking. Repaired distribution mains were thoroughly flushed and treated with chlorinated lime before placing into service. Samples from the system indicated no *B. coli*, and on only one occasion did the total bacterial count greatly exceed the average.

Destruction of the Moehne Dam: The following report from the Hygienic Institute (*Gelsenkirchen*)² describes damages to water works and the effect on the drinking water supply of the Ruhr District due to the flood caused by bombing of the Moehne Dam.

In the early morning of May 17, 1943, the dam across the Moehne Valley was the target of an air attack. The wall was completely destroyed in its central part for a length of about 250 feet and to a depth of about 75 feet (Figure 133). Since the impounded basin was almost completely filled at the time, the water poured out through the hole in such quantities that a high water wave developed in the Moehne and Ruhr Valleys which reached a height of 30 feet and more in the narrow parts of the Moehne Valley. Even on the upper course of the Ruhr the high water wave was from 18 to 25 feet above the river in the first hours after the blast. In the lower course of the Ruhr at Baldeney Lake near Essen, about 75 miles below the dam, the wave receded to former high water levels and dropped further below the high water mark at the point where the Ruhr flows into the Rhine.

The bulk of the water attained at first a velocity of 20 feet per second resulting in considerable damage in the Moehne and upper Ruhr Valleys. The worst damage occurred in the narrow parts of the valley, especially at places where the valley was restricted by structures such as plant buildings, bridges with adjoining road dams and dwellings. Cities suffering the worst damage were Neheim, Wickede and Froendenberg. The velocity of flow

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was greatly increased in these cities by obstacles so that the destruction was considerably greater. The water flow approximated 300,000 cubic feet per second at the beginning of the flood. Before the catastrophe the total quantity of water supplied by the water works concerned amounted to about 265 million gallons per day. This supply dropped on May 17, 1943, the day of bombing, to approximately 68.7 million gallons per day. The quantities of water pumped on succeeding days are shown in Table 36.

TABLE 36. WATER PUMPAGE—SUPPLIES AFFECTED BY FLOODING MOEHNE AND RUHR VALLEYS

<i>Date</i>	<i>Daily water pumpage</i>
Until May 16, 1943	265,000,000 gls.
on May 17	68,700,000
18	89,800,000
19	127,000,000
20	164,000,000
21	185,000,000
22	206,000,000
23	223,000,000
24	212,000,000
25	209,000,000
26	212,000,000

By June 8, 1943, the total water pumped rose to 250 million gallons per day and reached 265 million gallons per day on June 27, 1943.

Most of the water works in the Ruhr Valley were flooded, resulting in considerable damage. Some of the plants had to be completely rebuilt. Others could not be placed into operation for several days, because of water damage to electrical equipment. Whirlpool holes and gravel deposits were formed in the stream valley. Accumulation basins having a capacity of about 7.5 million square feet, for augmenting the ground water supply, were filled with mud so that the filter bottoms became practically impermeable.

On May 17, 1943, after the bulk of the high water had run off, each water works began clean-up operations with their own laborers assisted by the fire police, technical emergency crew and special police units.

Clearing and repairing the accumulation basins and replacing filter sand were major tasks; nevertheless, the normal supply of water was resumed in a short time. This was principally due to the fact that the bottom and the banks of the Ruhr, which had become muddy and impermeable by polluted water, had been cleansed by the high water wave and the channel refilled by water coming from the subsoil through the river bottom. According to former experiences, however, it was expected that the river bottom might again be covered with slime after a relatively short time. Cleaning and repairing of the accumulation basins had, therefore, to be hastened. Rainfall was quite favorably distributed in the summer and fall of 1943, which helped considerably in maintaining an adequate supply.

The following water works were completely destroyed by the break of the dam wall resulting in the flood:

(1). The water works for the town section Neheim of the city Neheim-Huesten (Figures 134 and 135).

(2). The newly established water works for the Russian camp in the town section Neheim of the city Neheim-Huesten.

(3). The water works in the slaughter house pasture for the town district Neheim of the city Neheim-Huesten.

(4). The water works of the city Soest in Wickede on the Ruhr.

(5). The works of the city of Herdecke.

Especially heavy damage occurred also in the water work for Echthausen, which began operating as a new works in 1942. This was a part of the water works for the northern Westphalian coal district at Gelsenkirchen. Besides the clogging up of the accumulation basins already mentioned, much destruction resulted to the well installations and the power plant was destroyed. Similar damage occurred at the water works situated farther below in the valley, namely: (1) the water works of the city Hamm in Barmen; (2) the community water works for Froendenberg; (3) the water works of the city of Menden; (4) the water works of Langschede (water works for the northern Westphalian coal district), and (5) the works for the city of Dortmund.

The Dortmund works were out of operation for two days. On the third day the distribution system was filled and pumping was resumed on the fourth day. The supply was then gradually increased from

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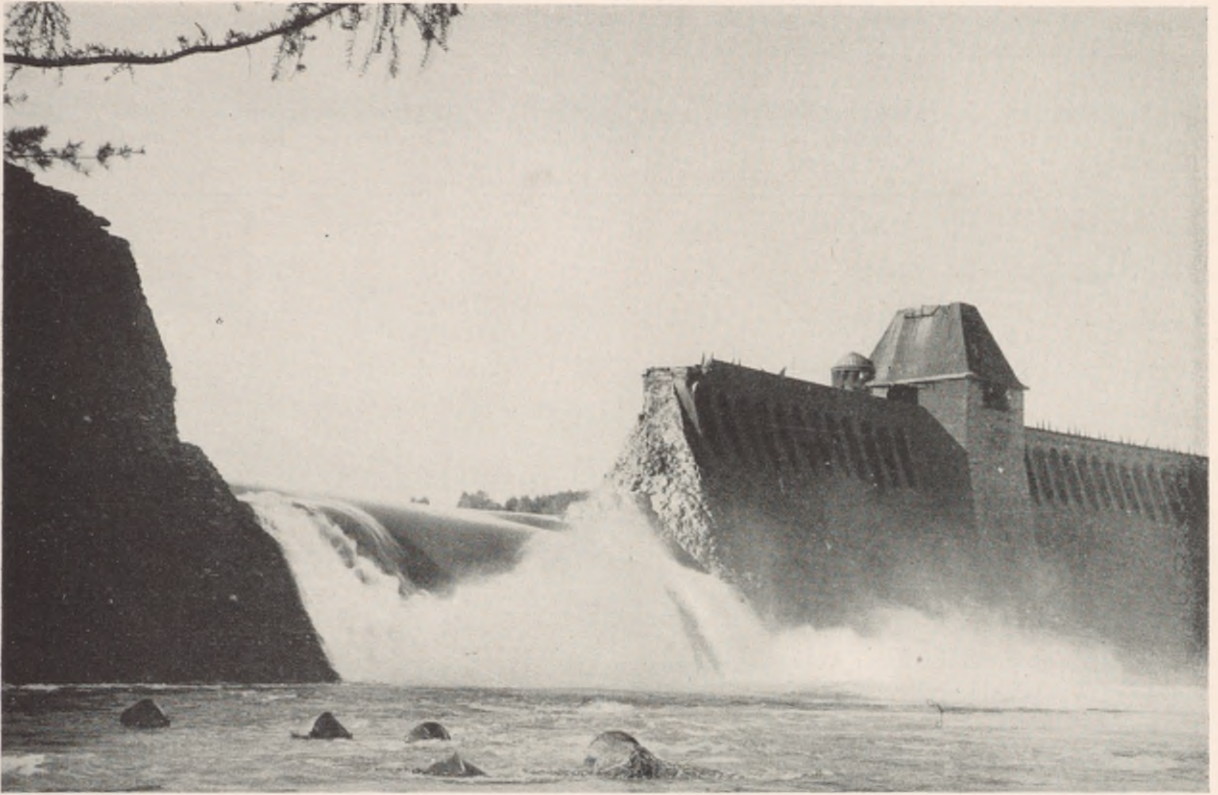


FIGURE 133. *Moehne Dam. Water pouring thru breach resulting from direct bomb hit during air attack of May 17, 1943.*



FIGURE 134. *Remains of water works at Neheim. Destroyed by the flood when the Moehne dam was destroyed by direct aerial bombardment—May, 1943.*

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TABLE 37. EFFECT OF MOEHNE RAID ON WATER WORKS

<i>Pump Works</i>	<i>Operations Stopped</i>	<i>Operations started again</i>		<i>Interruption</i>		<i>Former Flood level</i>	<i>Moehne Flood level</i>
	<i>May 17, 1943</i>	<i>Date</i>	<i>Time</i>	<i>Days</i>	<i>Hours</i>	<i>in meters</i>	
Echthausen	0200 hrs.	Aug. 23, '43	0600	98	4	138	145
Froendenberg	0345	Aug. 2, '43	0600	17	2	118	124
Langschede	0410	May 20, '43	1935	3	15	114	120
Witten	1030	May 18, '43	1700	1	6½	75	80
Horst	1720	May 17, '43	2400	—	6½	55	61
Steele	2120	May 17, '43	2230	—	1	55	59

20 to 80 per cent of normal. Operations at Langschede, which is the main supply for the district of Unna, were resumed within a few hours.

The effect on the Ruhr water works supplying the northern Westphalian coal district Gelsenkirchen is shown in Table 37.

The pump station supplying the city of Hagen was completely flooded, necessitating a complete shut down of the supply. The flood wave reached a height of 6 feet over the machine house, about 13 feet over the water supplying section, and about 7 feet over the rapid sand filter plant. Tremendous sludge masses, carried from the Hengsteysee, were deposited there. Sixty per cent of all the water demand had to be transferred from the Hasper Valley dam to the inner city district through an emergency line. Sections of the city situated on higher ground had to be supplied with water from water carts. Similar conditions existed in the water works situated farther down the Ruhr. However, it should be emphasized that most of the water works could begin operation again within a few hours.

The greatest difficulties in regard to the drinking water supply were naturally in the few cities where the water works had been completely destroyed. The water conveyed by the water works at Huesten and Habel was conducted into Neheim from Huesten. In addition large quantities of water were turned into the Neheim high reservoir from the Loermecke water works. In this way the city could be supplied with water in a few days. It must be noted that in all cases water supplied to Neheim was safe for drinking purposes.

The second completely destroyed water works, for the city of Soest in Wickede on the Ruhr, had

to discontinue the supply of drinking water even to the city. This city was supplied with water partly by an emergency pipe connection with the water works at Hamm, partly by the Loermecke water works, and by the old city plant in Soest. The old city well supply had to be treated with chlorine because of the objectionable bacteriologic condition.

It was necessary for a time to supply drinking water from private wells in most of the cities of the Ruhr district, especially in the city sections heavily damaged during the bombing attacks. These wells were tested for use as drinking before the catastrophe, but a single examination of well water, even though a negative result is obtained, cannot lead to the conclusion that the water is safe. Especially in the Ruhr district continuous excavations and sink holes in the earth's surface caused by mining operations must be taken into consideration. Therefore, upon our suggestion the individual city boards of health ordered signs to be put up at the wells warning the people to boil the water before drinking. Herdecke, which was suddenly cut off from the central water supply by the total destruction of the pump station, was again being supplied with water within a short time. This was done by using the collecting well that remained practically undamaged. The water was taken from the collecting well in water carts, treated with chlorine, and conveyed to the various sections of the city. Several private wells also supplied water which was boiled before drinking.

In general it must be noted that the exceptionally great efforts of technicians and sanitary engineers were successful in mastering these conditions. They



FIGURE 135. Pumping equipment damaged by flood—Neheim water works, May, 1943.

used the strictest precautions and continuously watched over the water plants and emergency supplies. No epidemics of any kind were experienced which could be traced to this raid.

Heavy damage to sewage treatment plants occurred in Neheim, Froendenberg and Witten. The treatment of sewage in the Ruhr district is of great importance in view of the fact that the river is a source of drinking water. Operation of the treatment plants was especially important when the additional water supply from the Moehne Valley Dam was cut off. Therefore, repair work on the sewerage plants was carried out immediately, so that Witten and Froendenberg were again ready for operation within a few weeks. In Neheim, in addition to the plant itself, the sewage collecting system and siphons under the Moehne were destroyed.

As a result of the high water level, especially in the Moehne and upper Ruhr Valley, damage of great extent occurred to the water distribution sys-

tem. Likewise, the river channel was changed in some places due to damage of the banks. At other places, especially at a sudden widening of the valley, heavy deposits of gravel have partially filled the channel, the greatest damage occurring in the Moehne Valley. Below the mouth of the Moehne the Ruhr was completely clogged by gravel for a length of about 500 meters. In addition decisive damage occurred to bridges and reservoirs.

At the time of this survey, the dam had been repaired but the level of impounded water was maintained below normal to prevent a repetition of the flood damage should it again be destroyed (Figure 136), and anti-aircraft guns were mounted in control towers. In addition cables with high explosive grenades were hung above the dam as protection against low-flying planes, and nets were installed to prevent aerial bombs or water-borne torpedos from reaching the base of the dam (Figures 137, 138 and 139).



FIGURE 136. *Mochne Dam, upstream side, after reconstruction. Water level maintained at halfway mark to reduce flood damage should dam be rededstroyed.*

Sewerage systems

For many years prior to the war, the problems of sewage disposal and prevention of stream pollution had been given considerable attention in Germany. As industry developed and certain areas became heavily populated, the objectionable conditions created by discharging raw or untreated sewage into streams became greatly amplified and in certain areas such as the Ruhr River Valley² the conditions became definitely acute. In these areas the cities and towns were dependent upon rivers and smaller streams as sources of drinking water, either by taking it direct or by using it to replenish (through filter basins) the ground water from which the drinking water was drawn. Hence it was imperative that the stream water be maintained in as clean a condition as possible.

Before the turn of the century it became evident that the laws prohibiting the discharge of sewage into water courses were definitely inadequate and that means other than law enforcement would have

to be taken to correct unsatisfactory conditions. A few years later enabling acts were passed whereby cities and towns in certain defined districts could organize into "Sewage Water Associations" for the purpose of providing drinking water supplies and controlling conditions of stream pollution. These associations were given broad powers permitting them to require the construction of sewage treatment facilities and to maintain and operate the plants in such a manner that the streams would be satisfactory for use as public water supplies. Table 38 shows a list of the associations, date of organization, population and size of area served (Sierp¹⁴).

It will be noted from this table that more than ten million persons are served by water supplies and sewage disposal facilities operated under the control of these associations. In addition, there are sewage treatment facilities installed for service to people living in unorganized areas, the total number of which is not known.

Sewage treatment facilities in most cases con-

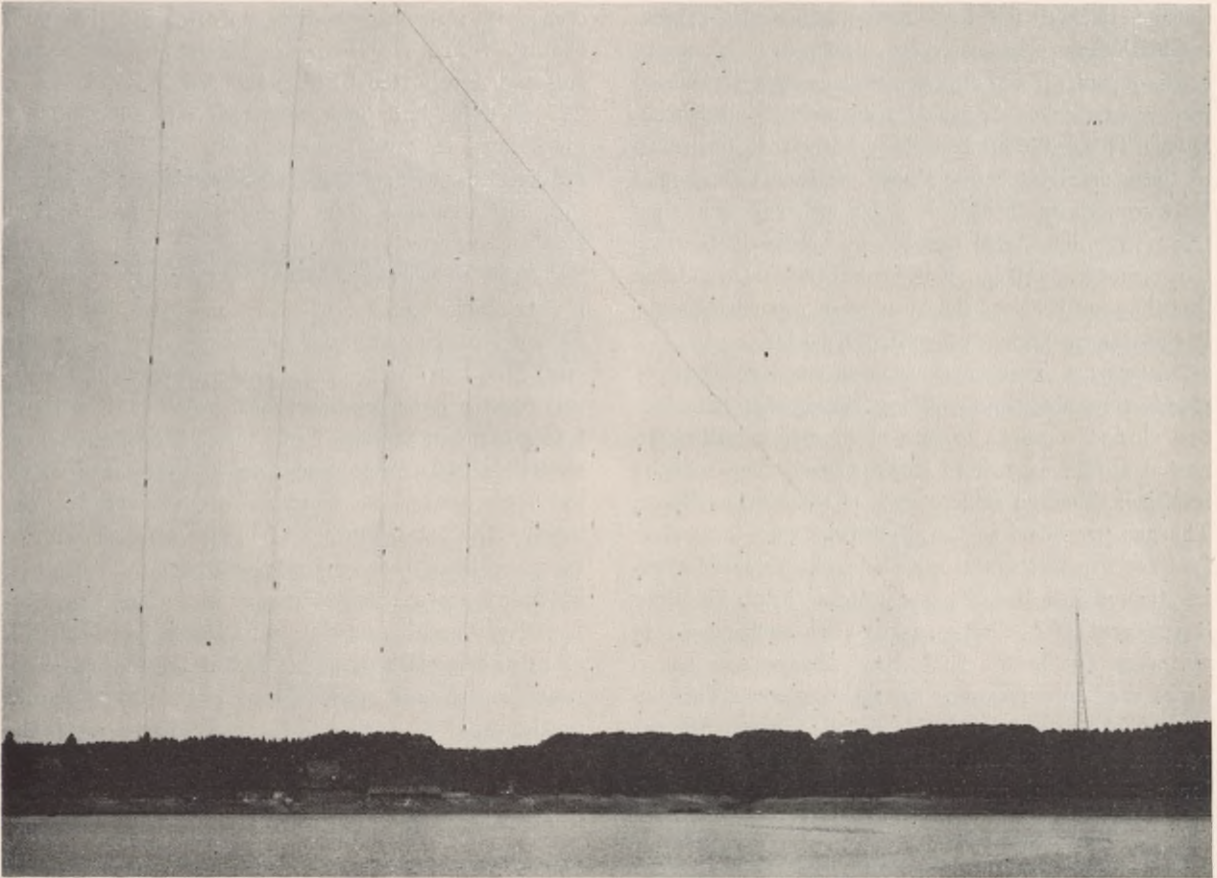


FIGURE 137. Cable with hanging grenades to destroy low flying planes and prevent skip bombing. Installed above Moehne dam after destruction by aerial bombardment May 17, 1943.

sist of solid removal only, secondary treatment by filtration being employed only when the amount of dilution water in the receiving stream is exceedingly small. In some cases where careful control of the stream is necessary, overflow basins are installed on the outfall sewer so that the quantity of sewage discharged into the stream can be maintained constant. These basins serve as storage space for the sewage during periods of daytime or heavy flow and are emptied during periods of night or low flow.

Similarly, impounding reservoirs constructed on the stream for the purpose of maintaining a constant dry weather flow are used in some places as a means of sewage treatment. These reservoirs afford large quantities of dilution water containing dissolved oxygen which is necessary for complete stabilization of the sewage. The quantity of sewage discharged into these reservoirs is carefully controlled so as to prevent undue pollution. Since the organic material in the sewage stimulates the growth of vegetation and food for aquatic life, fish

and ducks are often raised in these reservoirs for their food value. A sketch of the layout at Munich utilizing this system is shown in Figure 140.

In rural areas, sewage is often discharged onto agricultural land as a source of fertilizer and moisture for agricultural products. The land is prepared for irrigation by the construction of trenches, and disposal is carefully regulated to prevent overflow into near-by water courses. Where disposal is by this method, "Irrigation Associations" have been organized to assume the responsibility of careful control.

Sewerage and sewage disposal systems and damage thereto by bombing, as observed in several German cities, are as follows:

*Hamburg:*⁵ Sewage from this city is not treated except for mechanical coarse screening before discharge into the Elbe River. Several of the drainage areas were severely hit causing damages to the collecting system, lift stations, pressure lines and outfall sewers. As a result of these damages and the subsequent clogging of pipes with debris and silt,

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sewage backed up into residences and business establishments. In cases of damage to pressure lines or outfall sewers, the sewage was by-passed into road ditches or small tributaries to the Main River. This, of course, resulted in gross pollution to these small streams. Pump stations undamaged were sometimes shut down in an effort to save electric power. The total number of breaks in the system is not known, but it is probably safe to assume that they approached the number of recorded breaks in the water system, approximately 4,500.

*Stuttgart:*⁴ Treatment in this city consists of rough screening and settling tanks with continuous sludge removal to heated digestion tanks. Digested sludge is run to drying beds, then sold as fertilizer. Treated effluent goes to the Neckar River. The gas produced in the digesting tanks is used as fuel for over-all plant operation, the remainder being turned into the city gas system (approximately 8 per cent of the city supply) or compressed in cylinders for motor fuel. Raw sewage was sometimes used in emergency for fighting fires. This occurred in the big fire raids in 1944 when fire department pumpers shifted their intakes and sprayed large residential areas with sewage to hold back the fires. The health statistics show no marked in-

crease in water-borne disease following this procedure. Since April, 1943, the sewerage system suffered a reported 617 breaks. To May 23, 1945, 267 of these had been repaired, requiring 60,000 man days' labor. The remaining 350 breaks will require an estimated 70,000 man days for repairing. The disposal plant suffered only minor damage by bombing.

*Ulm:*⁶ Disposal of sewage and waste water is by discharge into a network of canals which in turn discharges into the Danube River below the city. Street drainage, rain water, kitchen and lavatory wastes are discharged into these canals without treatment, but sewage from toilet facilities is first settled in two compartment septic tanks located on the house sewer line. Damage to the sewers was extensive, the total number of breaks being unknown as many lines were covered with debris. Although hit many times, the system was maintained in comparatively good condition until December 17, 1944, and was especially hard hit during the raids of February and March, 1945. Most of the breaks could not be repaired during that time and as a result the system became clogged at many points with heavy accumulations of sludge and debris. These stoppages caused sewage to back up into the deeper

TABLE 38. SEWAGE-WATER ASSOCIATIONS ORGANIZED IN GERMANY

<i>Name of association</i>	<i>Date organized</i>	<i>Population</i>	<i>Size of area sq km.</i>
1. Emscher Assn., Essen	July 14, 1904	2,500,000	784
2. Sewerage Assn. for the Laisebach Area, Waldenberg	Mar. 12, 1907	80,000	31
3. Sewerage Assn. in Moers on Left Rhine Bank	Apr. 29, 1913	250,000	965
4. Ruhr Assn., Essen	June 5, 1913	1,400,000	4500
5. Lippe Assn., Dortmund	Jan. 19, 1926	500,000	2800
6. Niers Assn., Viersen	July 22, 1927	470,000	1370
7. Schwarze Elster Assn., Bad Liebenwerda	Apr. 28, 1928	300,000	3650
8. Wupper Assn., Wuppertal	Jan. 8, 1930	680,000	620
9. Mulden Assn., Chemnitz	Dec. 23, 1933	2,000,000	5500
10. Weisse Elster Assn., Leipzig	July 23, 1934	1,960,000	5100
Total		10,140,000	25,320



FIGURE 138. *Moehne Dam. Nets installed after reconstruction to prevent floating mines from hitting dam.*

cellars of residences and mercantile establishments.

Insanitary conditions were also created by the lack of sufficient water for flushing indoor toilets and other plumbing fixtures. At the largest hospital in Ulm, the water supply had been shut off for several months after the heavy raids during the forepart of March, 1945. Drinking water had to be brought in by buckets and the plumbing system could not be used. Fecal matter was dipped from toilet bowls and deposited into horse drawn wagons or trucks for periodic hauling away.

*Nuremberg:*⁷ This city has five disposal plants, one of which is a plain septic tank, and four of the double chamber type, similar to the Imhoff tank used in the United States. No further treatment is given the sewage, tank effluents going to the Pegnitz River. Estimation of total broken sewer lines was impossible due to the large amount of rubble on many of the streets. Four of the treatment plants were not damaged but the fifth (North plant) was hit by aerial bombs and artillery shells causing severe damage. A gas holder was destroyed and the sludge mechanism put out of working order. It was estimated that complete repairs would require several months. Undiluted sewage was not used in fighting fires but water was used from a stream receiving sewage from several small sewers. This water, however, was not heavily polluted.

*Cologne:*⁸ Damages here, exclusive of the central part of the city which was too badly damaged to appraise, consisted of 47 breaks in main trunk sewers (Figure 141) and 136 in important laterals. A new complete treatment plant had been constructed but was destroyed by bombing before being used. The old primary treatment plant was already badly damaged and raw sewage was discharged directly into the Rhine River.

Where sewers were blockaded by debris and mud

so that they would no longer flow, or where residences and other occupied buildings were without water under pressure for flushing plumbing fixtures, gross insanitary conditions sometimes prevailed. In some cases fecal matter was collected in buckets or pails and deposited into wagons or trucks to be hauled away and dumped into a stream or low, isolated area. In other cases, however, the people were forced to dump their wastes into shallow trenches on vacant lots or gardens. Accumulations were not always covered or otherwise given proper disposal and government officials anticipated an increase in fly-borne disease rates unless sewerage and water systems were restored promptly.

*Munich:*³ The sewage collection system is the combined type (carrying sewage and storm water) with treatment facilities consisting of screening, Imhoff type settling tanks and sludge drying beds. The gas produced by sludge digestion furnishes about 8 per cent of the city gas supply and the plant efflu-



FIGURE 139. *Moehne Dam—Steel nets installed on the downstream side, after reconstruction, to prevent bombs dropped vertically from reaching base of dam.*



FIGURE 141. Trunk sewer blown open by direct hit during air raid. Damaged water main at left.

ent is discharged into a fish pond where fish are raised for food value (Figure 140). Prior to June, 1944, the sewage collection system was damaged in only 17 places but after this date increased aerial attacks and use of delayed fuse bombs caused heavier damages. Although the sewers were laid under 9 to 16 feet of cover, a total of 350 breaks were reported, often causing leaks into basements wherein people were forced to take shelter from the air raids. Because of the increased frequency in raids and the general shortage of labor and materials, only 110 breaks had been repaired by the last of May (Figure 142). The treatment plant "Grosslappen" was heavily hit on July 11, 1944, when two of the sixteen settling tanks were destroyed and two others severely damaged (Figure 143). Temporary repairs were made soon afterward so that the plant continued to operate at a reduced efficiency. Completion of permanent repairs would require an estimated 9 to 12 months.

*Augsburg:*² Treatment here consisted of screening and Imhoff type settling tanks. No damage was reported to the plant but 94 breaks occurred in sewers, 30 being repaired by June 6, 1945.

*Frankfort:*¹¹ The sewage system comprises 605 km. (430 miles) of sewers and twelve primary treatment plants (settling and sludge digestion) arranged as follows: one main plant serving 500,000 persons; one district plant serving 25,000 persons, and ten small plants serving from 50 to 4,000 persons. Before the war the quantity of sewage flow was approximately 33 million gallons per day. When observed in June, 1945, it had decreased to

approximately 26.5 MGD and only about 60 per cent was directed through the clarification plants. Because of unrepaired damage to collecting sewers, the remainder was diverted directly to the Main River through emergency outlets. Due to bomb damage of the main plant which destroyed four sedimentation basins, pumps, sludge drains, power and light lines, tools and other equipment, ten of the fourteen sedimentation basins could be placed into makeshift operation only. This resulted in an estimated 50 per cent loss in efficiency of treatment. The other plants were not damaged and were in operation at the time of this visit.

Damage to the sewage collecting system amounted to approximately 500 breaks during the air raids of 1943, 1944, and 1945; 150 of these were in the main collecting system which is laid at a depth of 13 to 20 feet, generally in ground water. Because of the difficulty in making repairs and the lack of labor and equipment, only about 50 of these breaks were repaired during 1944 and 1945. The other 100 breaks required a total of 52,000 days of labor and an additional 57,600 days of labor were required in repairing approximately 400 breaks in the smaller lateral sewers. Two of eight pumping stations were taken out of operation because of damages to the pressure lines and two others because of electric power failure. By June 13, 1945, approximately one-half the total quantity of sewage from the city was being discharged without treatment into the Main River.

Other effects of bomb damage to sewerage systems: Aside from the amount of material and man hours required for the repair and reconstruction of sewers and disposal plants other effects of bombing include loss of fertilizer, resulting in lowered production of foodstuffs, and loss of gas production for plant operation and as a source of fuel for trucks and automobiles.

According to Sierp,¹⁴ one kilogram (2.2 lbs.) of organic matter—sewage sludge—will produce about 875 liters (31 cu. ft.) of gas when digested at 45° C (113° F); 3.4 cubic meters (120 cu. ft.) of purified sewage gas has the fuel value of one gallon of gasoline. Sierp also states that under normal driving conditions an automobile with a 40 PS (39.5 horse power) engine will travel about 100 kilometers (62 miles) on 18 cubic meters of methane gas from sewage (Figure 144).

The potential gas production from sewage is about 25 liters (0.9 cu. ft.) per man per day. Thus a sewage disposal plant serving a city of 100,000

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FIGURE 142. *Damage caused by direct bomb hit on trunk sewer during air raid—Munich.*



FIGURE 143. *Bomb damaged settling tanks—Munich sewage disposal plant. Sludge drying beds in rear.*



FIGURE 144. *Compressed gas for auto fuel—typical installation. Gas obtained from sewage disposal plants and gas works.*

could produce 2,500,000 liters (90,000 cu. ft.) of gas, with a fuel value equivalent to 735 gallons of gasoline. Destruction of sewers and disposal plants would thereby impair transportation, if the cities depended to any extent upon sewage gas to relieve this hard pressed transport system. Just how much effect destruction of these utilities had on fuel shortage is not known as the exact figures were not available for the amount of sewage gases compressed for motor fuel.

Garbage—collection and disposal

Garbage collection and disposal methods as observed in several German cities^{5, 12, 15, 16} are as follows:

Heavy weight sheet metal garbage cans are furnished by the city to each residence and establishment. These cans have heavy hinged lids, some self closing, and hold approximately 25 gallons. They are sufficiently heavy in construction to prevent dogs from upsetting them. The tightly fitting lids also prevent access of flies and rodents to the

contents (Figure 145). The quantity of garbage per capita per year averages about 0.3 cubic meter (10 cu. ft.). Modern garbage trucks are of all metal-covered type construction, of about 10 cubic meters (350 cu. ft.) capacity. Some have an automatic mechanism for elevating and dumping garbage cans. Disposal of garbage is by incineration, burial, or composting for use as fertilizer.

Bombing and general war conditions interfered seriously with garbage collection and disposal. During the last months of the war a shortage of manpower existed. The condition steadily became worse as trucks were confiscated for military uses or were destroyed in the raids. As gasoline became less and less available, trucks were equipped to run on gas from wood burners, or on gas compressed in cylinders. Gas plants were destroyed by bombing and artillery fire, eliminating this source of fuel for trucks. If horse-drawn carts were available they were used to the best advantage, but eventually the destruction of buildings and streets made collection impossible. Garbage cans were ob-



FIGURE 145. Typical German garbage cans. Property of the municipality. Note heavy construction with hinged, tightly fitting lids.

served in Cologne with potato vines growing down the sides, indicating how long they had been standing. When collection was re-established, garbage was often dumped in shell and bomb craters and covered with dirt and chloride of lime if it happened to be available. When rats were reported, poison baits were set around the garbage dumps. The following report on street cleaning and garbage removal was obtained from the city of Hamburg. The methods described are fairly typical for the cities visited.

Street cleaning: At the beginning of the war there were about 750 men employed in street cleaning. Main thoroughfares and streets with heavy traffic were cleaned once daily, residential streets two to three times weekly. The city area was divided into units, and the men assigned to each unit were responsible for the cleaning of their own districts. An annual total approximating 378,000 barrels of garbage was collected in carts and deposited in subterranean dumps numbering about 440. The removal from these dumps was by tractor-trucks operated under contract by the regional freight railroad system, except in the city district

of Altona where it was left to city forces for deposition on private or municipal garbage dumps.

Accumulations of sludge from approximately 64,000 street gully catch basins were also removed in this manner. This system of street cleaning was maintained regardless of the steadily reduced personnel without essential disturbance until the big air attacks in July, 1943. It then became necessary to make fundamental changes to meet the inadequacies.

For weeks the street cleaning could only be executed scantily because of the loss of personnel and vehicles, since a great number of the workers were over-age. In addition, the scarcity of vehicles became more pronounced and the fuel allotment was further reduced. Hence it was impossible to operate on a regular schedule of removing the garbage from the dumps and it was necessary to permit it to accumulate in heaps.

On June 27, 1945, the situation began to improve with more workers, trucks and horse carriages becoming available. Practically all accumulated garbage had been removed from the streets and the street cleaning program returned to normal.

Garbage removal: At the beginning of the war house garbage was removed in the city proper and in the larger urban areas by means of special trucks. Garbage containers of 25 gallons were supplied by the government and were kept in the basement of the dwellings. For the removal, 85 special trucks and for the city district of Altona 12 electrical tractors were available.

A total of 5,350,000 barrels of house garbage was removed, one half to the incinerators and the other half to various garbage dumps, situated in the outside districts of the city. Garbage was collected from houses twice a week. The full containers were carried out of the basements by a force of 400 robust workers who emptied them into trucks and then replaced empty containers.

From the beginning of 1942, when numerous workers were drafted and bombings occurred, it was necessary to use hired foreign volunteers. Until the catastrophe of July, 1943, the removal of garbage was accomplished without difficulty. However, through enemy action 56 of the special garbage removal trucks, 77 per cent of the trucks on hand, were lost, the remaining 29 being ancient models of 1926. Thereafter until an improvised system of collection and removal could be organized, garbage was collected only in certain places where gross insanitary conditions prevailed. In other

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FIGURE 146. *Hamburg after the air raids in July-August 1943, showing buildings gutted by fire.*

places it was thrown among the ruins and debris of demolished buildings. Sometime later, 15 modern trucks were obtained and additional trucks were rented. Although the collection schedule was improved, new difficulties were encountered. The truck motors had to be readjusted to use a substitute fuel and even this was not available in sufficient quantities. This condition lasted until the end of the war, but by using prisoners of war and foreign workers, shortening the carting routes, creating new dumping places in the ruined areas and by using hand carts, oxen teams, and barges, the removal of house garbage beginning in January, 1944, amounted to from 190,000 to 200,000 barrels per month. The improvised dumps in the ruined areas were so arranged by the city administration of Hamburg to be far enough from occupied houses to prevent their being a nuisance or public health hazard. In order to protect the population from offensive smell and the plague of rats and flies, these places were continuously sprinkled with chloride of lime and covered with earth.

Housing (light, heat, shelter)

The widespread destruction of dwellings led to several possibilities for the homeless: evacuating and moving in with neighbors, friends or relatives, or even inhabiting the destroyed dwellings as well as possible. The figures on percentages of dwellings destroyed vary in different towns, but the problem was considered of tremendous magnitude by the Germans. To give examples: 85 per cent of inhabitable dwellings in Essen were destroyed and from 700,000 to 800,000 persons were made homeless after the heavy incendiary raids on Hamburg in July and August 1943 (Figure 146).

As a result of the Moehne Dam bombing, the following damage was reported by the Hygienic Institute (Gelsenkirchen) by the flooding of the Ruhr Valley: houses completely destroyed—95; dwellings slightly to heavily damaged—971; farms slightly to heavily damaged—32; factories totally destroyed—11; factories slightly to heavily damaged—114; farm land destroyed—7,000 acres; farm land damaged—3,000 acres; cattle lost—5,700; pigs lost—625; railroad and street bridges destroyed—25; bridges slightly to seriously damaged—21 (Figure 147). Various power plants were also heavily damaged. Evacuation of large sections of city groups, which is described in the report of the civilian Defense Division, was handled on a national level. Every possible means of transporta-

tion was made available to the administrations of bombed-out areas and, although well planned and organized according to statements from responsible Germans, they could not cope with the whole problem. People had to stand in the open air, frequently in inclement weather, often improperly clothed, while waiting for trains or vehicles which were to evacuate them to safe areas. Many were crowded into waiting rooms, meeting places and halls with improper ventilation. Droplet infections were, therefore, enhanced, and upper respiratory infections increased. Washing facilities were often not available nor was a change of clothing; and to make matters worse, a national scarcity of soap was noticeable. The increase in pyogenic infections, particularly furunculosis, among evacuees was attributed to these factors in several public health publications. These same publications also deplored the increase in scabies and head lice and stated that by far the largest percentage of cases was found in evacuees, particularly children, in whom the urge for cleanliness had not been sufficiently fostered. Periodic inspections of native and foreign labor camps were conducted by health department personnel. (Cassel).¹⁵ Barracks were fumigated, clothing disinfected and inmates deloused when body or head lice were found.

Through overcrowding in homes, contacts with tuberculosis patients and carriers of diphtheria and streptococci were greatly enhanced. This is held to have been the greatest single factor contributing to the increase in diphtheria described in Chapter Four. In contrast to the above-mentioned increase of diphtheria, upper respiratory infections, pyogenic infections and scabies, was the absence of serious outbreaks of disease in those persons who had preferred to remain in their destroyed homes. Many families preferred to move into cellars and basements or even apartments which had been partially or almost completely damaged, instead of being evacuated to some other parts of Germany. They accomplished only the most urgent repairs, such as the replacement of broken window panes with plywood or paper. They were exposed to seeping sewage, and even seeping carbon monoxide from smouldering fires, or broken gas mains. Drinking water had to be carried from wells, street taps or wagon tanks, and although boiling of the water was recommended it is doubtful whether it was done in all cases. However, no serious outbreaks of enteric fevers ensued. Washing facilities were naturally very poor and contributed to the increase



FIGURE 147. Flood damaged houses in Neheim after bomb destruction of Moehne Dam, May, 1943.

in pyogenic infections which were generally observed throughout Germany during the war.

Before the war most cities carried on energetic campaigns to eliminate rats and other rodents. Poison baits were made available to property owners with instructions for setting them out. In some places (Nuremberg) participation in these campaigns was made mandatory by police department ordinance. As a result, the rat population was quite effectively controlled so that rats were not numerous except in sewers, dumping grounds and similar places where waste food was abundant. After the air raids, however, when it became necessary to curtail regular schedules of garbage collection, the rat population began to increase. They became particularly numerous in the bombed areas where food was scattered or garbage was dumped into the debris, and the ruins of buildings afforded excellent harborage. This is somewhat contradictory to the report from Hamburg where the absence of Weil's disease was attributed to rats being driven out of the city by aerial bombings. In June, 1943, the problem was apparently serious enough to warrant the attention of national government officials as a decree was issued by the Reich Ministry of the In-

terior ordering the destruction of rats by the civilian population (Nuremberg).⁷ Experts were sent to various cities to supervise the extermination of rats and other rodents. These eradication programs continued for a while until the lack of trained personnel and poisons interfered. During 1944 and 1945 the shortage of workers and materials became acute in some of the cities. Consequently little work was being done and the rat population again increased. However, most city officials reported the situations not serious from the standpoint of disease transmission. Some even reported the population to be diminished after the air raids because many were killed or driven away by fires and explosions.

Problems of decomposing bodies

The layman in Germany apparently had great fear that the presence of dead bodies in the ruins presented a threat to his health. To combat this impression, Professor Hagen and Rose¹⁷ of the German Air Force expressed the opinion (Aug. 1943) that there was very little danger. This is the only official attitude which could be obtained. They based their opinions on the following observations and theories:

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(1). The body is not a carrier of disease since putrefaction destroys any pathogen which may have been present. Furthermore the dead were usually in places uninhabited by the population for at least a few days after the bombing. Numerous cases were observed where people returned to live in houses under which corpses were known to be buried. But by that time putrefaction had progressed to a point where corpses could no longer be regarded as potential carriers of disease.

(2). Although there was a possibility that the corpse might become a breeding place for flies, there usually were but few flies present in the area. Furthermore, the disease organism would have to be present before it could be carried by the fly.

(3). It is not likely that human bodies would cause an increase in the rat population. The decay is usually in such an advanced state that the rats prefer other foods which are plentiful as a consequence of destruction.

(4). The application of quicklime to bodies is not practical because it is objectionable from a moral and ethical viewpoint and has not been proved to be hygienically effective or absolutely necessary for reasons of sanitation.

(5). No special sanitary measures are necessary in the removal or cleanup of charred bodies reduced to ashes. If moisture from decomposing bodies is present the remains should be cleaned with hypochlorite of lime solution, and the body sprinkled with dry hypochlorite of lime to prevent odors.

(6). It is not necessary to treat the bodies with hypochlorite after burial; however, they should be covered with soil to a minimum depth of one meter. There is no danger of pollution to the ground water from bodies after burial.

How far these measures were carried out is not known, but the general impression was gained that the bodies of those thought to be dead were not recovered until someone got around to it. Unlike the ruins in England, the cities of Germany present a picture just as they looked when the fires had died down after the raids. If a building collapsed on a family huddled in the cellar, it is safe to say they are still there unless the bodies could be recovered without much time or effort. In Ulm laborers were observed recovering the bodies from a public shelter which had been hit two months previously. The authorities estimated that at the time of this survey, 10,000 bodies remained unrecovered in the ruins of the "dead quarter" of Ham-
burg. Excepting one or two streets that had been

cleared, this section appeared much the same as it must have when the fires subsided two years ago. In early summer, 1945, the most conservative calculated estimate was that 70,000 or 80,000 bodies were still decomposing in the ruins of German cities, and as yet there has been no satisfactory explanation why they have not presented a greater threat to good environmental sanitation than was apparent during the survey.

Summary and conclusions

Strategic bombing inflicted heavy damages upon the public water supply and waste disposal system of the cities selected as targets for aerial attack. In those places where residential or industrial areas were specific targets, water mains and sewer pipes were ripped open by the heavy bombs even though they were sometimes laid 20 feet below the ground surface. These damages resulted in heavy losses of water until the sections of mains could be shut off, and in seepage of sewage into bomb craters, cellars, wells or other depressions where it was a menace to the public health. In those places where the source of water supply was located near a factory* or other strategic target, heavy damages occurred to the pumping station resulting in a loss of water throughout the entire district. For example, the well field and pumping station at Augsburg, located within a few hundred feet of an airplane factory (Messerschmitt), was hit repeatedly when the factory was named as the specific target.

Generally speaking, disease outbreaks which were definitely proved to be water borne or which could be traced to lack of sanitary facilities were amazingly low in number. Through an interview with Dr. Wilhelm Heine,¹⁶ Director of the Hygienic Institute, Ruhr Territory, it was learned that two epidemics of typhoid fever were reported for which improper conditions of water supply and sewage disposal were held responsible. One of these occurred in Bochum, a city of approximately 450,000 population located midway between Essen and Dortmund, date of onset about April 9, 1945. To date, July 2, 1945, the number of cases reached 450, with a mortality rate of 19 per cent. People residing in the area were not vaccinated because of the lack of typhoid vaccine. Three possible causes for the epidemic were revealed: (1) eating meat slaughtered under insanitary conditions; (2) drinking polluted surface water, and (3) drinking ground water pumped in an emergency from a mine used as an air raid shelter having improper toilet facilities.

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During the second epidemic 21 cases developed in the town of Buerhassel, 20 kilometers from Bochum. The cause was attributed to lack of toilet facilities in a coal mine shaft used as temporary living quarters by a girl who supposedly was a typhoid carrier. Water from this shaft, which showed evidence of fecal contamination, was also used as an emergency source of supply for the town.

It is difficult to realize that other and more widespread epidemics did not occur. Certainly with such incidents as broken water mains and sewer lines lying side by side in bomb craters; with sewage overflowing into basements of dwellings and other buildings used as air raid shelters; with water purification plants destroyed necessitating the drinking of water from sources of questionable quality; with sewage being used for fire fighting; with people bathing in polluted streams; with hospitals and other public institutions operating without water or sewerage; with fecal matter being dumped in gardens and vacant lots without adequate burial; with garbage and other refuse lying for days in the streets and amid the ruins of occupied residential districts, the situation was ripe for the development of disease into epidemic proportions.

Obviously there had to be some control to prevent these conditions from getting out of hand, and it appears that the precautionary measures of carefully selecting sources of emergency water supply; of observing them frequently; of flushing repaired mains thoroughly and disinfecting them when materials were available; and above all of requiring the boiling of all drinking water were the chief factors in preventing epidemics of water-borne diseases. On the other hand, in the closing days of the war, labor and materials for the repair of sanitary facilities were getting more and more difficult to obtain. Hence, with repeated aerial attacks it was becoming impossible to carry on uninterrupted programs of adequate water supply, sewerage disposal and refuse collection, and many city officials were deeply concerned about the situation getting out of hand.

It is, therefore, reasonable to believe, on the face of existing conditions, that disease would have become rampant had not the Germans been forced to surrender when they did. In any event, the dread of disease and the hardships imposed by the lack of sanitary facilities were bound to have a demoralizing effect upon the civilian population.

REFERENCES

1. Pamphlet—Trink und Brauchwasser, F. Sierp. Reprint from *Handbuch der Lebensmittelchemie*, Julius Springer, Berlin, 1939. Not on sale.
2. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Ruhr-Verband, June, 1945. Unpublished.
3. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Munich, May, 1945. Unpublished.
4. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Stuttgart, May, 1945. Unpublished.
5. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Hamburg, June, 1945. Unpublished.
6. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Ulm, May, 1945. Unpublished.
7. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Nuremberg, June, 1945. Unpublished.
8. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Cologne, June, 1945. Unpublished.
9. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Dortmund, June, 1945. Unpublished.
10. Reports from the Institute for Hygiene of the Hanseatic City of Hamburg, "The Detection of Typhoid and Parathyroid in Surface and Waste Waters" and "Lactose-Fuchsine-Plate for Coli Detection in Drinking Water by Means of Membrane Filters," by Dr. Gertrude Mueller, Staff Member.
11. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Frankfurt, June, 1945. Unpublished.
12. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Augsburg, June, 1945. Unpublished.
13. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Karlsruhe, May, 1945. Unpublished.
14. Pamphlet—Häusliches und Städtisches Abwasser, F. Sierp. Reprint from *Handbuch der Lebensmittelchemie*, Julius Springer, Berlin, 1939. Not on sale.
15. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Cassel, June, 1945. Unpublished.
16. Sanitary Report, prepared for U.S. Strategic Bombing Survey by Department of Water-Sewage, Essen, June, 1945. Unpublished.
17. Danger of Epidemics Caused by Dead Bodies—Expert Opinion, by Professors Hagen and Rose, German Air Force, Hamburg, August 6, 1943.

CHAPTER ELEVEN

FOOD SUPPLY AND NUTRITION

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The health of the German people was the basic factor upon which depended the ability of Germany to wage sustained war. The continuity and nutritional adequacy of Germany's food supply constituted the foundation of this health.

Although Germany's agricultural economy was incapable of adequately feeding her own population without imports, she was able to withstand prolonged blockade by war. The effect of blockade on the food supply was in large measure circumvented by the operation of the German system of supply control which, in turn, assured the continuity of Germany's ultimate source of productive capacity. In consequence, the extent to which the Allied bomber offensive interfered with the German food supply system is a measure of its contribution to the defeat of Germany. This chapter is an evaluation of that contribution.

A partial exposition of the structure and function of the German system of food control will be included as a background by which the effects of bombing may be more clearly understood. Since the food supply embraces greatly dispersed and ramified elements, only the effect of bombing on the entire system will be reported. The detailed report on one or a few factories, for example, would be but a small fraction of the whole picture.

Organization of German food supply

From 1933 to 1945 the Reich Ministry of Food and Agriculture (Reichs Ministerium fuer Ernährung und Landwirtschaft) and the Reich Food Estate (*Reichsnaehrstand*) had charge of all agrarian policies in Germany.¹ Their activities were divided, giving the Ministry of Food control over policy and administration and entrusting the Food Estate with the execution of agrarian policy.^{2, 3} The detailed supervision of agricultural and food economy procedure was handled mainly by the Food Estate and its branches.⁴ Although it originated as a self-administrative body, the Food Estate came under the jurisdiction of the Ministry during the

war. The latter, at the same time, was made subordinate to the Ministerial Council for the Defense of the Reich. The two organizations, in addition to promoting agriculture in general, enforced the agricultural market regulations on production, sales and distribution of agricultural products, including retail sales and price control.⁴ To accomplish this the membership of the two bodies extended beyond the field of agriculture and included sections for the entire food economy: producers, distributors, workers and manufacturers of agricultural products.¹

The Food Estate was directed by the Reich Farm Leader, who was also the Minister of Food and Agriculture. It was subdivided into provincial, district and local farmers associations.^{2, 3, 4} Through this complex organization the delivery of agricultural produce by the peasants on the land was controlled.

Also under the Food Estate were Central Marketing Associations (*Hauptvereinigungen*) at the national level to regulate and tax the movements of agricultural goods.^{2, 4} At the outbreak of the war there were in existence Central Marketing Associations for grain and fodder, milk and fats, eggs, livestock, potatoes, sugar, garden products, vineyard products, fish, brewery industry and confectionery. Under the Central Marketing Associations at the national level there were corresponding agencies at the lower levels which usually coincided with the area of the farmers association.

The activities of the Central Marketing Associations were limited to the realm of domestic trade. Foreign food trade was controlled by the Reich Offices (*Reichsstellen*).^{1, 4} Their duties included the regulation of tariffs, co-operation with domestic trade control and the storage and marketing of imported foods. At the beginning of the war there were in existence Reich Offices for grain and fodder; animals and animal products; dairy products, fats and oils; eggs; and garden and vineyard products.

Figure 148 translated from the original pre-

Organization of Food Control
in Germany

FIGURE 148

<p>Tasks:</p>	<p>Rationing and determination of requirements according to rations</p>	<p>Supply of requirements and adjustment of balance between surplus and deficient areas</p>	<p>Collection and shipment of supplies to wholesalers (import and export firms), manufacturers and retailers</p> <p>Regulation of the supplies and reserves</p>
<p>Agencies at: National level:</p>	<p>Reich Minister of Food and Agriculture</p> <p>In addition to these there are Reich Offices (Reichsstellen). Of these, some were set up in addition to the Central Marketing Associations; others in lieu of Central Marketing Associations. The Reich Offices were originally established as administrative departments of the Ministry of Food and Agriculture to regulate imports. Later they were also charged with the control of agricultural economy, especially in the field of storage of stocks, to the extent to which no Central Marketing Association existed.</p>	<p>Reich Farm Leader</p>	<p>Central Market Associations (for grain, potatoes, cattle, milk, fat, eggs, etc.)</p>
<p>Provincial level:</p>	<p>Provincial Food Office, Dept. B</p>	<p>Provincial Farm Leader, during the war: Provincial Food Office, Dept. A</p>	<p>Provincial Marketing Associations (for grain, potatoes, cattle, milk, fat, eggs, etc.)</p>
<p>District and city district level:</p> <p>Local level:</p>	<p>District of Municipal Food Office, Dept. B</p>	<p>District Farm Leader, during the war: District Food Office, Dept. A</p> <p>Local Farm Leader</p> <p>(Reich Food Estate)</p>	
<p>Functions:</p>	<p>Distribution of ration books and other ration permits to consumers</p> <p>Acceptance of ration stamps from the dealer and exchange into retail ration permits authorizing purchase of additional merchandise from the wholesaler</p> <p>Exchange of retail ration permits into wholesale permits authorizing purchase of merchandise from manufacturers or distributors</p>	<p>Control of deliveries of the provinces, districts villages and individual producers in accordance with established requirements</p> <p>Proof of deliveries made</p> <p>Adjustment of balances between surplus and deficient areas in cooperation with the Provincial Marketing Associations</p>	<p>Regulation of the distribution to manufacturers and wholesalers, with simultaneous consideration of regional balances</p> <p>Control of the distribution of all wholesale and retail ration permits</p>

pared by officials of the Reich Ministry of Food may serve to outline the structure and function of this complex organization more clearly.⁵

Production

Since Germany could not raise within her own boundaries sufficient food to supply her population adequately, self-sufficiency was a question of serious national consequence long before the war.^{6, 7} Even prior to the advent of totalitarian rule many national officials labored on the problem of increasing the degree of self-sufficiency of Germany.⁸ With the inception of the Nazi regime, the measures invoked to achieve this end became progressively harsher. The Goering Four-Year Plan was an example of the effort expended on this problem. It is notable, however, that our observations after the war indicated no development of new basic ideas or policies. Rather the war had led only to more thorough exploitation of previously established principles.

By the beginning of the war, Germany's over-all self-sufficiency in food had reached a level of approximately 83 per cent, on the peacetime basis of 2200-2400 calories per person per day, according to Hans-Joachim Riecke, State Secretary in the Reich Ministry of Food and Agriculture. In respect to some types of food, however, the situation was not satisfactory. For example, before the war she produced approximately 73 per cent of fish requirements, 12 per cent of corn, 50 per cent of legumes, and 60 per cent of fat within her own boundaries. To attain even this supply of fat, great effort was expended in increasing the hectareage of land devoted to oil seed cultivation approximately forty-fold from 1933 to 1939.^{9, 10} Thus it is clear that since the production capacity of all land within the pre-1939 limits was strained to the utmost to attain even this degree of self-sufficiency, any factor which decreased the yields per hectare was immediately reflected in the nutritional status of the population as a whole.

The country could be fed at a reduced level by the produce raised within its own boundaries if food were perfectly controlled and evenly distributed. However, in practice individual provinces were much less favorably situated in this respect.¹¹ Western Germany, an area of relatively small and diversified farms, was critically dependent on the eastern provinces for its flour, grain, and potato supplies. Reich Minister of Food and Agriculture Herbert Backe stated that it was necessary to ship

from 8 to 10 million tons of grain from east to west each year, not including Danzig and Posen. Industrialized centers in all parts of the country were dependent on the produce of widely dispersed areas for all their food supplies. Consequently, it is clear that all German civilians could be fed at a uniform level of adequacy during a war only by control of the country's food supply at the national level and by the continued operation of the transportation network of the country. Dr. Alfons Moritz, Head of Department II of the Reich Ministry of Food and Agriculture, stated that for this reason the bombing of rail and inland water transportation facilities became such a serious threat to national uniformity in food distribution.

Food processing

Of the many kinds of centralized food processing industries known in the United States, only a few played an important role in the food supply of German civilians.^{12, 13, 14} The principal examples of these were grain milling, sugar production and refining, and the large bakeries of urban areas.^{6, 15} The damage or destruction of these facilities, incidental to air attack on other industrial targets, seriously decreased their production capacity.

At the request of the Medical Branch of the Survey, captured officials of the Ministry of Food prepared a report which summarized the effects of bombing on the food industry.¹⁶ In discussing the processing industries these officials stated that of the total German grain milling output of 3,300,000 tons of rye and 4,000,000 tons of wheat per year, the bulk was centered near the river courses of the Elbe and the Rhine-Main with foci in Hamburg, Berlin, Bremen, Duisburg, Cologne, Mannheim, Ludwigshafen, Frankfurt-on-the-Main, Magdeburg and Dresden. The daily productive capacity of these mills was approximately 49,000 tons of grain. Aerial bombardment put out of action mills with a yearly output of 310,000 tons of rye and 1,400,000 tons of wheat or a daily productive capacity of 10,500 tons for both types of grain. This damage corresponds to a reduction of 9 per cent of the rye output, 35 per cent of the wheat output, and 22 per cent of the daily production capacity of all German mills having a daily output of more than 500 tons each. In Table 39 the effects of bombing between the heavily bombed non-Russian zone and the lightly bombed Russian zone of Germany are shown clearly by a breakdown of the statistics.¹⁶

FOOD SUPPLY AND NUTRITION

TABLE 39. BOMB DAMAGE TO GRAIN MILLS

	Yearly Output		Daily			
	Rye Tons	% %	Wheat Tons	% %	Production Tons	Capacity %
Non-Russian Zone	250,000	21	1,300,000	49	9,500	38
Russian Zone	60,000	3	100,000	8	1,000	4

Of the oat and barley mills, which were centered in Schleswig-Holstein, Oldenburg, and on the Rhine and Elbe River courses, bombing reduced the production capacity by 50,000 tons or 20 per cent of the total German production capacity for each type of grain. It was stated that the above figures apply only to large mills and include only that damage reported before the end of March, 1945, and that they should be increased by an unknown amount to include the damages to smaller mills and the effects of the bombing of late March and April. The report also stated that the effects of aerial attack on the alimentary paste industry, which is centered in southwest Germany and along the Rhine, were unknown because contact with these industries had been lost during the period of heaviest bombardment. Backe stated that bombing destroyed all the grain mills in Berlin except the Osthafen Muehle, or more than 80 per cent of the daily production capacity.

The center of the sugar industry, according to the report, was located in Saxony, Lower Saxony, Lower Silesia, Pomerania and the Rhineland. Factories producing raw beet sugar were located almost exclusively on the outskirts of the larger cities, in many cases at strategic rail traffic junctions, while pure sugar refineries were for the most part within the cities close to other industries. The damages to refineries, therefore, were considerably greater than those to raw sugar factories. Of the total yearly output of Alt-Reich refineries (800,000 tons), four plants producing 300,000 tons were destroyed. This corresponds to a decrease in production capacity of approximately 38 per cent.

In the meat and meat products industries it was stated that bomb damage to slaughter houses and manufacturing establishments remained within reasonable limits. Due to the destruction of several important factories for artificial sausage casings, however, production of these had almost completely ceased.

The edible oil refining industry, comprising approximately forty large and medium size mills,

was centered on the lower Elbe, in Stettin, on the lower Rhine and in Central Germany. Altogether this industry is estimated to have had a pre-war total production capacity of about 600,000 tons of vegetable oils. The only information available on this industry was that air attack had caused production breakdowns of large magnitude and long duration. The *Deutsche Fettsaeure Werke* in Witten (Ruhr) had developed a process for producing 11,000 pounds of synthetic butter per day which was sold principally to hospitals for use in special diets. This rate of production was maintained until the latter part of 1944, when bomb damage interfered with the operation of the plant and its supply of raw materials.¹⁷

In an interview by members of the Medical Branch, State Secretary for Food and Agriculture Hans-Joachim Riecke revealed that in all cases of bomb damage to food processing industries it appeared that hits were scored only as incidentals to attacks against other industrial targets or in area bombing. He further stated that Allied bombing had failed to attack a large sugar refinery even when it presented a readily accessible secondary target when a primary oil target nearby could not be bombed.

As the intensity of aerial bombardment increased, Germany's difficulties in maintaining its food processing industries also became more acute. Early attempts at partially protecting plants with blast walls were given up when experience showed them to be inadequate. In the later years of the war the only measures taken to offset the effect of bombing on these industries was to reconstruct plants (when possible) as they were destroyed and to transfer the load to other undamaged facilities.

Fertilizer supply

The dependence of land productivity on the availability of nitrogen fertilizers is indicated by the German experience that a decrease in production of 15 kg. of cereals per kilogram of nitrogen was caused by an insufficient supply of nitro-

FIGURE 149

NITROGEN PRODUCTION IN GREATER GERMANY 1943-45

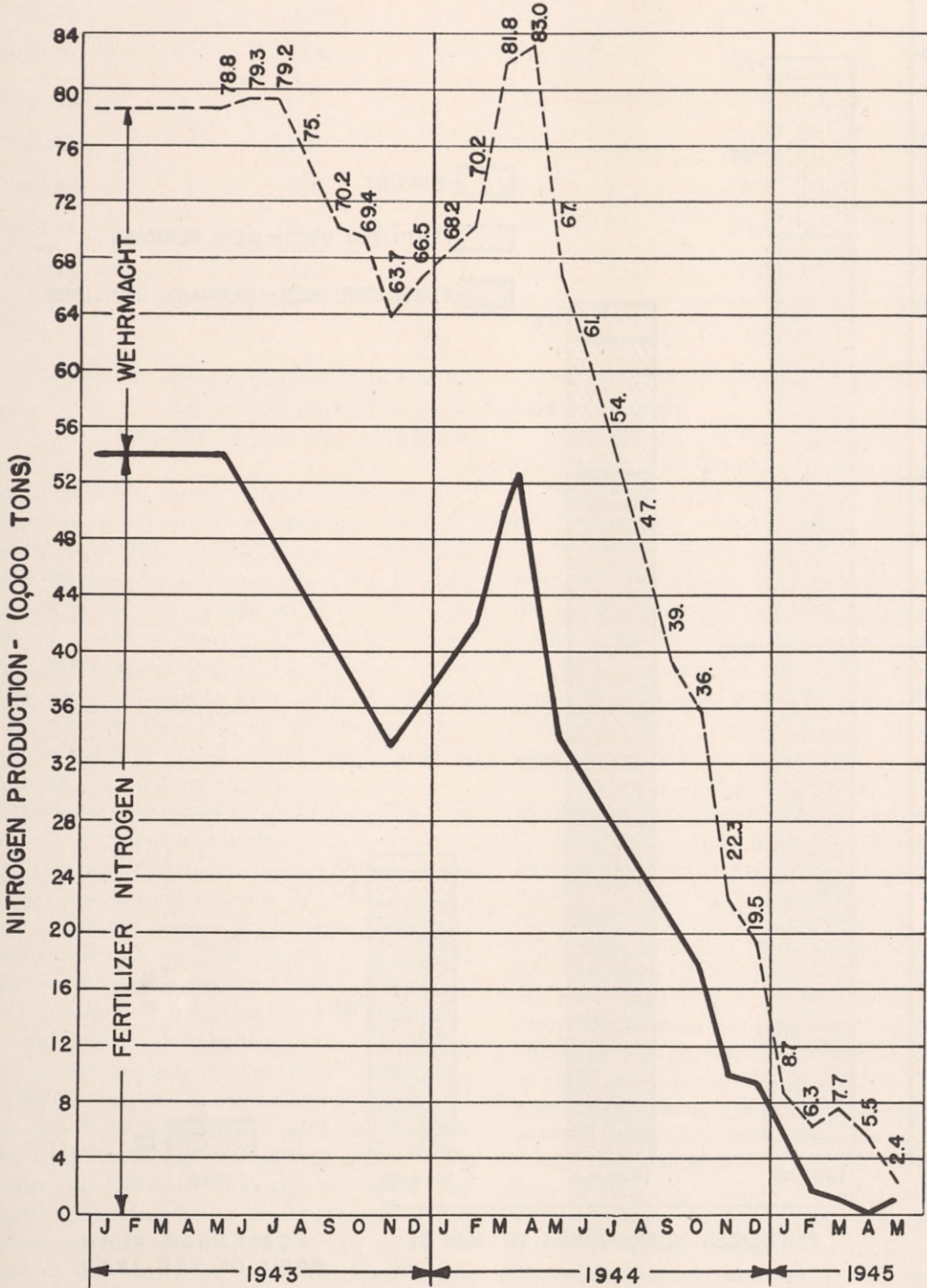
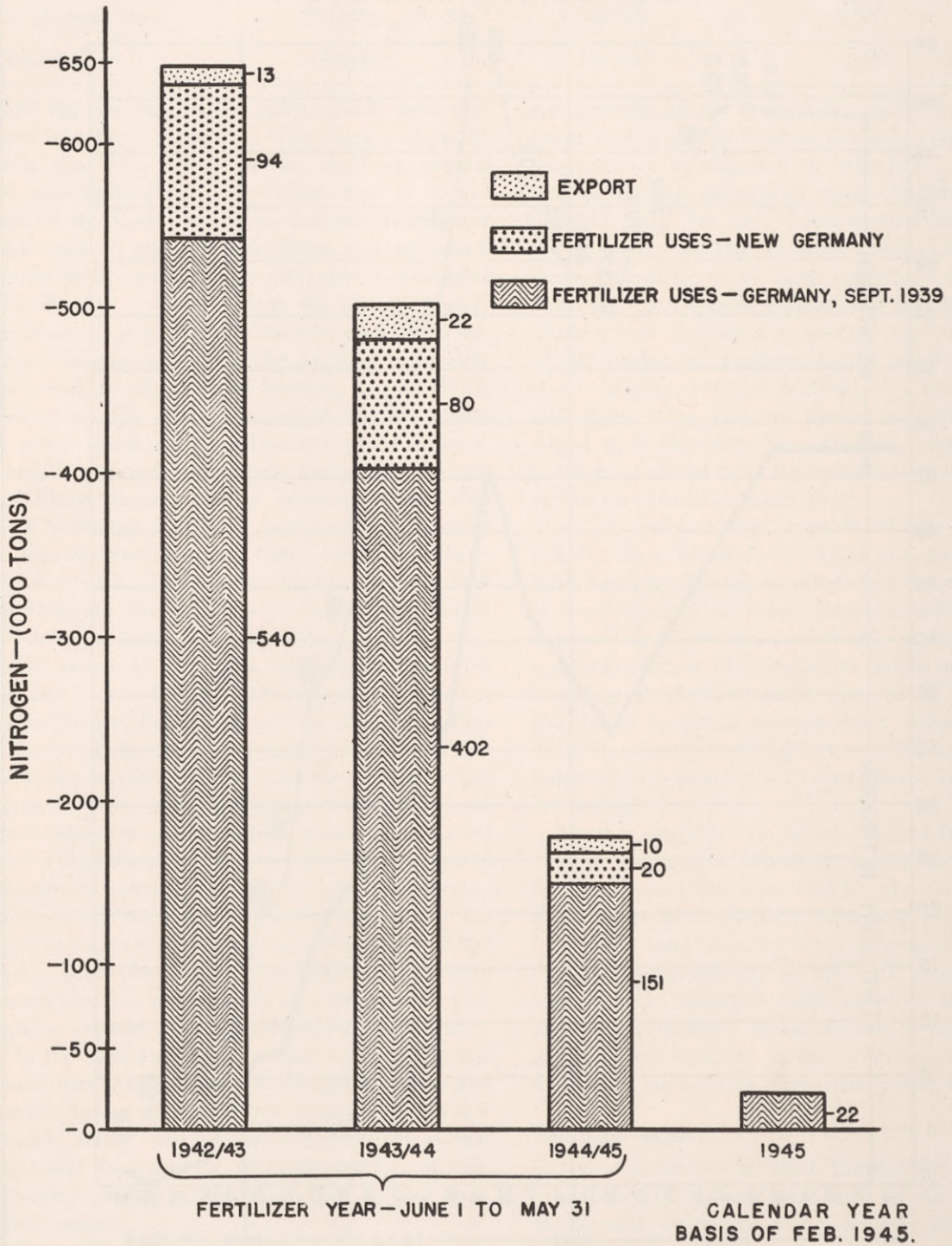


FIGURE 150

CONSUMPTION OF FERTILIZER NITROGEN GERMANY — 1942/45



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TABLE 40. CONSUMPTION OF COMMERCIAL FERTILIZERS BY GERMAN AGRICULTURE

Figures apply only to "Alt-Reich" territory or Germany without Austria, Poland, or Sudetenland.

Years (June 1-May 31)	Nitrogen (1000 T.N)	Potassium (1000 T. K ₂ O)	Phosphoric Acid (1000 T. P ₂ O ₅)	Calcium (1000 T.)
1938-39	718	1,256	762	2,963
1939-40	704	1,216	454	2,677
1940-41	675	1,366	351	3,280
1941-42	621	1,225	319	3,028
1942-43	506	1,348	340	3,372
1943-44	368	1,076	290	3,300*
1944-45	140*	—	60*	—

* Estimated.

gen.¹⁸ The trend of nitrogen production in Greater Germany (1943-45) and the consumption of fertilizer nitrogen (1942-45) is indicated by Figures 149 and 150.^{19, 20}

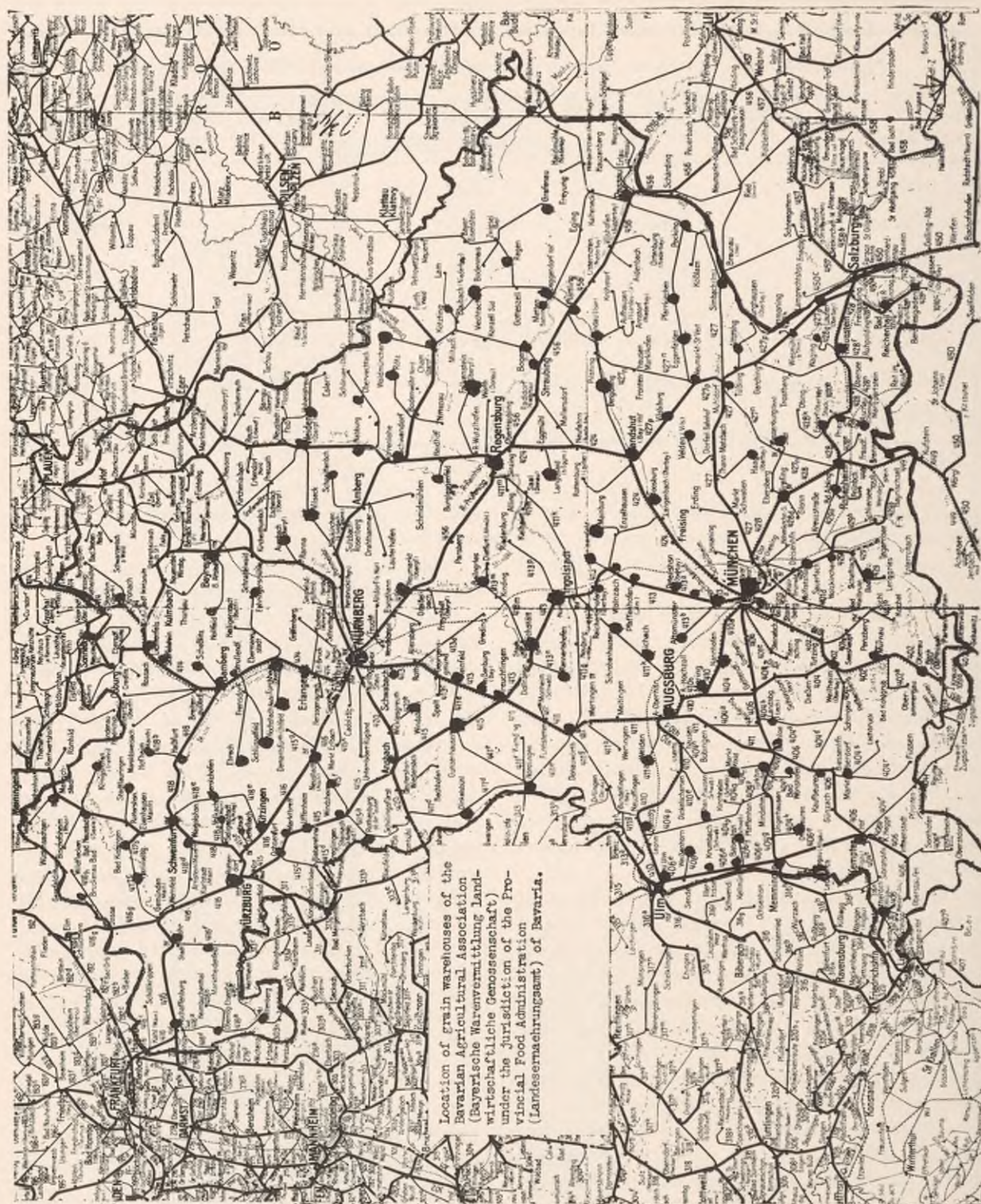
The information shown in these graphs is corroborated in a report dated December 6, 1944, signed by Reich Minister Backe and countersigned by Reich Minister for Armaments and War Production Speer.¹⁸ This report also stated that the agriculture of Greater Germany (Alt-Reich, Austria and the Sudetengau) had at its disposal during the last pre-war fertilizer year 1938-39, 745,000 tons of nitrogen, i.e., 21.5 kg. per hectare; and during the fertilizer year 1943-44, 398,000 tons of nitrogen, i.e., 11.5 kg. per hectare.

On the basis of a reduction in yield of 15 kg. of cereals per kilogram of nitrogen, this decrease of 10 kg. per hectare between the beginning of the war and 1943-44 is calculated to be equivalent to a loss of 150 kg. of cereals per hectare. The report also estimated that with the 192,000 tons planned for the use of agriculture in 1944-45 only 5 kg. would be available per hectare that year. This naturally would cause a further loss in yield. Later figures of actual consumption for 1944-45 show that only 140,000 tons, or 3.6 kg. per hectare, were used on the land.¹⁶ Backe went on to state that estimates for the 1945 cereal crop, not including the eastern territories (*Ostgebiete*), indicated it would fall 9,100,000 metric tons below the average of the last peacetime years, or about 4,800,000 tons below the average of the war years. This was based upon calculated estimates and on certified and controlled

statistics on the development of the crops for the most recent years.

Additional data on the consumption of commercial fertilizers by German agriculture from 1938-39 to 1944-45 are given in Table 40 which was compiled by officials of the Ministry of Food.^{16, 21} In describing this the Germans attribute the decline in nitrogen consumption until 1940-41 primarily to the increased supply required by the newly occupied territories in the east and west. From 1940 to 1943 the rising demand of the higher priority armaments industry for nitrogen was also increasingly detrimental to agriculture. After 1943-44, production losses increased daily so that in the production year 1944-45 at best only approximately 140,000 tons of nitrogen would have been available for agriculture. Most of these production losses were caused by the destruction of production plants, sources of power and transportation by air attacks. A detailed report on the extent of the destruction of nitrogen-producing facilities and its correlation with the bombing data is given in the *Appendix to the Final Report of the Oil Division of the Survey*.²² The German report further states that the initial decline in phosphoric acid shown in Table 40 was the result of the loss of imports.¹⁶ Up to the year 1943-44 the losses in domestic production capacity were still moderate, but in the second half of 1944 it declined rapidly on account of the increased damage caused by more intense aerial warfare. The relatively slight decline in potassium consumption after 1943-44 was caused primarily by progressive disorganization of transport by aerial bombardment.

FIGURE 151



Location of grain warehouses of the Bavarian Agricultural Association (Bayerische Warenvermittlung Landwirtschafliche Genossenschaft) under the jurisdiction of the Provincial Food Administration (Landesernährungsamt) of Bavaria.

In final analysis, aerial bombardment caused a diminution in agricultural productivity due to destruction of fertilizer production capacity. According to Dr. Karl A. Scheunert, President of the Reich Institute for Vitamin Assay and Research at Leipzig (*Reichs Institut fuer Vitamin Pruefung und Vitamin Forschung*), this contributed directly to an increasingly sharper decline in the consumer's daily food ration.

Storage

Storage is necessary in any food economy to eliminate the effect of seasonal variation in production. The war blockade increased Germany's dependence on its storage facilities, especially for those foods in short supply. Air attack against this link in the chain of supply destroyed reserve food stocks and storage buildings and interrupted the necessary supply of power for cold storage.¹⁶

These losses and the uncertainty of further losses through enemy action demanded increased attention by Germany to the storage of food. In the Ministry of Food, this attention resulted in the increased decentralization of storage facilities and the construction of enlarged cold storage space.²³ Decentralization of the bulk storage facilities in the area of the Provincial Food Offices of Bavaria is illustrated by the map in Figure 151.^{24, 25} The dispersal of bulk storage facilities indicated in this map was augmented from time to time by the Ministry's orders authorizing the issue of non-perishable foods, such as potatoes, to the final consumers weeks or months in advance of the normal rationing periods.

Professor Rudolf Plank, Director of the Refrigeration Institute in Karlsruhe (*Kaelte-technisches Institut der Technischen Hochschule Karlsruhe*), and internationally known as the leading refrigeration engineer of Germany, estimated that aerial bombardment had destroyed 35 per cent of Germany's total (approximately 460,000 square meters) cold storage capacity.²⁶ He also stated that the large cold storage warehouse in Mannheim, *Gebrueder Bender, G.m.b.H. Kuehlhaus Mannheim*, of approximately 6,000 square meters capacity, had been completely destroyed by bombing. Interrogation of the manager of the *Sueddeutsches Kuehlhaus* in Stuttgart, Fraeulein Maria Krafft, revealed that incendiary bombs reduced the cold storage space of 2,500 square meters by 36 per cent in February, 1944. Personal inspection of the 2,300 square meter *Kuelhaus und Eisfabrik Friedrich Kremper*, less than one-half mile away, re-

vealed no damage, however. Under interrogation two operating engineers of this plant stated that the incendiary bombs which had fallen on the plant in February and July, 1944, had been extinguished before they caused any damage. Manager Kruse of the *Linde Kuehlhaus* in Munich, stated that incendiary bombs in September, 1944, had destroyed 50 per cent of the entire 6,000 square meters of storage space of that warehouse. At the same time approximately 2,000,000 eggs, 400,000 kg. of butter, and 100,000 kg. of meat were damaged by the resulting fire which burned for eight days before it could be extinguished. Kruse estimated bomb destruction of the cold storage capacities of Berlin and Hamburg, both principal centers of this industry, to be approximately 50 per cent, and that approximately 58 per cent of Leipzig's capacity was destroyed.

The increased use of cold storage intensified Germany's dependence on transportation and on the continuity of the power supply. Aerial attack, as a result, not only decreased usable cold storage space as indicated above, but also seriously interfered with the operation of the remaining space by impeding shipments and damaging sources of power.

Dr. K. Linge writing in the *Zeitschrift fuer die gesamte Kaelteindustrie* in 1944 while describing the air raid precautions considered necessary for cold storage plants implied that no special provisions had been made for protecting these plants against damage from air attacks.²⁷ This was further corroborated by several officials of the Ministry of Food on individual interrogation.

All German sources of information and personal inspection by members of the Medical Branch are in agreement that bomb damage to bulk stocks while extensive was not alone sufficient to upset the food economy structure.^{23, 28} Estimates of the damage to stored foods in bulk warehouses prepared by specialists of the German Ministry of Food were as follows:¹⁶

Grain	220,000-250,000 tons
Edible fats	23,000 tons
Meat	6,000-7,000 tons
Sugar	60,000 tons
Sugar by-products	
for fodder	25,000 tons
Canned vegetables	2,000,000-3,000,000 cans
Canned fruit preserves	approx. 1,000,000 cans
Frozen fruits	5,000-7,000 tons
Potatoes	25,000 tons

To the quantity stated above must be added the indeterminate quantities lost in the retail trade and enroute and the indirect losses caused by the communal feeding and ration-free distribution of food to bombed-out civilians.

Distribution

The major task of the Ministry of Food was to direct the uniform distribution of bulk stocks and to continue an adequate supply of food to the final consumer. Immediately with the beginning of the war in September, 1939, an elaborate food rationing system was put into effect whereby the allowances of the principal foods were allocated to the individual civilian at four-week intervals.²⁹ Further detail on the administration and operation of the system will be presented in the section entitled "Food Control and Rationing System."

As the food available in any specific area was diminished through bomb destruction of food stocks, storage facilities and processing plants, the task of uniform distribution by the Ministry became more demanding. When the destruction of the transportation network out-distanced Germany's capacity to reconstruct it, however, uniform distribution became impossible by normal means and emergency measures were required. Eventually, even emergency measures were insufficient to meet the additional burden of intensified bombardment.

National control of the collection of food from surplus areas, its storage, its distribution to deficient areas and, through rationing, its consumption depended vitally on the communications network of the country. Experience showed that damage or destruction of transmission facilities and sources of power through air attack impeded this vital control in a given locality in proportion to the intensity and duration of the attack.

It was the constantly reiterated opinion of all food officials that the bomb destruction of the transportation network was the largest single factor contributing to the disruption of the food supply. Bulk shipments which had been carried on inland waterways were seriously impeded by the bombing of canals. Aerial attack against railway lines, bridges and terminal facilities caused widespread interruptions in service and destroyed rolling stock, freight enroute and handling facilities at terminals. These increasing disruptions made necessary a shift from canal and rail carriers to road

transport. That road transport could never replace the capacity of the normal carriers is readily apparent when one considers such bulk products as grain and potatoes, according to Fritz Siebert, of the Bavarian Ministry of Finance and Economics.

Ministry of food action against bombing

Consolidated reports of bomb damage to all parts of the food industry were received each morning by the food ministry. The reconstruction and renewed operation of the affected processing and storage facilities were based on these reports.

At Goebbels' order in 1942 an Interministerial Air War Damage Committee (*Interministerieller Luftkriegsschaedenausschuss*, or *LKA*) was formed to consolidate calls for assistance to the individual ministries from cities after air bombardment. The LKA comprised representatives of all ministries and was administered from an office in the Ministry of Propaganda. Despite its early beginning, the first call to the LKA came only after the heavy raids on Hamburg July 24-August 3, 1943. The LKA was called upon to make available emergency food supplies for communal feeding by a city which had been attacked only when the extent of damage made that city incapable of caring for itself or when neighboring cities or the respective provincial food office could not cope with the situation. After the LKA received a call for assistance, its members conferred to determine action to be taken. The food ministry representative on the committee then advised the Central Marketing Associations to give orders to the Provincial Marketing Associations. Necessary transportation for the shipment of food to bombed cities was requested from the rail and road transport ministries by the respective liaison official in the Ministry of Food. The size, composition and frequency of special food allowances to air raid victims were decided in each case by Ministerialdirektor Julius Claussen, head of Section B of Department II of the food ministry, on the basis of a point system he had established. The granting of special food rations was instituted after numerous requests from cities for more food, usually bread and butter. Special rations were also authorized by the Ministry on the order of administrative superiors after special request. The food distributed as post-raid allowances belonged to the Reich Offices previously described or was on loan to the national government from commercial owners.

Further action to counteract the effects of bomb-

FOOD SUPPLY AND NUTRITION

ing was taken by the food ministry in its own operation when its offices were moved into rural areas to diminish their vulnerability to air attacks, as reported by Julius Claussen and Hans-Joachim Recke.

Finally, in February, 1945, when transport had become so disrupted that uniform distribution of food was no longer possible, the basic national policy of food distribution was abandoned for a more expedient scheme. With this change in policy, the Ministry was forced to fall back on the ability of each province to produce all the food required by its own population. As previously mentioned, the agricultural characteristics of many of the provinces made individual province self-sufficiency an untenable thesis. Although it is based on the false premise that Germany was 100 per cent self-sufficient in food during the war, Table 41, derived from information prepared for the Medical Branch by officials of the Ministry of Food from agricultural production and consumption statistics, indicates the dangerous character of this step.³⁰

A monthly summary³¹ of the damage to all sectors of the German economy was published by Department III of the Reich Statistical Office at Weimar, according to information obtained through Dr. Walther Engelmann. Specimens of these showed in great detail the number of horses, sheep, head of cattle killed, the number of barns, stables, and pieces of farm equipment and gave a complete picture of the destruction in agriculture.³²

Food control and rationing system

Administration: The structure and administration of the Ministry of Food and Agriculture, like other German ministries, were highly complex in basic organization. In addition, it was penetrated with a Party control mechanism which paralleled the State organization.⁴ While there were many active Nazis in key positions at the ministry level, it appears that the political activities of this group were most evident at the lower levels where there was more intimate contact with the peasants.

The section of the Ministry which was responsible for the entire food rationing program was called Department Two (Abteilung II). The chief of this department, Ministerialdirektor Alfons Moritz, was responsible directly to the Minister of Food and Agriculture Herbert Backe.²

Dr. Franz Wirz, consultant to the food ministry, contended that political relationships between the Ministry of Food and the Ministry of the Interior

TABLE 41. THE DEGREE OF SELF-SUFFICIENCY
OF THE PROVINCES
(in % of total requirement)

	<i>Vegetable</i>	<i>Animal</i>	<i>Total</i>
Pomerania	168	147	157
Mecklenburg	165	157	162
Saxony-Anhalt	161	108	137
Lower Saxony	146	143	144
Lower Silesia	144	111	126
Marienwerder	143	144	144
East Prussia	133	147	143
Bayreuth	114	135	129
Upper Silesia	112	88	97
Kurhessen	109	126	121
Thuringia	101	92	94
Kurmark	93	50	65
Bavaria	78	129	117
Moselle Province	75	93	87
Hessen-Nassau	71	68	69
Wurttemberg	58	118	100
Schleswig-Holstein	57	106	89
Westmark	56	40	46
Weser-Ems	55	144	127
Westphalia	50	83	72
Baden	48	78	68
Rhineland	47	39	41
Saxony	47	47	47
Eastern Germany (average)	133	98	113
Western Germany (average)	74	101	92

NOTES

(1). Per capita food requirement is considered to be uniform for all provinces and equal to the average per capita production in Reich territory during the war years, i.e., Germany is assumed to be 100 per cent self-sufficient in all respects during the war. Therefore, the percentages stated indicate the self-sufficiency of the German provinces relative to each other only and do not give any indication of the adequacy with which the national nutritional requirements would be satisfied.

(2). The food imports and food consumption of this period were not considered in this table. Imported fodder, however, appears as animal products in the food production.

(3). Increased or decreased food production of the provinces compared to this food requirement approximately expresses food surplus and deficit. This is represented here in per cent of the food requirement of the provinces.

Example: Pomerania produces 157 per cent of its total food requirements, i.e., it has a surplus of 57 per cent over its requirements. Of its requirements Saxony produces only 47 per cent, i.e., it must receive 53 per cent of its requirements from other provinces.

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(4). Food production embraces market output plus self-supply by the farmers. This is measured by the "Grain Value" of the various products according to the following key:

100 kg. grain	=	100 kg. grain value
100 kg. legumes	=	120 " " "
100 kg. oilseeds	=	200 " " "
100 kg. potatoes	=	25 " " "
100 kg. sugarbeets	=	25 " " "
1 ha. vegetable area	=	4000 " " "
100 kg. live cattle	=	600 " " "
100 kg. live sheep	=	600 " " "
100 kg. live pigs	=	500 " " "
100 kg. live poultry	=	600 " " "
100 kg. eggs	=	500 " " "
100 kg. milk	=	70 " " "

made it difficult if not impossible to utilize effectively the ability of the nutrition experts of the country. It is of note in this connection that Moritz stated that the Wehrmacht had solved the problem of maintaining the nutritional adequacy of the ration much more effectively than the civilian sector because of its relative freedom from political influence. He further stated that the Ministry did not include on its own staff any qualified nutritionists. Despite these serious difficulties, fortuitous circumstances appear to have staved off a more rapid deterioration of the nutritive value of the German civilian's diet, in the opinion of Professor Benno Bleyer, University of Munich. When the food shortage eventually became critical, however, continued operation of the existing rationing policy brought incipient dietary deficiencies into sharper relief.

Operation: For the purpose of establishing food ration allowances the civilian population of Germany was divided into a number of consumer groups according to age and occupation. The manner in which these varied with time is shown in Table 42.³³ Farm workers and prisoners of war made up further categories, the latter varying as to the country of origin and the type of occupation.³⁴ As reported by Paul Kaufmann (Stuttgart), Jews were nominally divided into consumer groups, depending upon age and occupation; but in all cases allowances soon decreased to the starvation level. That Jews did not actually starve in most cases was due only to gifts of food from non-Jewish friends.³⁵ Special supplements were granted, in addition to the normal rations, to children and nursing and pregnant women on the basis of standards laid down by the national health organization.³⁶

The food allowances authorized for each consumer group were based on national dietary habits and on traditional methods of operation in the Ministry of Food rather than specifically on their

nutritional value. In establishing the ration allowances for any period, the food ministry merely calculated them from food stocks available.

Working from eight to ten weeks in advance of each normal four-week ration period, the Ministry based its calculations on a food balance sheet. A set of translated food balance sheets on a summarized yearly basis for the years 1938 to 1944 is reproduced in Appendix C-3.^{37, 38} On the asset side of the sheet were entered the amounts of critical foods available for distribution. These were determined from the quantities on hand and due in as reported by the lower levels of the food control system. The quantities required for consumption, based on the total population in each of the many consumer groups appeared as liabilities.³⁹ From these calculations were determined the daily allowances of foods per individual in each consumer group. In Appendix C-4 are given the daily ration allowances for every fifth rationing period from the beginning to the fiftieth period and for all rationing periods from period 57 to 74.⁴⁰

The only check on the nutritional value of the ration which was maintained by the Ministry of Food was the periodic calculation of its calorie, protein and fat content. The mineral and vitamin content of the ration was never determined by the Ministry. Copies of the calculated values for all consumer groups are included in Appendix C-4 on the sheets which show the daily ration allowances.⁴⁰ These calculations were carried out by a statistician in the Ministry and were based on food composition tables compiled by a committee of technical experts. A perusal of these documents makes it apparent that ministerial officials even among themselves were inclined to make the ration appear to be of higher value than it actually was. A copy of the composition tables will be found in Appendix C-5.⁴¹

The only additional checks on the nutritional quality of the ration were made by one or the other of several nutrition experts at the request of the Ministry, when a reduction in allowances was contemplated. Since none of these experts was directly responsible for maintaining the quality of the ration, even their sporadically expressed opinions on the subject seldom made much difference in the food ration policy. On occasion other experts made statements concerning the nutritional quality of the national diet either directly, or through the Ministry of the Interior, to the Ministry of Food. In all such cases, however, it was the

TABLE 42

Scheme of consumer groups in the German system of rationing of foodstuffs 1939 - 45 (without self-suppliers)									
Period ¹⁾	workers			Normal Consumers	Youths			Children	
	very heavy	heavy	long-and night		14-18	10-14	6-10	3-6	0-3
----- equal rates for all groups -----									
1									
2	+	+	-	+	+ ²⁾		+ ²⁾		+
3	+	+	+	+	+ ²⁾		+ ²⁾		+
4	+	+	+	+	+ ⁴⁾		+ ³⁾		+
5	+	+	+	+	+ ⁴⁾		+ ³⁾		+
6	+	+	+	+	+ ⁴⁾		+ ⁴⁾		+
7	+	+	+	+	+ ⁴⁾		+ ⁶⁾		+
8	+	+	- ⁵⁾	+	+ ⁶⁾		+ ⁶⁾		+

- 1) Period 1 = 8/28 - 9/24/39 = 1st ration period Period 5 = 11/18/40 - 4/5/42 = 17-34 ration period
 " 2 = 9/25 - 11/19/39 = 2-3 " 6 = 4/6/42 - 10/15/44 = 35-67 " "
 " 3 = 11/20/39 - 7/28/40 = 4-12 ration period " 7 = 10/16/44 - 4/8/45 = 68-73 " "
 " 4 = 7/29/40 - 11/17/40 = 13-16 " 8 = from 4/9/45 = from 74th " "
 2) for bread: 6-10, 10-14 years
 3) " " 6-10 years
 4) " " Normal consumers over 20 years, youths 10-20 years
 5) Eliminated because lack of raw materials and disruption of transportation made 24-hour work day impossible
 6) To conserve paper and minimize work of staffs which had lost personnel to the armed forces

often exercised prerogative of the Ministry to ignore such opinions.

Changes in ration allowances: Ration allowances were altered to conform to changes in the quantities of available food in accordance with the procedure outlined above. The gradual diminution in the available food during the course of the war was reflected in reductions in the size of the allowances to the civilian population. A graphic representation of the weekly allowances of the principal rationed foods is given in Figures 152, 153, 154, 155 and 156 for all changes from September, 1939, to the last functional ration period before Allied occupation.^{42, 43}

All Ministry of Food officials interviewed were in agreement that the ultimate factor which caused reductions in the consumer's allowances was a decrease in the agricultural output. Of the many factors contributing to such a decrease they listed the following in order of importance:

(1). Loss of eastern agriculturally productive territories outside the Alt-Reich as the enemy advanced. This loss was estimated to be approximately 10,000,000 tons of cereals.¹⁸ A large part of it was foodstuffs which had to be abandoned because bombing had disrupted transport.

(2). Reduction in available fertilizers, especially as sources of nitrogen, which accounted for a loss of approximately 9,100,000 tons of cereals.¹⁸ As shown above, this was due principally to damage to fertilizer manufacturing plants by aerial bombardment.

(3). Progressive decrease in fodder for meat animals in favor of food for human use.⁴⁴ This policy was forced upon the Germans as the biologically uneconomical conversion of food by animals could no longer be afforded by their straitened agriculture, as previously discussed.

(4). Decrease in availability of farm machinery and replacement parts due to the over-all reduction in production and distribution caused, in part, by bomb damage to manufacturing plants and transport.

(5). Decrease in manpower on the farms as the drain by the military services and by the reconstruction of bomb-damaged industry increased.⁴⁵

(6). Diminution in fuel for operating farm machinery due to air attack on production plants.²²

In addition, the destruction of reserve food stocks, processing plants, storage facilities and the disruption of transportation by Allied bombardment also assisted in the reduction of the food ra-

tion allowances. By November, 1944, the reduction in rations, particularly for the normal consumer group, had reached a critical stage.

By the beginning of 1945, the bomb destruction of the food supply system had attained such proportions that the Ministry of Food was forced to abandon its basic principles of rationing.⁴⁶ Due to the delays innate in calculating new allowances and in distributing forms for the ration cards to the Provincial Food Offices, it was not until ration period 74 (April 9 to April 29, 1945) that a new procedure was put into effect. At this time the earlier form of ration coupons, which stated the allowances of food in grams, were replaced by numbered coupons which bore no statement of the weight allowances or, in most cases, of the types of food. A translated extract of the decree of the Ministry of Food which established this change is reproduced in Appendix C-2.⁴⁶ In Figure 157 are reproduced samples of the ration cards authorized for the normal consumer group in period 65 (July 24 to Aug. 20, 1944) and for period 74 (April 9 to April 29, 1945) for comparison.⁴⁷ The allowance in grams and the type of food authorized for each coupon in each area was made known to the public by announcement only a few days before the beginning of a new ration week. Through the use of the new system, the Ministry hoped to offset its inability to forecast food stocks which had been forced upon it by the Allied bombing offensive. It was also hoped that the flexibility of the new system would make possible provincial differences in the ration allowances as the local food situations required.

The new system would have allowed an adequate food supply for the people in the provinces of surplus agricultural production. In provinces of less than 100 per cent self-sufficiency, however, it is obvious that unbearable shortages would soon have appeared. In addition, the disruption of communications by bombing made the collection of necessary statistics upon which to base national control almost impossible.

Supplements to ration: The basic food ration allowances were supplemented in some instances by additional quantities of the principal foods and by vitamin concentrates. An elaborate schedule of special supplements existed, authorized for the sick by the Ministry of Food for each ration period, which recognized the special requirements of different diseases and distinguished between hospital patients, outpatients and those ill at home.

FIGURE 152

DEVELOPMENT OF FOOD RATION ALLOWANCES

BREAD

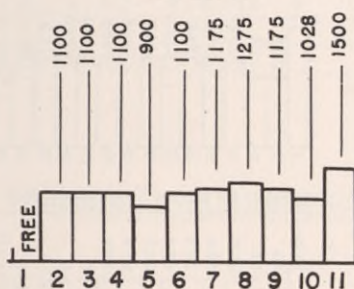
WEEKLY ALLOWANCES IN GRAMS

RATION PERIODS FROM:

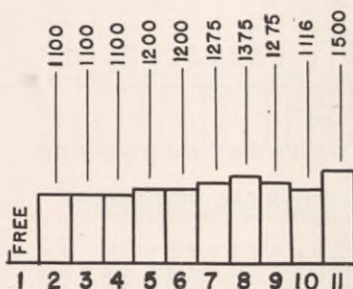
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25/9/39 - 19/11/39	(2)	19/10/42 - 30/5/43	(6)	5/2/45 - 8/4/45	(10)
20/11/39 - 28/7/42	(3)	31/5/43 - 19/9/43	(7)	FROM 9/4/45	(11)
29/7/42 - 5/4/42	(4)	20/9/43 - 15/10/44	(8)		

CHILDREN

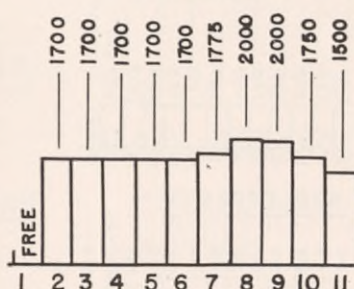
0-3 YEARS



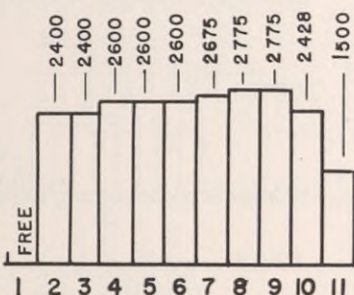
3-6 YEARS



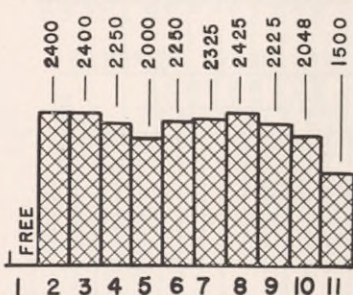
6-10 YEARS



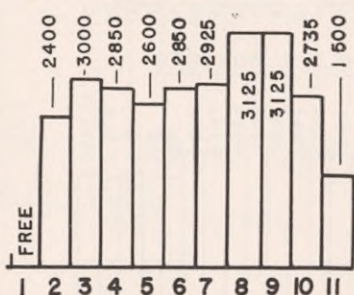
ADOLESCENTS



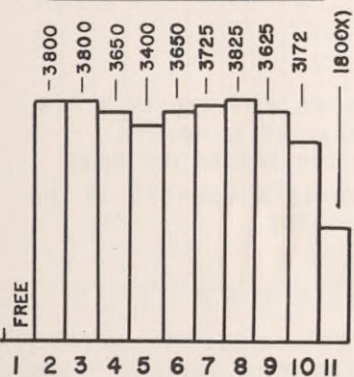
NORMAL CONSUMERS



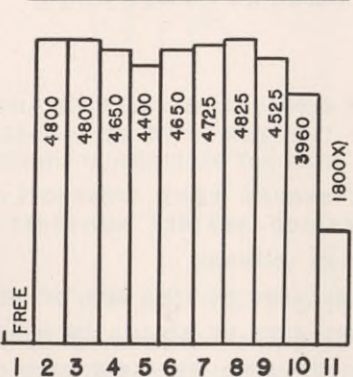
LONG & NIGHT WORKERS



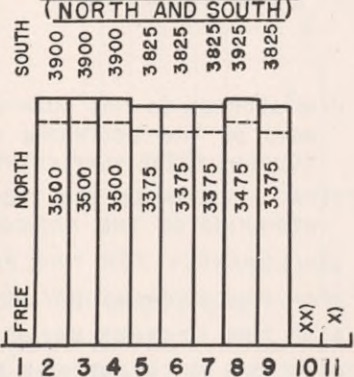
HEAVY WORKERS



VERY HEAVY WORKERS



SELF-SUPPLIERS (NORTH AND SOUTH)



X) - IN ADDITION TO THIS QUANTITY SUPPLEMENTS WERE TO BE ANNOUNCED WITHIN ONLY A FEW DAYS OF THE BEGINNING OF THE PERIOD. THESE SUPPLEMENTS WERE NOT UNIFORM FOR THE ENTIRE REICH.

XX) - ALLOWANCES FOR THIS PERIOD UNKNOWN.

DEVELOPMENT OF FOOD RATION ALLOWANCES

FAT

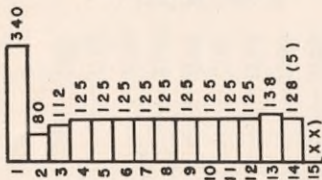
WEEKLY ALLOWANCES IN GRAMS

RATION PERIOD FROM:

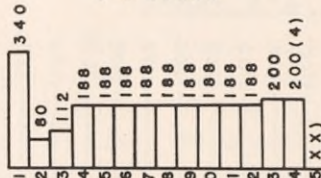
28/8/39 - 24/9/39 (1)	1/11/40 - 17/11/40 (6)	6/4/42 - 30/11/42 (11)
25/9/39 - 22/10/39 (2)	18/11/40 - 30/4/41 (7)	1/12/42 - 30/5/43 (12)
23/10/39 - 19/11/39 (3)	1/5/41 - 31/10/41 (8)	31/5/43 - 4/2/45 (13)
20/11/39 - 25/8/40 (4)	1/11/41 - 4/1/42 (9)	5/2/45 - 8/4/45 (14)
26/8/40 - 31/10/40 (5)	5/1/42 - 5/4/42 (10)	FROM 9/4/45 (15)

CHILDREN

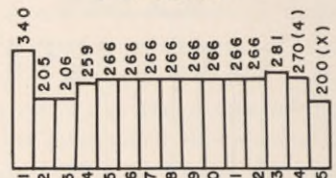
0-3 YEARS



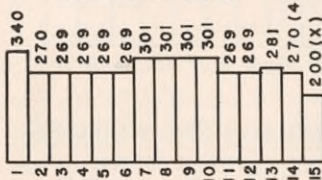
3-6 YEARS



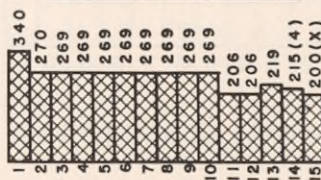
6-14 YEARS



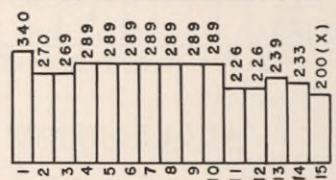
ADOLESCENTS



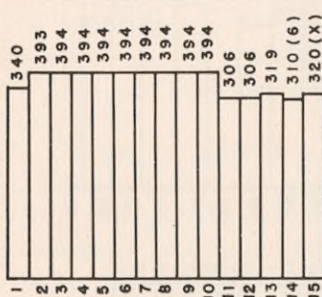
NORMAL CONSUMERS



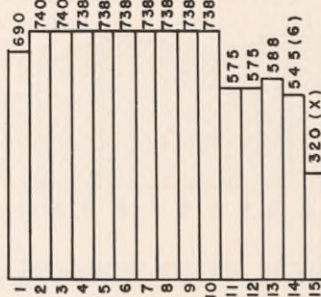
LONG & NIGHT WORKERS



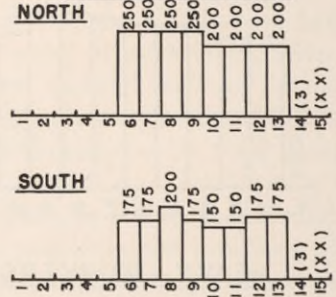
HEAVY WORKERS



VERY HEAVY WORKERS



SELF-SUPPLIERS (INCL. CHILDREN)



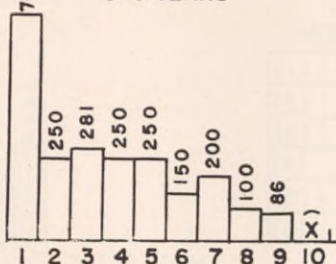
- X) IN ADDITION TO THIS QUANTITY SUPPLEMENTS COULD BE ANNOUNCED WITHIN ONLY A FEW DAYS OF THE BEGINNING OF THE PERIOD TO BE ISSUED AGAINST NUMBERED COUPONS. THESE SUPPLEMENTS WERE NOT NECESSARILY UNIFORM FOR THE ENTIRE REICH.
- XX) FAT ALLOWANCES FOR THESE GROUPS WERE, APPARENTLY, TO BE ANNOUNCED AT THE BEGINNING OF THE RATION PERIOD AGAINST NUMBERED COUPONS
- 3) ALLOWANCES FOR THIS PERIOD UNKNOWN
- 4) OF THIS 90 GRAMS MAY BE REPLACED BY 112.5 GMS. OF MEAT
- 5) OF THIS 40 GRAMS MAY BE REPLACED BY 50 GMS. OF MEAT
- 6) OF THIS 130 GRAMS MAY BE REPLACED BY 162.5 GMS. OF MEAT

DEVELOPMENT OF FOOD RATION ALLOWANCES MEAT & MEAT PRODUCTS WEEKLY ALLOWANCES IN GRAMS

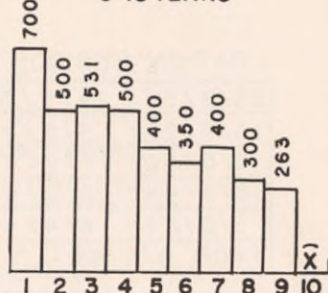
RATION PERIODS FROM:

28/8/39 - 24/9/39	(1)
25/9/39 - 19/11/39	(2)
20/11/39 - 10/3/40	(3)
11/3/40 - 1/6/41	(4)
2/6/41 - 5/4/42	(5)
6/4/42 - 18/10/42	(6)
19/10/42 - 30/5/42	(7)
31/5/42 - 4/2/45	(8)
5/2/45 - 8/4/45	(9)
FROM 9/4/45	(10)

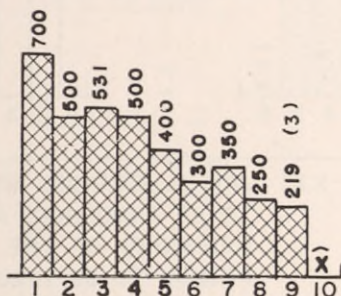
CHILDREN 0-6 YEARS



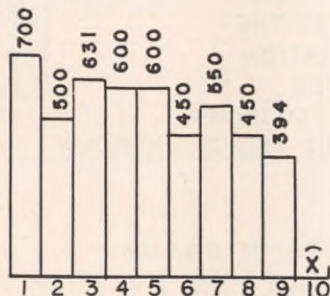
ADOLESCENTS 6-18 YEARS



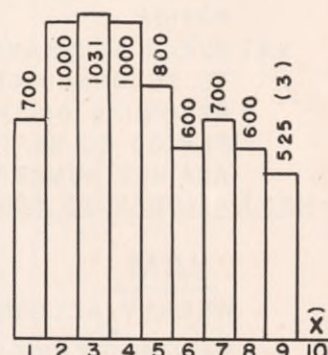
NORMAL CONSUMERS



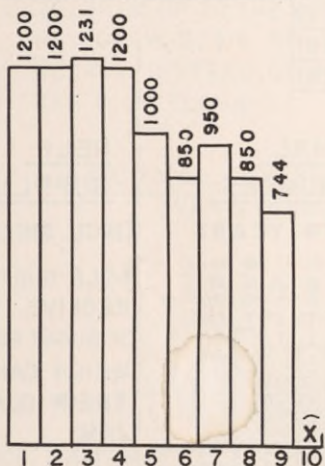
LONG & NIGHT WORKERS



HEAVY WORKERS

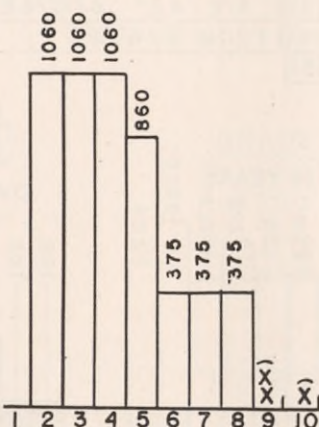


VERY HEAVY WORKERS

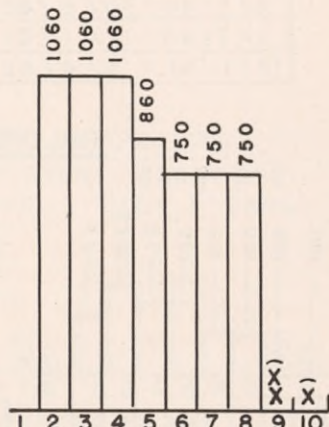


SELF-SUPPLIERS

UP TO 6 YEARS



OVER 6 YEARS



X) MEAT ALLOWANCES WERE TO BE ANNOUNCED AT THE BEGINNING OF THE PERIOD FOR ISSUE AGAINST NUMBERED COUPONS. NO GUARANTEED UNIFORMITY FOR ENTIRE REICH.
 XX) ALLOWANCES FOR THIS PERIOD UNKNOWN.
 3) INCREASE IN ALLOWANCE MAY BE OBTAINED AT THE EXPENSE OF THE FAT ALLOWANCE. SEE FAT CHART

FIGURE 155

DEVELOPMENT OF FOOD RATION ALLOWANCES

HOUSEHOLD SUGAR WEEKLY ALLOWANCES IN GRAMS

RATION PERIODS FROM:

28/8/39 - 24/9/39	(1)
25/9/39 - 5/5/40	(2)
6/5/40 - 17/9/44	(3)
18/9/44 - 4/2/45	(4)
5/2/45 - 8/4/45	(5)
FROM 9/4/45	(6)

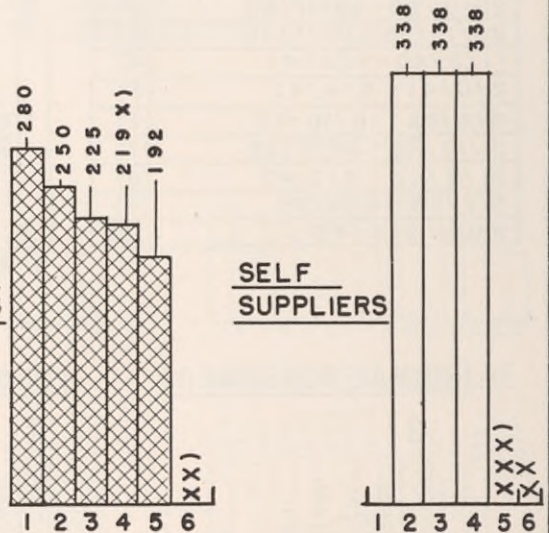
X) REDUCTION EQUALIZED BY INCREASE IN JAM RATION

XX) SUGAR ALLOWANCES WERE TO BE ANNOUNCED AT THE BEGINNING OF THE RATION PERIOD TO BE ISSUED AGAINST NUMBERED COUPONS

XXX) ALLOWANCES FOR THIS PERIOD UNKNOWN

NON-SELF SUPPLIERS

SELF SUPPLIERS



JAM

WEEKLY ALLOWANCES IN GRAMS

RATION PERIODS FROM:

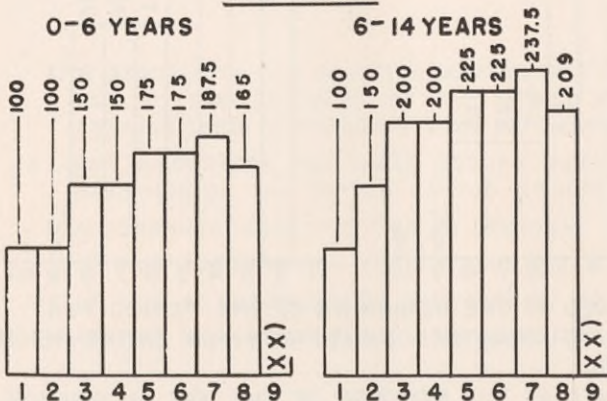
28/8/39 - 22/10/39	(1)	6/4/42 - 17/9/44	(6)
23/10/39 - 5/5/40	(2)	18/9/44 - 4/2/45	(7)
6/5/40 - 30/6/40	(3)	5/2/45 - 8/4/45	(8)
1/7/40 - 12/1/41	(4)	FROM 9/4/45	(9)
13/1/41 - 5/4/42	(5)		

XX) JAM ALLOWANCES WERE TO BE ANNOUNCED AT THE BEGINNING OF THE RATION PERIOD TO BE ISSUED AGAINST NUMBERED COUPONS

CHILDREN

0-6 YEARS

6-14 YEARS

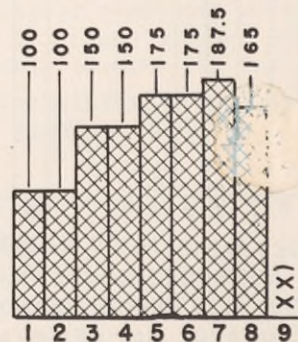


NORMAL CONSUMERS OVER 14 YEARS

SELF SUPPLIERS

OVER 14 YEARS

(INCL. CHILDREN)



SELF-SUPPLIERS RECEIVE 17.5 KG. OF SUGAR PER YEAR WHICH CANCELS THEIR CLAIM TO JAM

IN ADDITION, ADOLESCENTS FROM 10 TO 18 RECEIVE EVERY 4 WEEKS BEGINNING 16 OCTOBER 1944, ALTERNATELY:

{ 200G - JAM
125G - ARTIFICIAL HONEY

FIGURE 156

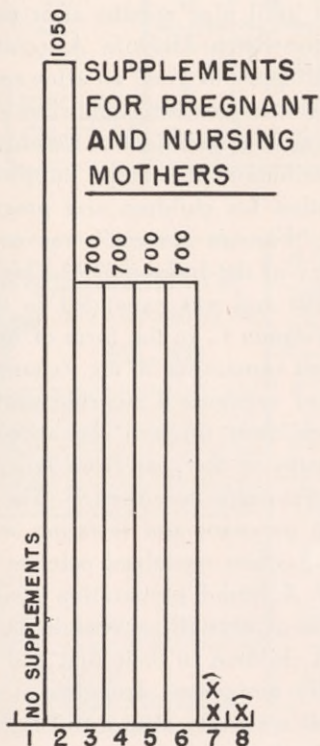
DEVELOPMENT OF FOOD RATION ALLOWANCES

NÄHRMITTEL

WEEKLY ALLOWANCES IN GRAMS

RATION PERIODS FROM:

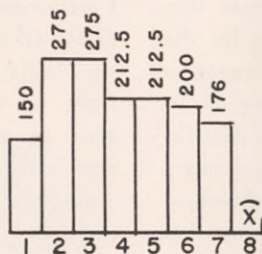
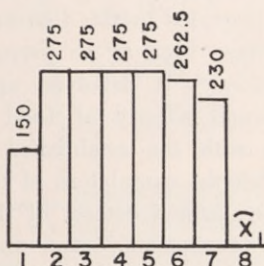
28/8/39 - 24/9/39	(1)
25/9/39 - 23/3/42	(2)
24/3/42 - 5/4/42	(3)
6/4/42 - 31/5/42	(4)
1/6/42 - 12/11/44	(5)
13/11/44 - 4/2/45	(6)
5/2/45 - 8/4/45	(7)
FROM 9/4/45	(8)



CHILDREN 1)

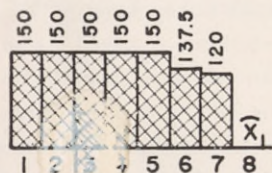
0 - 3 YEARS

3 - 6 YEARS



1) CHILDREN UP TO THE AGE OF 1 1/2 YEARS MAY DRAW 375 G. OF NÄHRMITTEL WEEKLY INSTEAD OF 500 G. OF BREAD OR 375 G. OF FLOUR

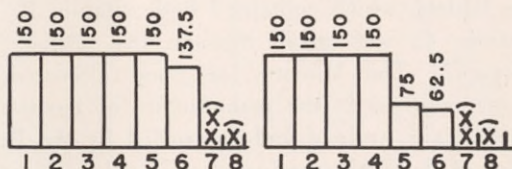
NORMAL CONSUMERS OVER 6 YEARS



GRAIN SELF-SUPPLIERS CHILDREN

UP TO 3 YEARS

OVER 3 YEARS



X) NÄHRMITTEL ALLOWANCES WERE TO BE ANNOUNCED AT THE BEGINNING OF THE RATION PERIOD TO BE ISSUED AGAINST NUMBERED COUPONS.

XX) ALLOWANCES FOR THIS PERIOD UNKNOWN

Examples of the special allowances for patients are presented in Table 43.⁴⁸ In general, the attending physician's certificate was considered sufficient evidence for granting virtually any supplement within reason. On certificate by a physician, pregnant and nursing women could be authorized supplemental rations of $\frac{1}{2}$ liter of milk daily and 125 grams of butter weekly from the moment pregnancy was established until nine months after parturition. In addition, the Reich Midwife Association received from the Ministry of Food an allowance of roasted coffee, of which practising midwives could distribute 20 grams as a stimulant to a woman in labor.³⁶

The distribution of vitamin supplements to the normal ration for children and pregnant women, known as "*Vitamin Aktion*," was carried out by the Ministry of the Interior.^{49, 50} This program began in 1940 and was expanded in the winter of 1941-42. Vitamin C, in the form of lemon flavored sugar tablets containing 50 mg. (changed to 30 mg. in 1943) of synthetic l-ascorbic acid, was issued daily to children through the schools for three winter months of the year from January to March or from February to April.⁵¹ The tablets distributed to pregnant and lactating women by the local health offices contained calcium gluconate in addition.⁴⁹ A liquid preparation consisting of an oil solution of crystalline vitamin D₂ was distributed to all children in their first and second years by specially designated druggists at the direction of the local maternity clinics.⁵² The results of this program for both vitamins were presumed by one of its directors, Dr. Joseph Grunwald, to have been successful; but the evidence presented was based entirely on subjective observation of the rate of incidence of infectious diseases and the morale of children.⁴⁹

The German Labor Front took upon itself the task of supplementing the diets of industrial and mine workers with vitamin tablets. Distribution of the tablets, which contained both vitamin B₁ and vitamin C, was made through the normal employers.⁵¹ The Ministry of Food allocated the sugar required in the manufacture of the tablets. Technicians, trained and controlled by the Berlin office of the DAF, conducted standard analyses for the vitamin C level of the blood of the recipients in each sector and forwarded the results to Berlin.⁵³ There, as reported by Drs. Stepp and Schroeder (First Medical Clinic, Munich), a constant check was maintained on these reports to determine the efficacy of the program and the re-

sults, when positive, were published as propaganda in aid of the DAF.

Feeding during and after air raids

The task of feeding the population of any area under bombing attack was the responsibility of the National-Socialist Public Welfare Agency (*National-Sozialistische Volkswohlfahrt* or NSV).⁵⁴ Relatively small stocks of food were maintained by the NSV in or near all cities for use in emergency. In any city which had been attacked this organization made application for food supplies to its respective Municipal Food Office. When the extent of damage seriously impeded municipal administration or when the supplies requested were not available within the city, application was made in succession to the provincial and national levels of the food control administration.

After an air attack, the NSV provided hot coffee to the population of a damaged area at the latest by the next morning. During the same afternoon a single dish meal (*Eintopf*) and additional hot coffee and bread were supplied at central locations. Further supply was provided by the distribution of ration-free and cost-free food to be prepared by the individual families.⁵⁵ It devolved upon the NSV to restore normal supply of food of the area in accordance with the established rations within three days after the completion of the raid. Appendix C-1 is a translated extract of the NSV report on its work during and after the great Hamburg air raid of July 24 to August 3, 1943.⁵⁴ The food ministry specified the duties of all lower echelon offices in maintaining reserve stocks and in all cases directed shipments of adequate stocks to affected areas when necessary by the most expeditious means.⁵⁶

Many cities were equipped with an extensive system of air raid bunkers for the protection of their populations. Apparently, however, according to information received from Drs. Geiger and Baurmann of the *Alten Vincents Krankenhaus*, Karlsruhe, no provisions were made for kitchen facilities within these bunkers at the time of their construction. As the intensity of the Allied bomber offensive increased, some cities planned the installation of kitchens in their bunkers for the preparation of food during and immediately after air attacks. In no city visited had these plans progressed beyond the paper stage. An example of this planning by the municipal government of Stuttgart, of

FOOD SUPPLY AND NUTRITION

TABLE 43. RATIONS FOR PATIENTS

I. Maximum Weekly Supplements for the Ill in Bed at Home:¹⁾

Bread and Flour	1800 gm.	Butter	160 gm.
Meat	500 gm.	Naehrmittel	750 gm.
Fat (with the exception of butter or in place thereof)	270 gm.	Eggs	7 each
		Whole Milk	5¼ liters

II. Maximum Weekly Supplements for the Sick in Hospitals Entitled to Supplements: (in grams)

<i>Type of Food</i>	<i>General Hospitals</i>	<i>Sanitoriums for Tuberculosis</i>	<i>Children's Hospitals</i>	<i>Medical personnel endangered by tuberculosis³</i>
Flour	70	—	210	—
Meat	70	280	—	—
Butter	20	210	140	70
Margarine	40	70	35	—
Lard	—	70	—	—
Cheese	140	70	—	—
Naehrmittel	105	200	320	175
Jam	105	140	105	—
Sugar	70	175	70	100
Eggs (each)	2.8 ²	2.8 ²	2.8 ²	—
Whole Milk (liters)	1.4	2.0	—	—

III. Weekly Rations for Adult Patients in Hospitals Not Entitled to Supplements:⁴

Flour	1669 gm.	Cheese	31 gm.
Meat	250 gm.	Jam	187 gm.
Butter	94 gm.	Sugar	219 gm.
Margarine	31 gm.	Eggs	1 each
Lard	40 gm.	Skimmed Fresh Milk	¼ liter

Notes: (1) More than three of the above items were not authorized at any one time. In urgent cases exceptions to this rule as well as to the maximum quantities were granted. Statement was required on the doctor's certificate of which ration cards were to be surrendered in return for supplements. During the stay in a hospital or sanatorium these supplements were not authorized.

(2) Including normal rations.

(3) In tuberculosis sanitoriums.

(4) Special hospitals and institutions for cripples, chronic illnesses, mental cases, epileptics, etc.

FOOD SUPPLY AND NUTRITION

which only one experimental installation had been made, is presented in Figure 158.

As may be deduced from this highly condensed report on the measures adopted for emergency feeding, a heavy burden was added through this means to the already overtaxed transportation system, labor pool and food supply system by air attack.

Nutritional quality of the national diet

Standard of ration composition: Since the effective standard of ration composition was weight of food rather than its nutritional value, it must be concluded that the physiologic value of the German diet was maintained largely by chance. This situation prevailed because of the absence of any unified and active body of thought in Germany concerning its significance. In lieu of unification and a directed policy, the many minor attempts served principally to divert the professionally qualified nutritionists from an effective course of action.⁵⁸

Dr. Mahla, assistant to Professor Wirz, Schwabinger Krankenhaus, Munich, stated that quite unlike the United States and England, Germany had no published and generally accepted standards for nutritional elements in the diet such as those of the National Research Council in the United States. Many of the individual German physiologists accepted the National Research Council "Recommended Dietary Allowances" in the absence of any published standard in their own country; many others felt that these standards were too high.²¹

In all cases, however, there was no whole-hearted acceptance of these standards by German experts.

In order to resolve differences of opinion on the subject of human nutritional requirements, the Ministry of Food called together in 1939 the committee mentioned above. Among the members were appointed a nutrition expert, statisticians and representatives of the Ministry of Food and the Food Estate.⁴¹ In addition to the table of food composition already mentioned, the committee established a table of reduced human nutritional requirements for calories, protein, fat and carbohydrates, which could be approximated under war conditions for use in the Ministry. These standards in complete form are shown in Table 44.⁵⁹ Several of the officials interviewed stated, however, that neither the table of composition nor the nutritional standards were used to the best purpose.

These standards were used by the food ministry as a rough check of the nutritional adequacy of any new group of ration allowances although they already represented an attenuated level of nutrition. Table 45 shows the calorie and protein requirements of the food ministry committee standards compared with those of the National Research Council.⁶⁰

Since the nutrition experts consulted by the Ministry were chosen less for their professional competence than for their political affiliations, it was usually the less qualified, more politically active individuals who most frequently had the opportunity to state their opinions. An additional difficulty in this respect lay in the fact that the politically

TABLE 44. PHYSIOLOGIC NORMS FOR CONSUMER GROUPS
(Daily requirements)

	Total Calories	Fat (gms.)	Protein (gms.)	Carbohydrate (gms.)
Very heavy workers	4500	152	112	641
Heavy workers	3600	99	97	556
Normal consumers	2400	67	64	370
Children: 6-14 years	1900	53	53	292
10-14 "	2050	56	56	319
6-10 "	1750	50	49	265
0-6 "	1300	49	39	167
3-6 "	1400	50	41	187
Average of self-suppliers	3100	86	86	475

FOOD SUPPLY AND NUTRITION

TABLE 45. COMPARISON OF RECOMMENDED DIETARY ALLOWANCES
OF UNITED STATES AND GERMANY

	Calories		Protein (gms.)	
	United States	Germany	United States	Germany
Very active	4500	4500	70	112
Moderately active	3000	3600	70	97
Sedentary	2500	2400	70	64
Children: 0-1 year	100/kg.		3.5/kg.	
0-3 years		1200		38
1-3 "	1200		40	
3-6 "		1400		41
4-6 "	1600		50	
0-6 "		1300		39
7-9 "	2200		60	
6-10 "		1750		49
6-14 "		1900		53
10-12 "	2500		70	
10-14 "		2050		56

powerful leader of the health services of the country, Dr. Leonardo Conti, insisted that questions of nutritional adequacy of the diet belonged in the province of his organization. Thus, relative political position of individuals as well as government agencies convened to divert the best answers to a serious national problem.

In addition to the lack of a nationally accepted nutritional standard for the diet, professional consciousness of the significance of mineral and vitamin requirements seemed far behind the level of the United States. It was the feeling of many medical men, including Major Reinhard Perwitzschsky, commanding officer of the Artilleriekaserne Hospital, Garmisch-Partenkirchen, that present day attention to the use of vitamins was a greatly overrated fad which would soon lose its apparent significance. In this type of professional matrix, where individual creativeness was discouraged and nationalized bodies were not established, it is clear that the best physiologic interest of the country was not served. Furthermore, this lack of recognition constituted another point in the vulnerability of Germany's nutritional level to air attack since the supply of protective foods could be reduced below a critical level before it would be recognized.^{61, 62}

Analysis of diet: The relative adequacy with which the various consumer groups were supplied

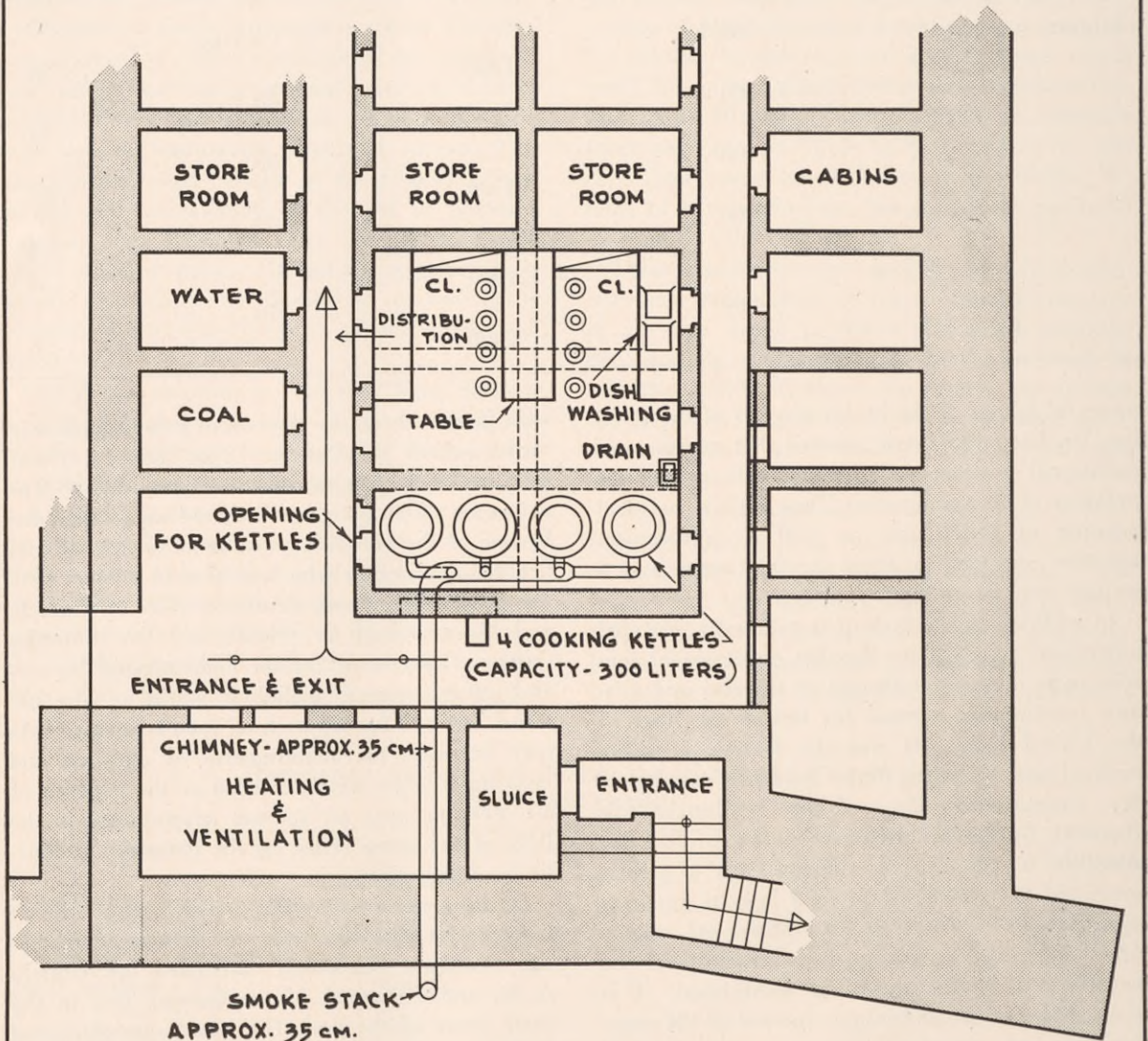
with food is shown by their calorie consumption in ration period 55 (October 18 to Nov. 14, 1943) as illustrated graphically in Figure 159.⁶³ The values on which the graph is based were calculated by one of the nutrition consultants to the national health organization who was also in contact with the Ministry of Food, Professor Wirz of Munich, and his assistants Dr. Mahla and Dr. Mercedes Gaffron. They were further authenticated by several other sources, including works of the national institute for research on food economy.⁶⁴ As may be seen, the requirements of children and lactating women were exceeded at the expense of all other groups; an unusual development in the light of the stress rested on the industrial productivity of the latter.

On his own initiative the president of the Reich Institute for Vitamin Assay and Research in Leipzig, Professor Scheunert, calculated the vitamin A, B₁ and C content of the German diet in the early years of the war. The results are shown in Tables 46, 47, 48.⁶⁵ From these it may be seen that potatoes constituted the principal source of vitamin C and that approximately one-half of the vitamin A intake was consumed as vegetables which were never rationed. In these tables Vitamin C is given in milligrams and other factors are in international units.

On the basis of the daily allowances shown in

FIGURE 158

KITCHEN CONSTRUCTION
PLATZ DER S.A. AIR RAID SHELTER
(STUTT GART)
COOKING CAPACITY - 1200 PORTIONS



FROM: MUNICIPAL CONSTRUCTION OFFICE
STUTT GART
MARCH 9, 1945

TABLE 46

Daily Vitamin Supply during the Ration Periods #1 - #9 (28 August 1939 - 5 May 1940), without vegetables

No.	Dates	Children			Children			Children			Normal			Heavy Workers			Very Heavy Workers		
		3 - 6 years			6 - 10 years			10 - 14 years			Consumers			Workers			Workers		
		A	B ₁	C	A	B ₁	C	A	B ₁	C	A	B ₁	C	A	B ₁	C	A	B ₁	C
1.	26 Aug. '39 - 24 Sept.	1758	515	70	1112	612	147	1112	698	117	1112	698	147	1112	1021	228	1198	1179	228
2.	25 Sept. - 22 Oct.	1655	538	57	1052	640	104	1052	742	104	728	711	102	814	1123	154	846	1254	154
4.	20 Nov. - 17 Dec.	1846	386	32	1540	399	44	1540	514	64	1058	452	62	1144	681	97	1178	732	97
5.	18 Dec. '39 - 14 Jan. '40	1713	440	32	1407	497	43	1407	660	64	927	598	62	1013	931	97	1047	1055	97
6.	15 Jan. - 11 Feb.	1633	395	32	1329	409	43	1329	521	64	845	458	62	931	691	97	965	742	97
7.	12 Feb. - 10 Mar.	1457	458	28	1157	515	36	1157	678	54	700	646	52	786	979	81	820	1102	81
8.	11 Mar. - 7 Apr.	1488	443	25	1188	466	28	1188	629	43	731	597	41	817	901	62	851	1024	62
9.	8 Apr. - 5 May	1801	440	22	1492	468	25	1492	631	39	983	599	37	1068	903	55	1103	1030	55

X) Vitamin A and Vitamin B₁ in international units

xx) Vitamin C in milligrams

The vitamin quantities listed above are increased by those which were added through vegetables (e.g. cabbage, carrots, salads, et.). It is impossible to figure these out exactly. They can only be calculated very roughly according to the quantities of vegetables sold in the Berlin market.

Source: Translated from the original German manuscript of Prof. K.A. Scheunert, President of Reich Institute for Vitamin Assay and Vitamin Research (Reichsanstalt fuer Vitaminsuefung und Vitaminsuefung), Leipzig, 5 July 1945.

VITAMIN SUPPLY THROUGH VEGETABLES DURING THE RATION PERIODS #2 - #10 (25 Sept., 1939 - 5 May, 1940)

#	Period Date	% loss in the kitchen	Net Ration Ration (Grams)	Weekly Supply			Daily Supply		
				A	B	C	A	B	C
2.	25 Sept.-22 Oct.	24	1245	13021	421	57	1860	60	8
3.	23 Oct.-19 Nov.	"	1245	13021	421	57	1860	60	8
4.	20 Nov.-17 Dec.	"	1000	10450	334	45	1494	47	6
5.	18 Dec.-14 Jan.	"	1000	10450	334	45	1494	47	6
6.	15 Jan.-11 Feb.	"	700	7315	234	31	1045	33	4
7.	12 Feb.-10 Mar.	"	500	5225	167	22	746	26	3
8.	11 Mar.- 7 Apr.	"	500	5225	167	22	746	26	3
9.	8 April - 5 May	"	500	5225	167	22	746	26	3
10.	6 May - 2 June	"	600	6270	200	27	895	28	4

TABLE 47

gives a general view of the vitamin quantities which under equal distribution of vegetables would have been added to the figures shown in

TABLE 48

WEEKLY AND DAILY VITAMIN SUPPLY DURING THE RATION PERIOD #4 (20 November - 17 December 1939) WITHOUT VEGETABLES

Foods Rationed	Loss in the kitchen %	Children 0-3 yrs.				Children 3-6 yrs.				Children 6 - 10 yrs.				Children 10-14 yrs.				Normal Consumer				Heavy Workers				Very Heavy Workers				Vitamin content in 100 g													
		Ration Net (Grams)				Ration Net (Grams)				Ration Net (Grams)				Ration Net (Grams)				Ration Net (Grams)				Ration Net (Grams)				Ration Net (Grams)				A	B	C											
		Ration	A	B	C	Ration	A	B	C	Ration	A	B	C	Ration	A	B	C	Ration	A	B	C	Ration	A	B	C	Ration	A	B	C	A	B	C											
Cream Milk	0.5	5250	5224	6791	1308	52	3500	3482	4526	870	34	1750	1742	2265	436	17	1750	1742	2265	436	17	-	-	-	-	-	-	-	-	-	-	130	25	1									
Cheese	1	62.5	62	(475	(23	-	62.5	62	(475	(23	-	62.5	62	(475	(23	-	62.5	62	(475	(23	-	62.5	62	(475	(23	-	62.5	62	(475	(23	-	575	25	-									
Curds	5	125	119	(	(	-	125	119	(	(	-	125	119	(	(	-	125	119	(	(	-	125	119	(	(	-	125	119	(	(	-	500	25	-
Butter	2	156.25	153	4590	-	-	218.75	214	6420	-	-	212.5	208	6240	-	-	212.5	208	6240	-	-	175	171	5130	-	-	175	171	5130	-	-	3000	-	-									
Margarine	2	-	-	-	-	-	-	-	-	-	-	78.12	-	-	-	-	78.12	-	-	-	-	141.25	-	-	-	-	203.75	-	-	-	-	-	-										
Lard	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	46.25	-	-	-	-	108.75	-	-	-	-	390	-	-	-	-	-											
Meat	20	281.25	225	337	139	-	281.25	225	337	139	-	531.25	425	637	263	-	531.25	425	637	263	-	1031.25	825	1237	511	-	1231.25	985	1477	610	-	150	62	-									
Eggs	2.2	116	113	700	38	-	116	113	700	38	-	116	113	700	38	-	116	113	700	38	-	116	113	700	38	-	116	113	700	38	-	620	34	-									
Flour																																											
Rye and Bread	1	412.5	408	-	183	-	412.5	408	-	183	-	637.5	631	-	283	-	900	891	-	400	-	1425	1411	-	634	-	1800	1782	-	801	-	-	45	-									
Wheat Flour	1	412.5	408	-	97	-	412.5	408	-	97	-	637.5	631	-	151	-	900	891	-	213	-	1425	1411	-	338	-	1800	1782	-	427	-	-	24	-									
Grains	1	275	272	-	354	-	275	272	-	354	-	150	148	-	192	-	150	148	-	192	-	150	148	-	192	-	150	148	-	192	-	-	130	-									
Coffee Substitute	1	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	-	-	-									
Sugar	0.1	250	250	-	-	-	250	250	-	-	-	250	250	-	-	-	250	250	-	-	-	250	250	-	-	-	250	250	-	-	-	-	-	-									
Sweets	0.1	31.25	31.2	-	-	-	31.25	31.2	-	-	-	31.25	31.2	-	-	-	31.25	31.2	-	-	-	31.25	31.2	-	-	-	31.25	31.2	-	-	-	-	-	-									
Chocolate, Candy	0.1	28	28	-	-	-	28	28	-	-	-	28	28	-	-	-	28	28	-	-	-	28	28	-	-	-	28	28	-	-	-	-	-	-									
Cocoa	1	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	-	-	-									
Artificial honey	1	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	31.25	31	-	-	-	-	-	-									
Marmalade	1	100	99	39	15	-	100	99	39	15	-	100	99	39	15	-	100	99	39	15	-	100	99	39	15	-	100	99	39	15	-	75	30	-									
Total Rationed:	Weekly:	12932				2157	52	12497				1719	34	10356				1401	17	10356				1607	17	6981				1144	7581				1751	-	7821				2106		
	Daily:	1847				308	7	1785				245	5	1479				200	2	1479				229	2	997				163	1083				250	-	1117				301		
II. Ration Free																																											
Skimmed milk	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	875	866	-	9	-	875	866	-	9	-	875	866	-	9	-	-	1	-									
Fish	30	26.5	18.5	-	6	-	26.5	18.5	-	6	-	26.5	18.5	-	6	-	26.5	18.5	-	6	-	26.5	18.5	-	6	-	26.5	18.5	-	6	-	-	30	-									
Bonbons, Cake	1	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	100	99	-	-	-	-	-	-	-								
Potatoes	19	1000	810	-	405	97	2000	1620	-	810	194	3000	2430	-	1215	292	4500	3645	-	1322	437	4500	3645	-	1822	437	7000	5670	-	2835	680	7000	5670	-	2835	680							
Fruit	4.75	600	571	428	171	-	600	571	428	171	-	600	571	428	171	-	600	571	428	171	-	600	571	428	171	-	600	571	428	171	-	75	30	-									
Beverages	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1200	-	-	-	-	1200	-	-	-	-	1200	-	-	-	-	-	-	-	-								
Total Ration Free:	Weekly:	428				582	97	428				987	194	428				1392	292	428				1999	437	428				2008	437	428				3021	680						
	Daily:	61				83	14	61				141	27	61				199	42	61				285	62	61				289	62	61				421	98						
Total Daily:		1908				391	21	1846				386	32	1540				399	44	1540				514	64	1058				452	62	1144				681	97	1178				732	98

FOOD SUPPLY AND NUTRITION

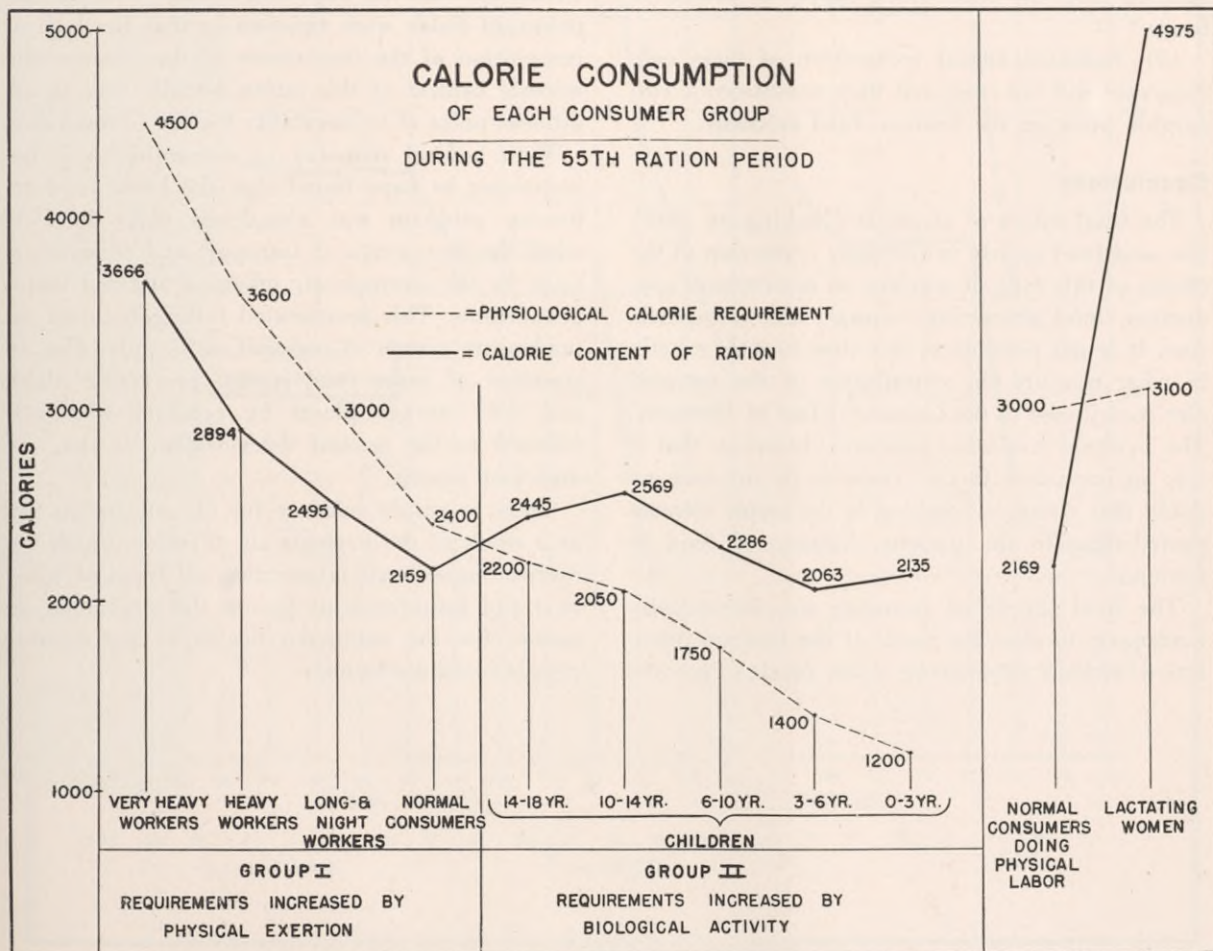
part in Appendix C-4 and composition values from German and United States sources the relative consumption of the nutritive elements for the normal consumer and heavy worker groups was calculated for all ration periods.^{66, 67, 68, 69} Calories, protein, calcium and vitamins A, B₁ and B₂ for rationed foods only were considered. Vitamin C was omitted due to insufficient data on the quantities of vegetables and potatoes in the diet. Graphs of the results as related to bombing experience are shown in Figures 160 and 161.^{70, 71} Values prior to period 60 (Mar. 6 to Apr. 2, 1944) were omitted from the graphs because they were of approximately the same magnitudes as those shown for periods 60 to 65 (Mar. 6 to Aug. 20, 1944). It will be noted that the first large decline (approximately 10 per cent) at period 68 (October 16 to November 12, 1944) and the later, sharper drop (approximately 40 per cent) at period 71 (January 8 to February 4, 1945) clearly coincides with the peaks of Allied bomb tonnage dropped. With the

steady increase of Allied bombing up to the end of the war and the collapse of the entire rationing structure it appears reasonable to assume that there was an extrapolated downward trend of all curves after period 73. The assumption that an earlier intensification of the bombing offensive against transport would have caused an earlier collapse of the German food economy appears to be justified by these curves and by statements of top Ministry officials.

Effect of changes in ration allowances: Widely diverse opinions on the effect of the gradually diminishing allowances of food were held by various nutrition experts and medical men in Germany. A general survey of these opinions and analysis of captured documents, however, indicates that:

(1). The nutritional value of the average diet in Germany improved during the early course of the war because the system of price control tended to insure a more nutritious diet for the lower income groups by making food available at low cost.

FIGURE 159



In addition, the rationing program had the effect of making only the more nutritious foods available for consumption by all groups by limiting the possibilities of purchase. This parallels British war experience.⁷²

(2). The gradual decrease in calories and protein in the diet caused a reduction in body weight for all groups and a reduced rate of growth in school children, as shown in Figures 162, 163, 164, and 165 and in the quarterly health reports of Stuttgart.^{72, 73}

(3). Deficiencies, principally in vitamins B₁ and C and calcium, began to appear clinically after a prolonged period at subclinical level. There were also indications from the experimental results with dark adaptation tests and blood assays, reported by several German nutritionists, that the vitamin A level decreased significantly beginning in 1944.^{74, 75}

(4). If the trend of ration allowances had continued at the indicated rate, serious consequences to the entire population would undoubtedly have resulted from the diminishing supply of protective foods.

(5). Sufficient official recognition of these consequences did not exist and they constituted a vulnerable point in the German food economy.

Conclusions

The total effect of strategic bombing on nutrition and food supply in Germany is the sum of the effects of this type of warfare on agricultural production, food processing, storage, and transportation. It is not possible at this time to state exactly in what measure the curtailment of the national diet contributed to the ultimate defeat of Germany. The evidence available indicates, however, that it was an important factor. There is in any case no doubt that strategic bombing is the major element contributing to the present shortage of food in Germany.

The food supply of Germany was intrinsically inadequate to meet the needs of the German population without dependence upon foreign imports.

Every attempt was made to increase Germany's self-sufficiency through a highly organized system of food production, storage and distribution and food rationing. The success of this delicately balanced, highly integrated organization was dependent upon the integrity of the German transportation and communications system. Since the productive capacity of all German land was strained to the utmost to attain even the degree of self-sufficiency which has been described in this report, any damage to the factors supporting this productivity obviously contributed to malnutrition in that country. The bombing in which the German transportation system was disrupted, and the air attacks in which sources of fertilizers, farm machinery, and fuel were destroyed, caused the ultimate breakdown of the German food supply system. Disruption of transport, in particular, made the uniform distribution of food to all areas impossible.

It was not apparent that the Germans considered the vitamin and mineral content of foods in determining the ration allowances of the people. Immediately with the beginning of the war, all the principal foods were rationed so that the lack of recognition of the importance of the vitamin and mineral content of this ration actually was an additional point of vulnerability for the German diet.

With a food economy so vulnerable it is not surprising to have found that the basic food rationing program was abandoned early in 1945 when the destruction of transport and communications by the strategic air offensive attained major proportions. This necessitated falling back on the inadequate system of regional self-supply. The destruction of large food stocks, processing plants and cold storage plants by bombing also contributed to the general deterioration of the German food supply.

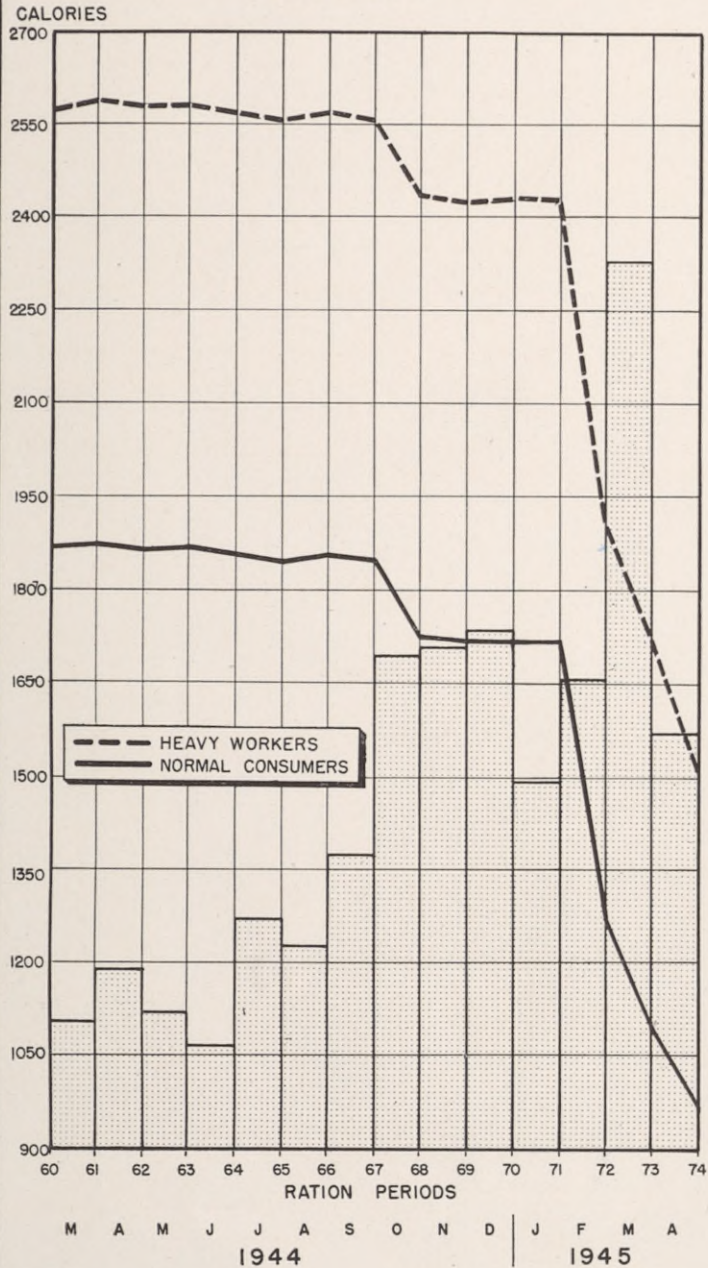
There is ample evidence for the conclusion that as a result of the strategic air offensive, which was directed against all large cities, all types of transport and manufacturing plants, the nutritional demands for the continued health of the German people could not be met.

FIGURE 160

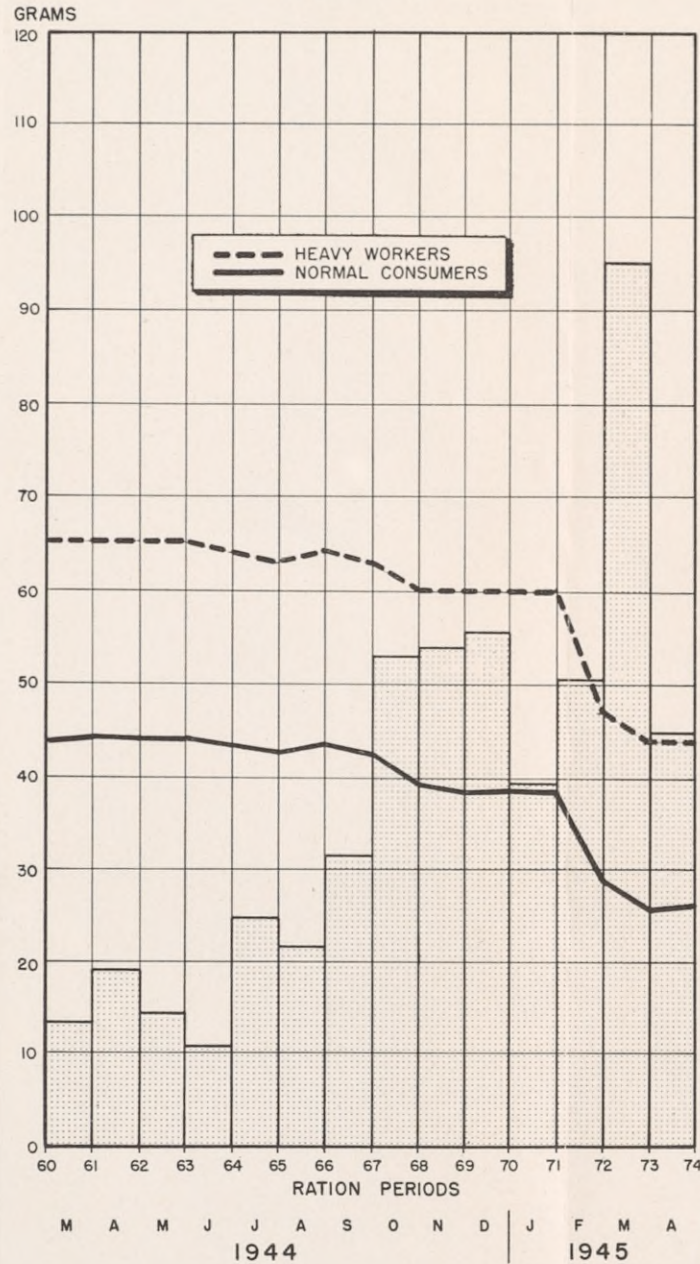
TOTAL BOMBING EXPERIENCE & NUTRITION IN GERMANY

NUTRITIONAL VALUES OF RATIONED FOODS ONLY
 MONTHLY TOTAL TONNAGE REPORTED DROPPED ON GERMANY, ALL AIR FORCES.

CALORIES



PROTEIN



CALCIUM

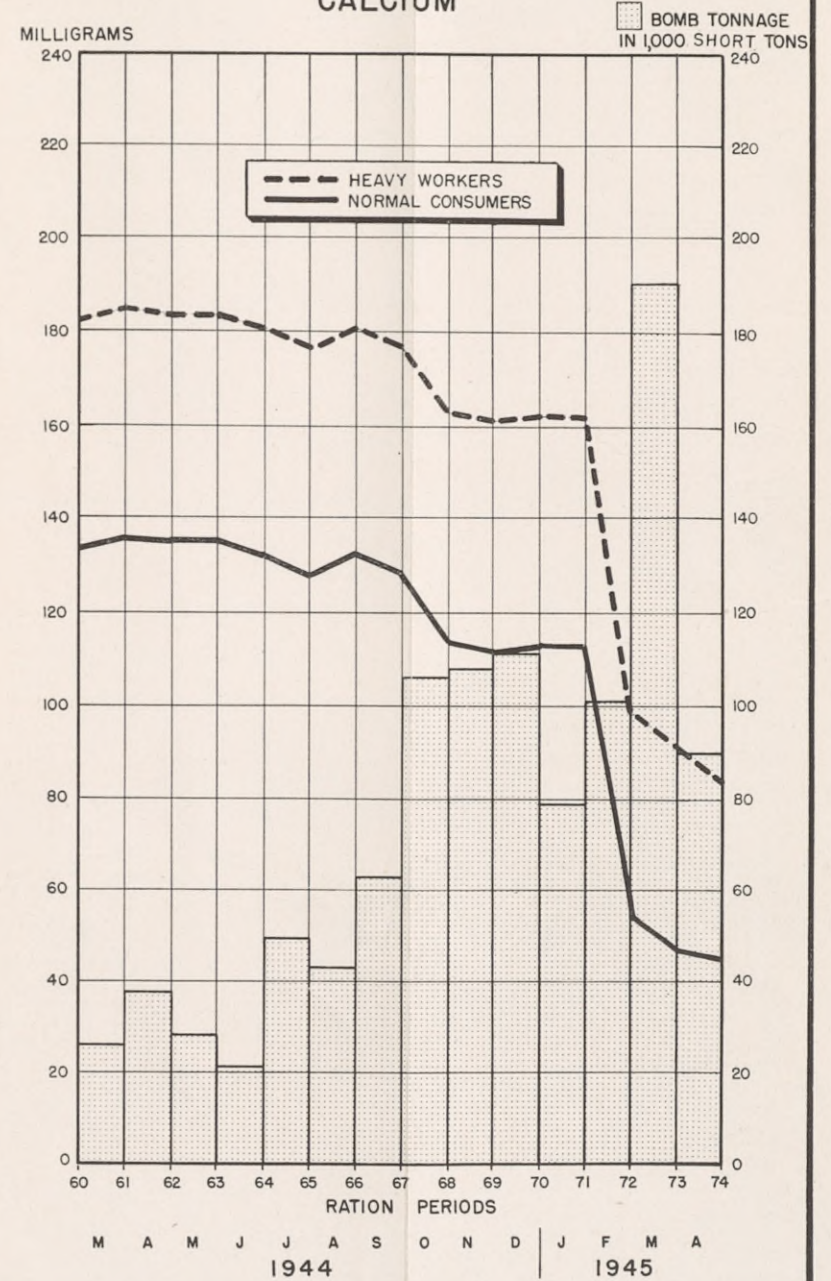


FIGURE 161

TOTAL BOMBING EXPERIENCE & NUTRITION IN GERMANY

NUTRITIONAL VALUES OF RATIONED FOODS ONLY
 MONTHLY TOTAL TONNAGE REPORTED DROPPED ON GERMANY, ALL AIR FORCES.

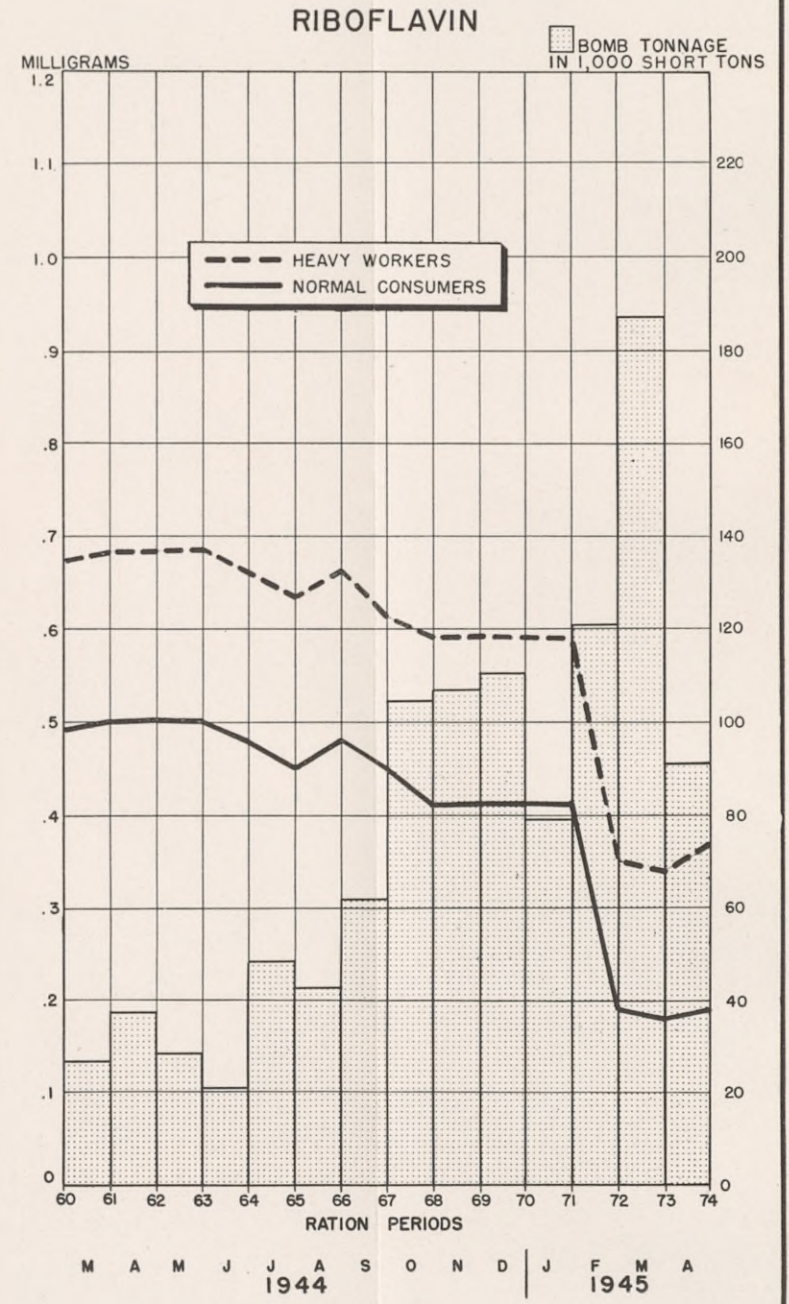
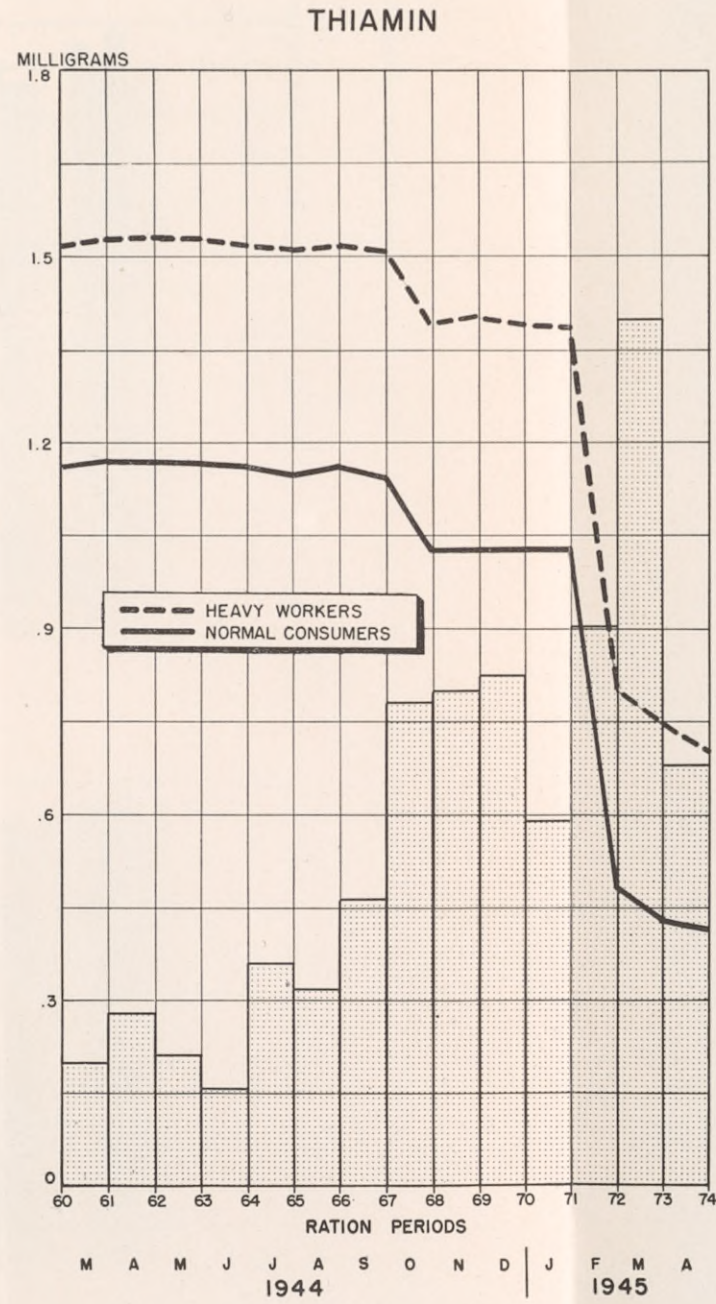
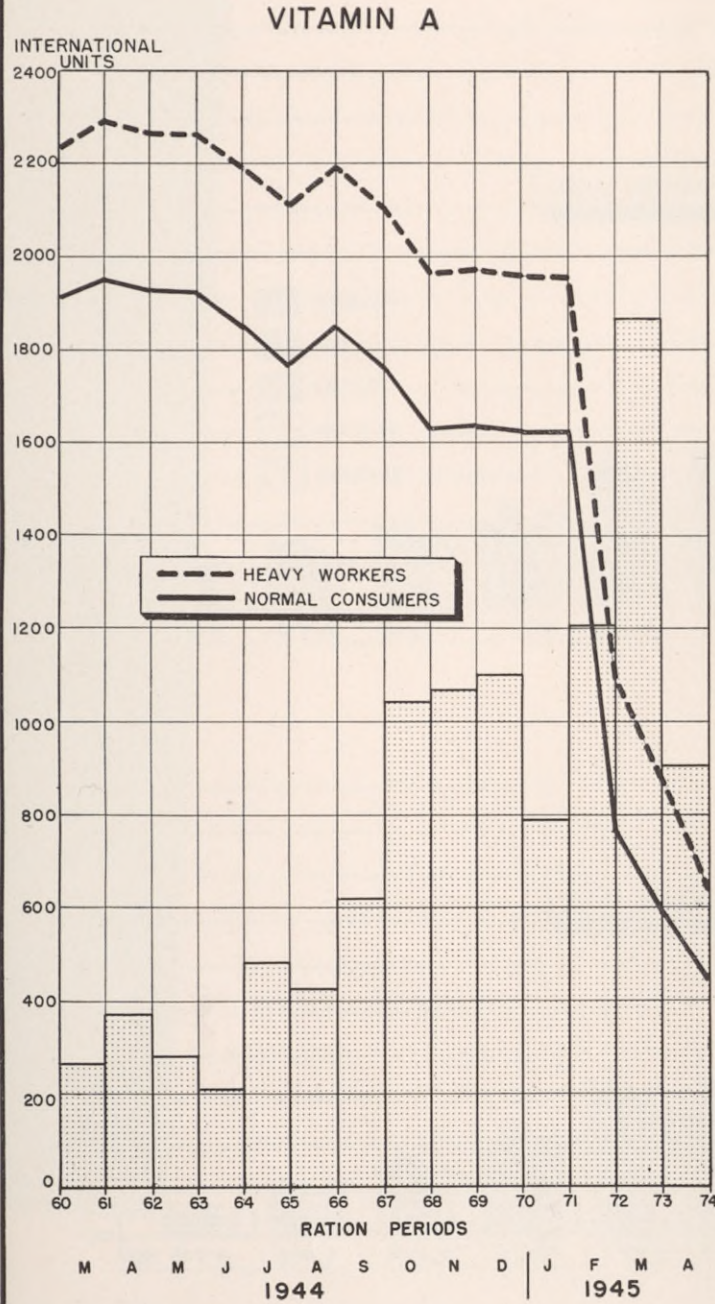
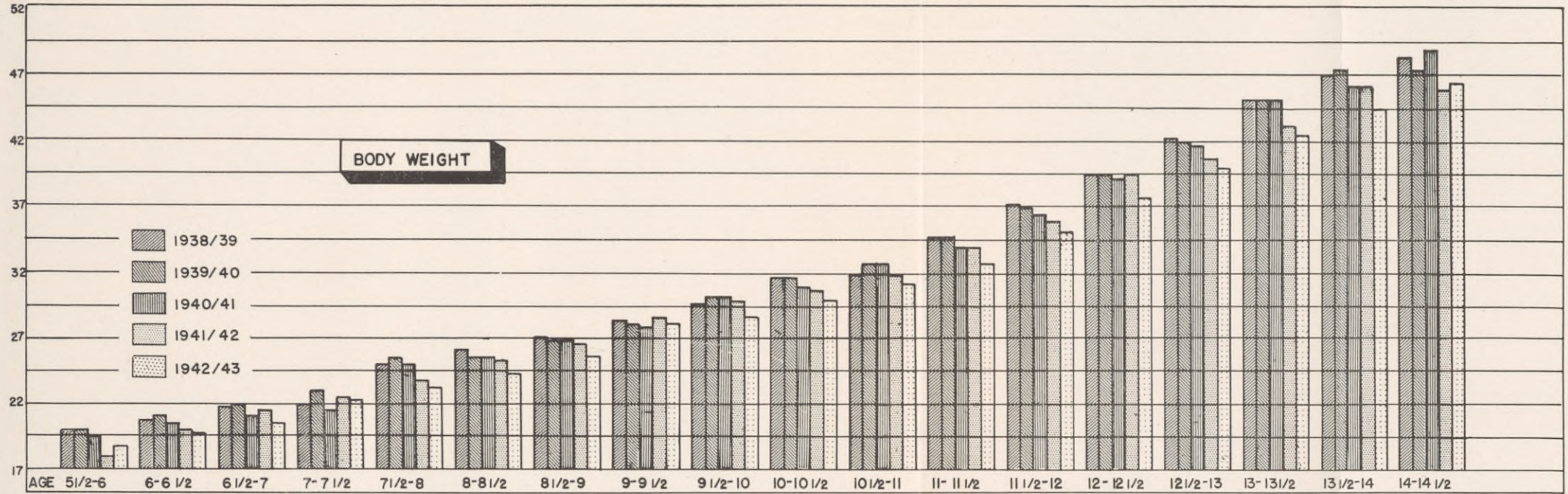


FIGURE 162

CHANGES IN HEIGHT & WEIGHT
OF STUTT GART
ELEMENTARY SCHOOL GIRLS
1938/43

WEIGHT
IN
KILOGRAMS



HEIGHT
IN
CENTIMETERS

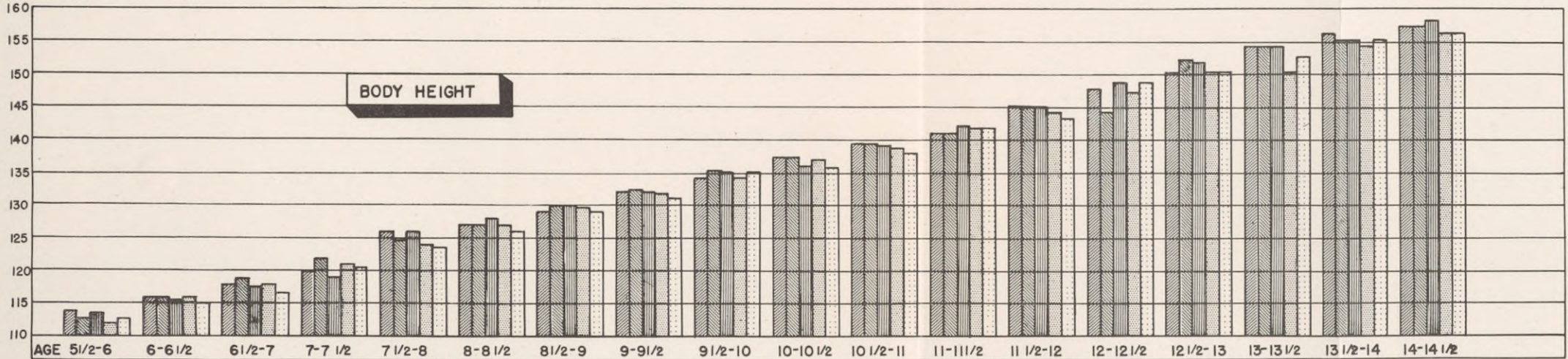


FIGURE 163

CHANGES IN HEIGHT & WEIGHT
OF STUTTGART
ELEMENTARY SCHOOL BOYS
1938/43

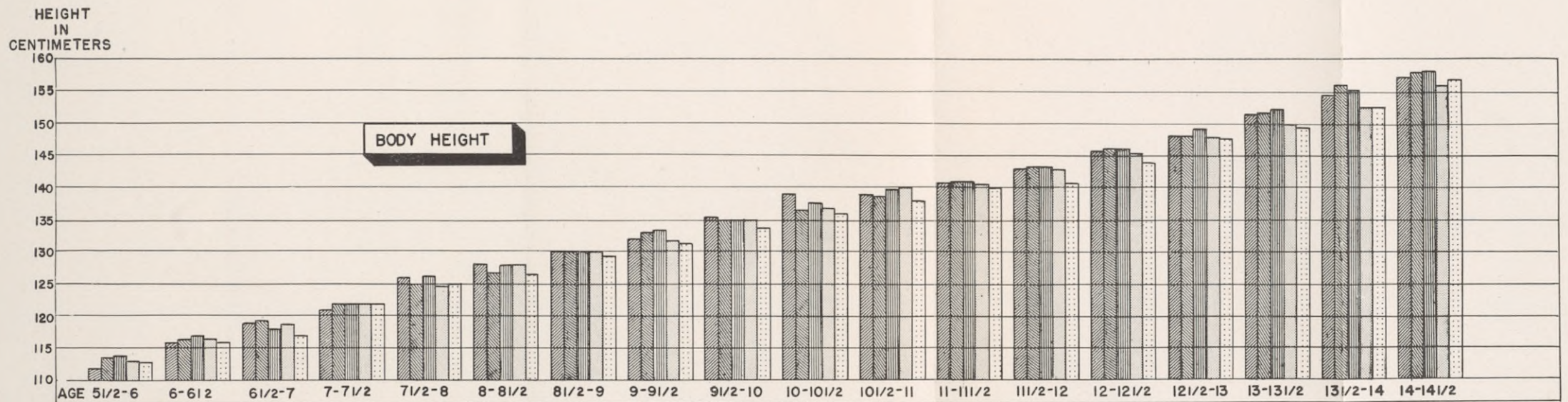
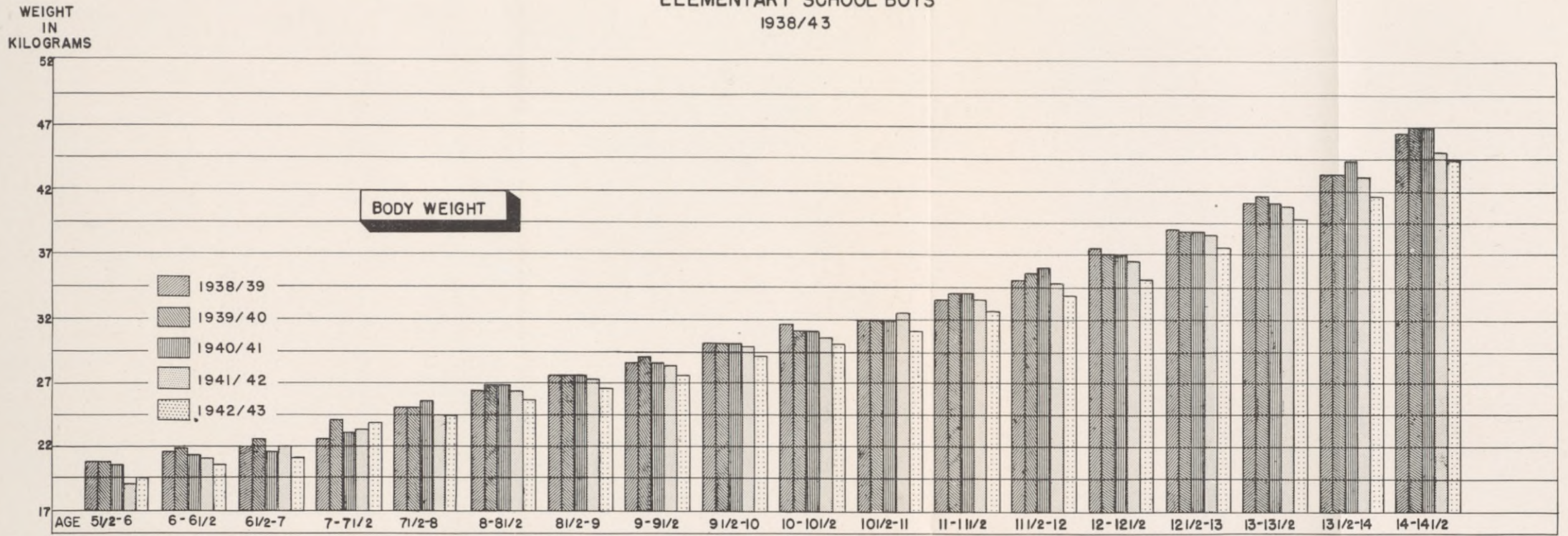
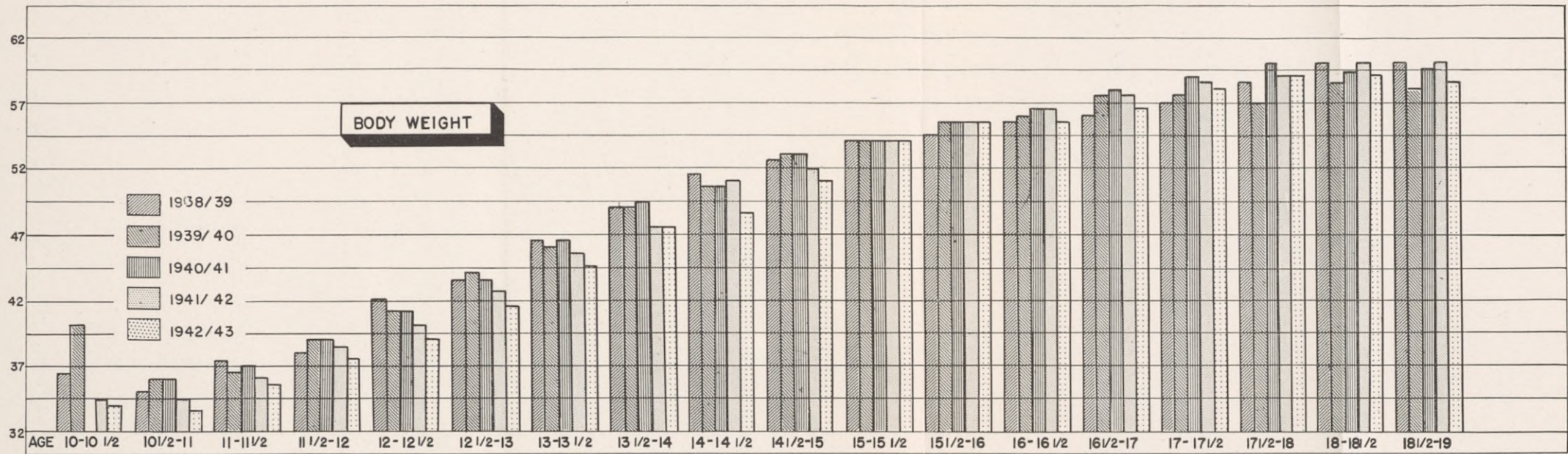


FIGURE 164

CHANGES IN HEIGHT & WEIGHT
OF STUTTGART
HIGH SCHOOL GIRLS
1938/43

WEIGHT
IN
KILOGRAMS



HEIGHT
IN
CENTIMETERS

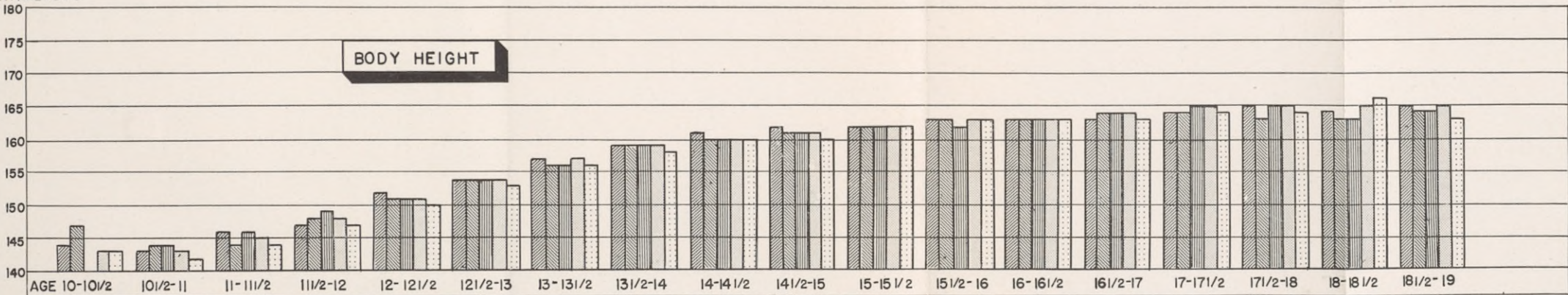
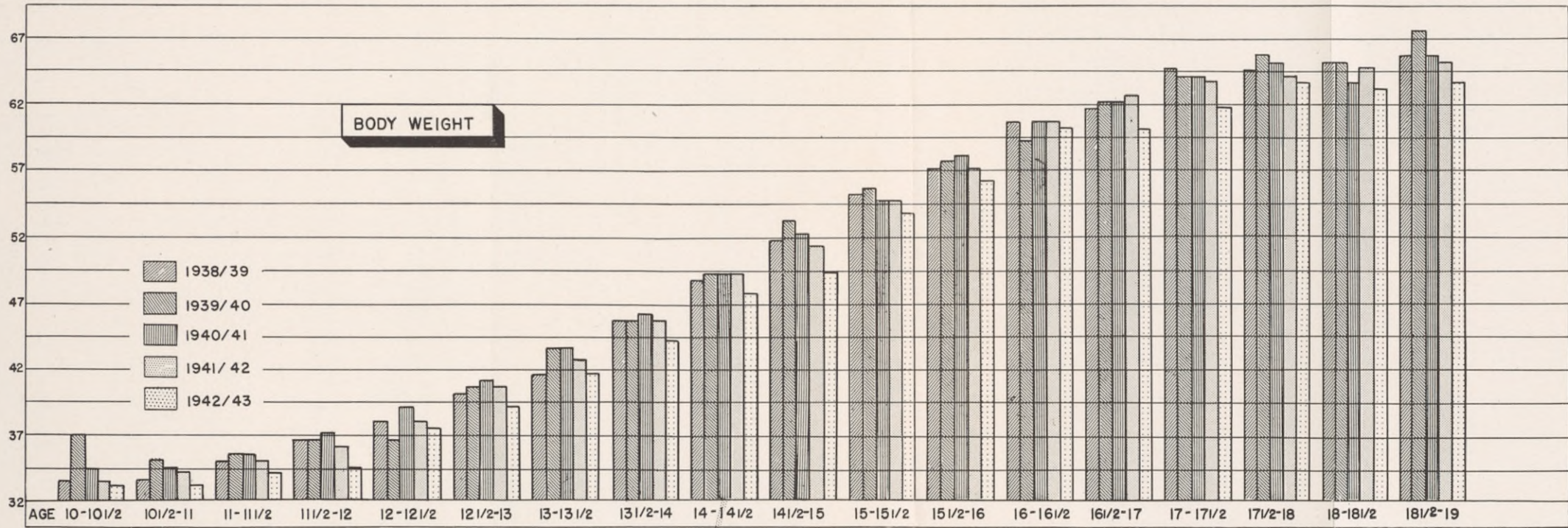


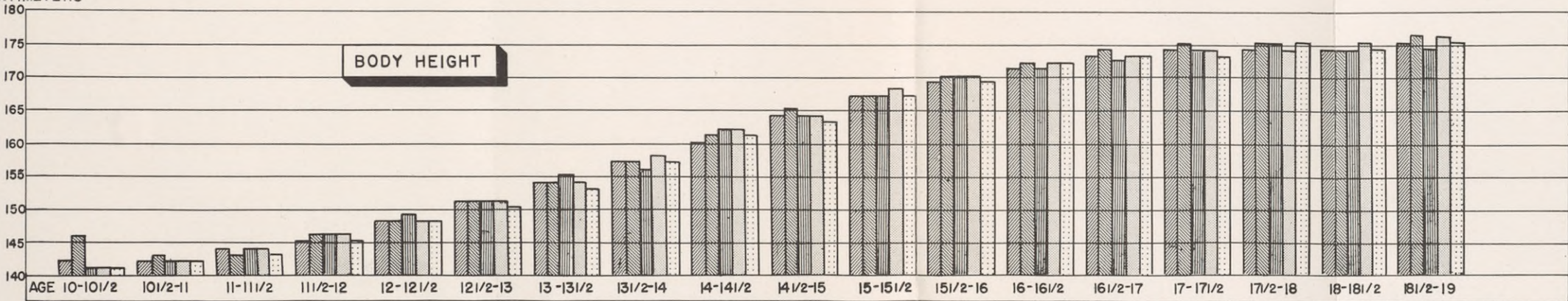
FIGURE 165

CHANGES IN HEIGHT & WEIGHT
 OF STUTTGART
 HIGH SCHOOL BOYS
 1938/43

WEIGHT
 IN
 KILOGRAMS



HEIGHT
 IN
 CENTIMETERS



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REFERENCES

1. Nahrungsmittelversorgung in Bayern. Provincial Food Office of Bavaria. Munich, June 5, 1945. (Unpublished)
2. Organization Chart of the Reich Ministry of Food and Agriculture and Reich Food Estate. U. S. Group C.C., February 1, 1945.
3. Organization Chart—German Food, Agriculture and Forestry Administration. U. S. Group C.C., October 10, 1944.
4. Report C-9; Administrative Machinery and Controls for Food and Agriculture in Germany during the war. Combined Working Party on European Food Supplies, London, January, 1945.
5. Organisation der Ernahrungswirtschaft in Deutschland. Prepared for the Medical Branch by Ministerialdirektor Claussen, formerly of the Reich Ministry of Food and Agriculture, July, 1945. (Unpublished Chart)
6. Germany Basic Handbook. Economic Survey. Section B: Agriculture, Fisheries and the Food Industries. Foreign Office and Ministry of Economic Warfare, Economic Advisory Branch of Great Britain. London, September, 1944.
7. Germany Basic Handbook. Economic Survey. Section A: General Introduction. Foreign Office and Ministry of Economic Warfare, Economic Advisory Branch of Great Britain. London, November, 1944.
8. Un die Nahrungsfreiheit Europas. Herbert Backe, Wilhelm Goldmann, Publishers, Leipzig, 1942.
9. Die Landesbauernschaften in Zahlen, 2. Folge, 1938-1939. Administrative Office of the Reich Farm Leader, Reichsnaehrstand. Berlin, April, 1940.
10. Der neue Angriff auf die Fettluecke. H. H. Freudenberger, Zeitschrift fuer Gemeinschaftsverpflegung, Volume 19, Number 20, page 315, October, 1941.
11. Kriegsernaehrungswirtschaft. Dr. Heinz Dommashk. Rembrandt-Publishers, and Deutsche Verlags Company, Berlin. Volume I and Volume II, November, 1944.
12. Germany—Report upon Can Manufacture and Canning. F. E. Walch, Jr. Dewey and Almy Chemical Company, Cambridge, Mass., November, 1943. (Unpublished)
13. Food Processing and Canning in Germany. Gerard J. Bos, March 15, 1945. (Unpublished)
14. German Canning Industry. Capt. Bebout, Food and Agriculture Branch, U. S. Group C.C. (Unpublished)
15. Deutsches Reich Ruebenzucker Fabriken. P. van der Heijden. London, April 17, 1945. (Unpublished)
16. Reports on German Food Economy, I. Getreide und Muehlen, II. Kuehlhaeuser, III. Milch- und Fettwirtschaft, IV. Fleischwirtschaft, V. Zuckerwirtschaft, VI. Obst- und Gemuesewirtschaft, VII. Kartoffelwirtschaft, VIII. Aenderung des Lebensmittelkartensystems, IX. Rationsssaetze 67-75. Zuteilungsperiode, X. Entwicklung des Duengemittelverbrauchs. Prepared for Medical Branch by former officials of the Reich Ministry of Food and Agriculture, July 2, 1945. (Unpublished)
17. Technical Report No. 144-45, The Manufacture of Synthetic Rubber. M. E. Spaght, U. S. Naval Technical Mission in Europe. July, 1945.
18. Report on the Supply of Nitrogen. Reich Minister of Food and Agriculture H. Backe and Reich Minister for Armaments and War Production Speer. Berlin, December 6, 1944. (Unpublished) Translation.
19. Stickstofferzeugung Grossdeutschlands. Graph prepared by Generalbevollmaechtigten fuer Sonderfragen der Chemischen Erzeugung. February, 1945. (Unpublished)
20. Tatsaechliche deutsche Stickstofferzeugung. Graph prepared by G. B. Chem. and Stickstoff Syndikat. June 19, 1945. (Unpublished)
21. Verbrauch der deutschen Landwirtschaft an Handelsduengemitteln. Prepared for the Medical Branch by Dr. Haefner, Reich Ministry of Food and Agriculture. June 15, 1945. (Unpublished)
22. Oil Division Final Report Appendix. Published by U. S. Strategic Bombing Survey. August 25, 1945.
23. Bericht ueber Nahrungsmittelversorgung und Ernahrung fuer die Jahre 1939/45. Prepared for the Medical Branch by the Provincial and Central Food Office, Hamburg. June 30, 1945. (Unpublished)
24. Map of the Province of Wurttemberg showing location of Food Storage Warehouses. Prepared by Provincial Food Office of Wurttemberg. Stuttgart, May 25, 1945. (Unpublished)
25. Map of Province of Bavaria showing location of Principal Grain Storage Warehouses. Prepared for Medical Branch by Provincial Food Office of Bavaria. Munich, July 4, 1945. (Unpublished)
26. Darstellung der belegten Flaechen in den privatwirtschaftlichen und den der Vorratwirtschaft dienenden gemeindlichen Kuehl- und Gefrierhaeusern Deutschlands nach den Ermittlungen der Fachgruppe Kuehlindustrie, 1944. Graph, Fachgruppe Kuehlindustrie der Wirtschaftsgruppe Lebensmittelindustrie, Berlin. January 24, 1945.

FOOD SUPPLY AND NUTRITION

27. Air Raid Precautions for Cold Storage Plants. Dr.-Ing. K. Linge. Zeitschrift fuer die gesamte Kaelte Industrie. 51: ½; p. 12-14, Jan.-Feb., 1944. (Abstract)
28. Report on Food and Nutrition in the Province of Wurttemberg. Prepared for the Medical Branch by the Provincial Food Office, Stuttgart. May 22, 1945. (Unpublished)
29. Food Control in Germany. 1. Rationing of the Civilian Population. Report by Foreign Office and Ministry of Economic Warfare of Great Britain. London, February 15, 1945.
30. Ernaehrungswirtschaftliche Ueberschuesse und Zuschuesse der Landesbauernschaften. Dr. Haefner, June 15, 1945. (Unpublished)
31. Abstract of Report on Reich Office of Statistics. U. S. Group C.C. May 21, 1945.
32. Die Taetigkeit der feindlichen Luftwaffe ueber dem Reichsgebiet, August, 1944, September, 1944, October, 1944, November, 1944. Published by Reich Office of Statistics, Weimar. October 26-December 8, 1944.
33. Schema der Verbrauchergruppen im deutschen System der Rationierung von Lebensmitteln, 1939-1945 (ohne Selbstversorger). Dr. Haefner, June 28, 1945. (Unpublished)
34. Versorgung der Ostarbeiter und sowjetischen Kriegsgefangenen, 1942-1945. Lebensmittelversorgung der Juden. Reports prepared for Medical Branch by Dr. Haefner, June 15, 1945. (Unpublished)
35. Nahrungsmittel und Ernaehrung. Report prepared for Medical Branch by Dr. Kessner, Chief of the Municipal Food Office, Stuttgart. May 21, 1945. (Unpublished)
36. Zulagen fuer werdende und stillende Muetter sowie Woechnerinnen. Dr. Haefner, July 1, 1945. (Unpublished)
37. Food Rationing Periods in Germany During the War Years 1939-1945. Table prepared by Medical Branch from German sources. New York, August, 1945.
38. Food Balance Sheets for Greater Germany, 1938/39 to 1943/44. Prepared by officials of the Reich Ministry of Food and Agriculture, June, 1945. (Unpublished)
39. Statistik der Verbrauchergruppen und der Zuteilung an Lebensmitteln. 68. Zuteilungsperiode (16 Oktober bis 12 November 1944). Prepared in the Reich Office of Statistics at the request of the Reich Ministry of Food and Agriculture. Weimar, 1945.
40. Taeglicher Nahrungsverzehr. Dr. Haefner. Undated series of 73 pages. (Unpublished)
41. Naehrstoff- und Naehwertgehalt von Lebensmitteln. Prepared by the Reich Office of Statistics in collaboration with the Reich Health Office. Johann Ambrosius Barth, Publishers. (Special supplement to the journal Die Ernaehrung.) Leipzig, 1943.
42. Development of Food Ration Allowances. Graphs prepared by Medical Branch from German sources. New York, September, 1945.
43. Entwicklung der Rationssaetze. Prepared by Reich Ministry of Food and Agriculture. Undated series of 5 pages. (Unpublished)
44. Die Verwertung der Bodenerzeugung und der Einfuhr. Graph prepared by Ernaehrungswirtschaftliche Forschungsstelle, Berlin. Undated.
45. Repair of Pump-Damage at Dykes Draining-Installations and Agricultural Areas — Hansestadt Hamburg. Prepared for the Medical Branch by the Municipal Sanitary Office, Hamburg. June 9, 1945. (Unpublished)
46. Durchfuehrung des Kartensystems fuer Lebensmittel fuer die 74. Zuteilungsperiode vom 2. bis 29. April 1945. Decree of the Reich Ministry of Food and Agriculture, Berlin. February 20, 1945.
47. Chart showing Ration Cards for Normal Consumers for Ration Periods 65 and 74. Prepared by Medical Branch from German copies. New York, August, 1945.
48. Zulagen fuer kranke und gebrechliche Personen. Dr. Haefner. June 15, 1945. (Unpublished)
49. Prophylaktische Vitaminaktionen 1940-1945. Prepared for Medical Branch by Dr. Joseph Grunwald, Assistant to State Secretary for Health Dr. Conti. July, 1945. (Unpublished)
50. Vitamin C Aktion. File of report and correspondence from the Main Party Office for National Health, Munich.
51. Report on Vitamin Assay of Cebionzucker and Vitamultin. E. Merck Company, Darmstadt. July 5, 1945. (Unpublished)
52. Die Vitamine A, B, C, D, E, K. E. Merck Company, Darmstadt, 1943.
53. 4. Vitamin Aktion (1944) der DAF- wissenschaftliche Auswertung — Einberufung der technischen Hilfskraefte. Letter to Professor Stepp, Munich, from the German Labor Front, Berlin. November 2, 1943. (Unpublished)
54. NSV-Aktion in den Hamburger Grosskatastrophentagen von, 24 Juli bis 3 August 1943. Published by NSV Office, Hamburg. Undated.

FOOD SUPPLY AND NUTRITION

55. Sofortmassnahmen nach folgenschweren Luftangriffen. Letter to Councillors and Mayors of the Province from the President of the Province of Moselleland. Koblenz, June 12, 1944. (Unpublished)
56. Einsatz des Handels nach Luftangriffen. Letter to all Provincial Food Offices from the Reichminister for Food and Agriculture, Berlin. June 23, 1943. (Unpublished)
57. Kuecheneinbau. Luftschutzraum Platz der S.A., Stuttgart. Plan of air raid bunker kitchen designed by the Municipal Construction Office, Stuttgart. March 9, 1945. (Unpublished)
58. Produktionsumstellung beim Gemeinschaftswerk der DAF. Letter to the German Labor Front, Berlin, from Professor Stepp, Munich. June 18, 1943. (Unpublished)
59. Physiologische Norm der Verbrauchergruppen. Dr. Haefner. June 15, 1945. (Unpublished)
60. Recommended Dietary Allowances. Revised 1945. Reprint and Circular Series, No. 122, August, 1945, National Research Council, Washington, D. C.
61. Vitamin B₁ — Versorgung — Schaffung einer Aneurinreserve. Report to the Reich Ministry of the Interior, from Professor A. Scheunert, President of the Reich Institute for Vitamin Assay and Research, Leipzig. July 25, 1944. (Unpublished)
62. Massnahmen zur Sicherung der jetzt gefaehrdeten Versorgung mit Vitamin C. Ibid. March 24, 1944.
63. Physiologisches Kaloriensoll und Kalorienist (55. Kartenperiode) der einzelnen Verbrauchergruppen. Photostat of graph by Professor Wirz, Main Party Office for National Health, Munich. November, 1943. (Unpublished)
64. Ernaehrung in Deutschland und Europa im vierten Kriegsjahr. National Institute of Food Economy Research, Berlin. November 18, 1943.
65. Tabellen zur Vitaminversorgung der deutschen Bevoelkerung. Professor A. Scheunert, Leipzig. July, 1945. (Unpublished tables)
66. Vitamintabellen. Heft 8, Beihefte zur Zeitschrift Die Ernaehrung. 2nd Edition. Werner Droese und Herbert Bramsel. Johann Ambrosius Barth Publishers, Leipzig, 1943.
67. Nahrungsmitteltabelle. 14. Auflage. Dr. Hermann Schall. Johann Ambrosius Barth Publishers, Leipzig, 1942.
68. Nutritive Value of Common Foods. Table I. Nutritive Value of 100 Grams of Food E.P. National Research Council, Washington, D. C. Committee on Food Composition of the Food and Nutrition Board. March 15, 1945.
69. Nutrient Values of European Foodstuffs During the War. Special report D2, Combined Working Party on European Food Supplies, London. December, 1944.
70. Total Bombing Experience and Nutrition in Germany. Graphs prepared by Medical Branch. New York, September, 1945.
71. Total Bombing Tonnage Dropped on Germany from First Attack to V-E Day by 8th, 15th, 12th and 9th Air Force, 1st Tactical Air Force and RAF. Tabulating Service Branch. September, 1945.
72. Changes in Height and Weight of Stuttgart School Children. Col. Beckman, Bad Cannstatt Municipal Hospital. Undated. (Unpublished)
73. Vierteljahresberichte- II/1942, III/1942, IV/1942, I/43, II/1943, III/1943, IV/1943. Prepared by Provincial Party Office for Public Health, Stuttgart. July 16, 1942-October 20, 1943.
74. Vorgehen bei Untersuchungen auf Vitamin A — Mangel. Letter to the Institutes engaged in the program of investigation of the Supply of Germany from Professor Scheunert, Leipzig. April 20, 1945. (Unpublished)
75. Bestimmungen von Vitamin A und Carotin im Blutserum (in der Zeit vom 23.3. — 22.4., 43). Report by Professor Stepp, Munich, to the President of the Reich Health Office, Berlin. Munich, April, 1943. (Unpublished)

CHAPTER TWELVE

MEDICAL SUPPLIES

DEVELOPMENT, PRODUCTION AND DISTRIBUTION

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A smoothly functioning, scientific medical supply industry has become as important to the health of society as the number of hospitals and the availability of well-trained physicians. The quality of medical care which the people of a community enjoy is dependent, among other things, on the ability of manufacturers of drugs, dressings and surgical devices to produce and deliver their products to the doctors serving the people. Our economy and our knowledge of disease and the human body have resulted in the discovery of therapeutic agents which the druggist can make neither satisfactorily nor economically. Thus for many years medical education has taken the presence of such drugs and supplies for granted with the result that when they are not at hand their absence is immediately reflected in the progress of the patient, usually to his detriment.

When Allied bombers pulverized plants of the German medical supply industry and wrecked the railroads of the Reich the whole complexion of medical care changed. The sulfonamides grew scarce, insulin became a treasured rarity, glandular extracts disappeared, and the plan to produce penicillin (the process was well known) had to be abandoned. The surgeon fared little better in the last year of the war when x-ray and similar equipment was usually unobtainable or destroyed, worn-out instruments could not be replaced, and a large part of the surgical dressings were made of paper or on occasion even of moss.

The privations the war imposed upon the practice of medicine were mostly the consequence of bombing. They did not appear until the last summer of the European conflict because of the tight control which the national government had established over the allocation of raw materials and the distribution of medical supplies. This control remained firm to the end but in the last nine months the destruction of factories making pharmaceuticals, dressings, and instruments and the collapse of the system transporting them from the plants

to the patient greatly lowered the caliber of medical care in Germany.

The pharmaceutical industry

The drug industry was concentrated in Berlin, Hamburg, and the cities of the Ruhr and Rhineland. The textile industry providing the raw materials for the manufacture of surgical dressings was located primarily in Silesia, and the glass industry was for the most part in Thuringia. These geographical factors proved to be important in deciding the ultimate effect the air war had on medical supplies. Such dispersal made this industry extremely vulnerable to British and American attacks on rolling stock and canal shipping. The facilities were even more endangered by their location within the geographical areas for, with the exception of the plant for biologicals at Marburg and the large surgical dressing factory Scherrong at Tutlingen in Wurttemberg, the drug and surgical supply factories were usually in an area occupied also by the important units of the armaments industry and other strategic targets.

The laboratories and factories in Berlin and Silesia could not be visited. Rumors filtering out of the Russian area concerning Schering, William R. Warner, and other companies were not reliable and cannot therefore be properly included in this account of our investigation. This report concerns only that part of the industry located in the British, American and French areas of occupation.

Knoll, A. G., Ludwigshafen

This firm was founded in 1886 with a capital of 5,400,000 RM. It was incorporated in 1887 and is considered to have been a major producer of stimulants, sedatives, and narcotics in Germany. The preparations include cardiazol (metrazol) a very strong stimulant used extensively in the German Armed Forces and mainly by the Luftwaffe in much the same manner as benzedrine is employed in the USAAF. Knoll also produced tanalbin,

MEDICAL SUPPLIES



FIGURE 166. Ludwigshafen. Target evaluation photograph of marshaling yards shortly after raid in May 1944. Knoll plant is seen to be still burning. Its location in the vicinity of the strategic rail net is readily apparent.

a tannic acid albuminate employed by the Wehrmacht in the treatment of diarrheal conditions; octinum, another widely used preparation developed as a war substitute for atropine; as well as morphine, codeine, and barbiturates. The importance of this organization to the German war effort is documented in a letter to the Reich's Ministry for Armaments and Munitions dated June 22, 1944. This stated that entire sales to the Armed Forces amounted to:

1941	—	RM 3,078,760
1942	—	RM 4,295,539
1943	—	RM 3,032,784
1944 in the period between Jan. 1 and May 31		RM 1,054,487

Informants at Knoll estimated this to represent 50 per cent of the value of their entire production.

The plant is located in the industrial district of Ludwigshafen adjacent to the main intersection of the north-south, east-west trunk lines of the railroad serving that part of Germany (Figure 166). The lay-out consists of 57 buildings dispersed over an area of 75,000 square yards. They are modern and for the most part two-story buildings of reinforced concrete.

The plant was hit on May 27, 1944, September 5, 1944, and January 6, 1945. In the May raid, 295 B-17's of the Eighth Air Force dropped 2,832 high explosive bombs (500 lb. each). The immediate interpretation report (No. K 2258 Headquarters, Eighth Fighter Command) stated that buildings were observed on fire (Figure 166). No statement as to the severity of damage had been made. The raid of September 5, 1944, caused little damage to the plant but that on January 6, 1945, resulted in the complete destruction of 75 per cent of the facilities of the Knoll, A.G. This attack by 70 aircraft of the Eighth Air Force in which 205 tons of high explosive bombs were dropped was directed at the near-by marshaling yards. The power plant, administrative offices, tableting and coating departments, and the research laboratories suffered severe damage (Figures 167 and 168). All operations of the plant were discontinued for several weeks until machinery could be salvaged and moved into the basement of the main administration building. When production was resumed, it could be carried out only on a very limited scale. Dr. Walter Sauerbeck, chief chemist of the company and son-in-law of the owner, stated that limited production might have been resumed de-

MEDICAL SUPPLIES

spite the material damage had it not been for the destruction of the plant power house (Figure 169). The loss of the steam plant caused the shutdown of all facilities except those which could be operated with emergency power from the city lines and an auxiliary heating system.

The main research laboratories of the Knoll organization were evacuated to Heidelberg late in the summer of 1944. This migration to the safety of Heidelberg seemed to be common practice for laboratories in that part of Germany. When the city was taken it was found to be a haven for many industrial scientists. Dr. Kraft, assistant director of research for Knoll, was located there. He stated that the early raids in which only minor damage was done to the plant were sufficient to interrupt their investigations of penicillin. It is evident from correspondence taken from the files that this concern was regarded by the Speer Ministry as one of the most important research organizations for penicillin in Germany. Kraft added

that if it had not been for the repeated interruptions of his work by the air attacks he would have been able to begin supplying the German Army with penicillin by the spring of 1945.

After January, 1945, Knoll was forced to stop their supply of octinum, employed as one of the principal drugs in the treatment of burns in the German Army, and to curtail their supply of tannalbin and morphine.

No shelters were provided in the factory grounds since most of the workers lived in the neighboring area and were assigned to public facilities in the vicinity of their homes. Early in 1944, the intensity of the air raids increased to such a degree that the management was granted the use of the three large shelters belonging to the German Railways. Dr. Werner Mothes, director of the plant, and Dr. Freese, production manager, estimated that each air raid alarm during working hours deprived them of 1600 man-hours of labor. There were 800 employees in this plant, and since all of them left



FIGURE 167. *Knoll plant viewed from grade crossing on western boundary of plant property. Power plant is to extreme right, center is chemical synthesis building. The granulating department and the towered building for filling, packaging and storage of finished supplies is shown in the background. All buildings are severely damaged or completely destroyed, i.e., will have to be taken down to their foundations and entirely replaced.*

FIGURE 168

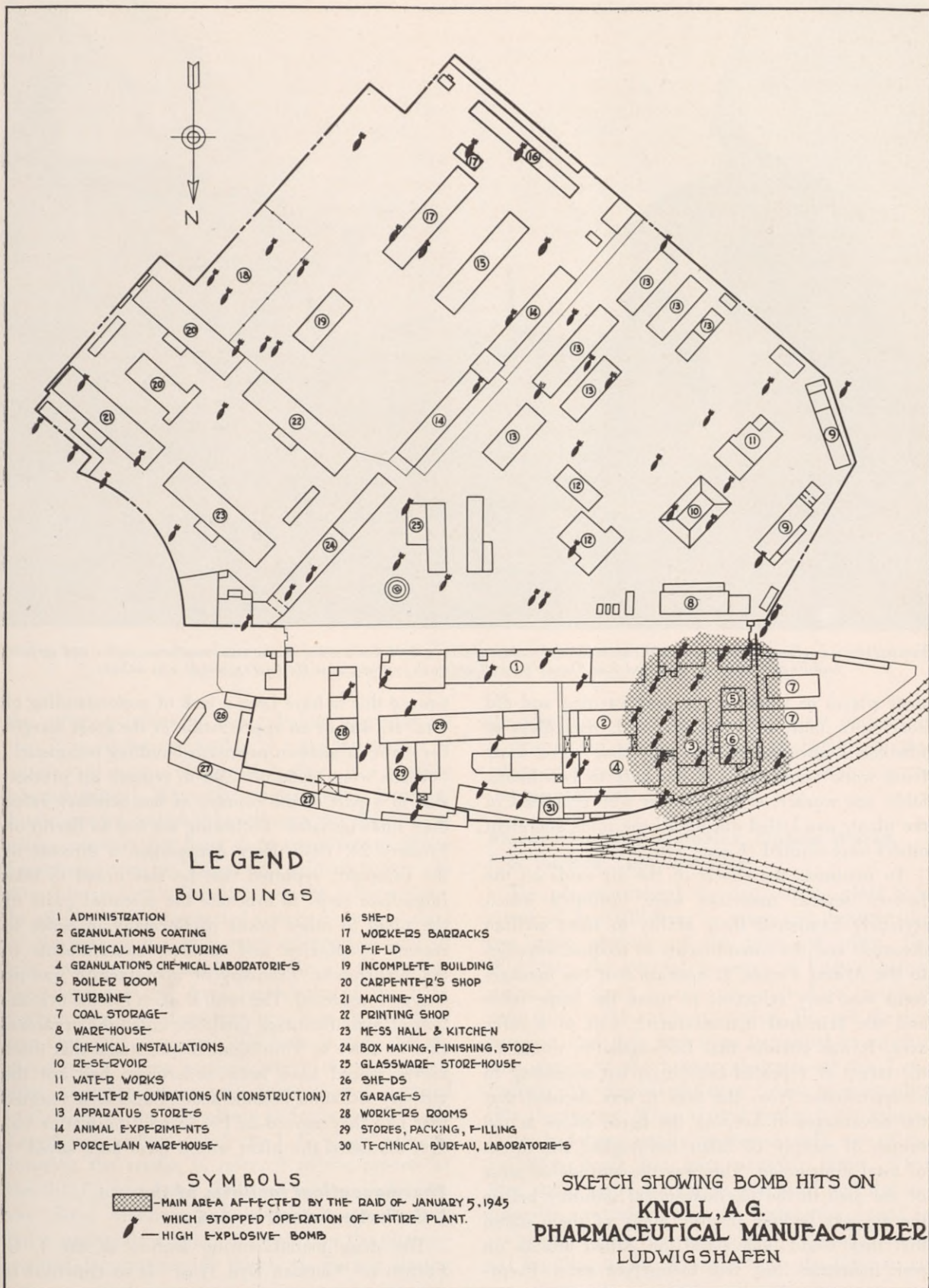




FIGURE 169. Looking north from main entrance to the plant showing total destruction of chemical synthesis, boiler and turbine buildings (buildings 3, 5, and 6 in Figure 169). Warden in look-out post (left foreground) was unhurt.

their places of work on the first warning and did not return until all clear sounded, regardless of whether Ludwigshafen was hit, they were away from work from one and one-half to two hours. Only one worker, a fire watcher who remained in the plant, was killed during all the raids and eight others were injured (Figure 170).

To minimize the effects of the air raids on the factory several measures were instituted which seriously hampered their ability to meet civilian demands and the commitments in medical supplies to the Armed Forces. It appears that the management was very reluctant to move the home office and the principal manufacturing unit to a safer area. It was obvious that Ludwigshafen would be the target of repeated bombings, but according to correspondence from the files it was decided that the advantages of keeping the home offices at the source of supply of labor outweighed the threat of total destruction. This was the attitude of most of the men in the pharmaceutical industry before the air war became intense. Many of them stated that they could understand the Allied attacks on war industries but felt themselves safe. Events

proved this to have been a lack of understanding of total air war or an appreciation of the great margin for error in modern precision bombing technique.

Plans were made too late to remove all production to a part of the country of less military value than Ludwigshafen. Following his trip to Berlin on January 24, 1945, Herr Arnsperger, a director of the company, reported that he was urged to take immediate steps to evacuate the essential parts of the plant to other towns of Germany in order to resume production and to meet commitments to the Wehrmacht. Economy of manufacture was no longer considered. The central office for the evacuation of manufacturing facilities urged the organization to move to Thuringia. It was stated that these moves would have been undertaken had not the military situation become acute. Sauerbeck asserted that had they moved in 1943 when the matter was first discussed the plant would have been saved.

Pharmaceutical facilities of the I. G. Farbenindustrie, A. G.

The drug manufacturing section of the I. G. Farben or "German Dye Trust" is so entwined in



FIGURE 170. *View of destruction inside plant area. Granulating and coating building is to the left while rear of administration building is to the right. Most of damage visible here is from blast effect only.*

the other activities of this fabulous organization that it is almost impossible to trace the results of an air raid on one of the plants down to a finished pharmaceutical. When the giant chemical works at Ludwigshafen were hit, Leverkusen was deprived of acids necessary for their drug manufacture. When Leverkusen was hit, Elberfeld could no longer obtain sulfuric acid with which to make sulfonamides. In all this highly integrated system the serum plant at Marburg is the only quasi-independent unit. It was therefore impossible to study all the factors contributing to the final breakdown of the I. G. Farben pharmaceutical empire within the limits of our time and personnel. We have limited the observations to those sections where the preponderance of manufacture was drugs. For a detailed evaluation of the big plants at Ludwigshafen and Leverkusen without which the I. G. would cease to function the reader is referred to the reports of the Oil, Chemical and Rubber Division of the Survey. Since American and British airmen dropped but a negligible number of bombs on the pharmaceutical laboratories of the I. G. Farben during

the war the succeeding paragraphs are devoted to a description of the influence of bombings elsewhere on the ability of these units to supply essential medications.

Biochemical Laboratories, Oppau Works, I. G. Farben, Ludwigshafen

The pharmaceutical division of this plant consisted of five buildings in open area between the two main sections of the principal plant. Dr. Wuertzler, the general manager at Ludwigshafen, stated that these laboratories played an insignificant role in the entire operation. He had the impression that they had been permitted to operate as a fetish of the former chairman of the I. G. Farben. No documents were found to contradict this observation. When visited in March, the laboratories had been totally destroyed, only one of the buildings being left even partially intact. What files could be located were examined and the impression was gained that the destruction would in no way influence the availability of essential medical supplies to the Wehrmacht or the German ci-

vilian population. The plant was still under shell fire and none of the scientists could be located for interrogation, and according to information obtained they had fled to the east bank of the Rhine. The files contained nothing of interest.

The damage to the remainder of the I. G. plant, where most of the heavy chemicals for the German dye trust were produced, has been reported in detail by the Oil, Chemical and Rubber Division. Although also engaged in the manufacture of synthetic rubber, gasoline, 90 per cent hydrogen peroxide and related chemicals for affiliated companies, and for the rest of Germany, a large number of products employed as basic ingredients in pharmaceutical manufacturing were made at Ludwigshafen. These include 2,4 dichlorobenzoic acid for atabrine and polyvinylpyrrolidone or "kollidon," the basic substance in the synthetic blood substitute "periston." When this plant was attacked and partially destroyed, the effect was felt by the entire pharmaceutical industry in Europe and mainly by the other facilities of the I. G. Farben.

I. G. Farben, Hoechst

This is a large rambling plant covering approximately one square mile, engaged in the manufacture of pharmaceuticals and of chemicals of all types. The diversity of products is apparent from the lists in Table 49.

No heavy air attacks were directed against this plant during the war. It is not listed as a target in the tabulation data. Nevertheless, Hoechst laboratories were damaged slightly by several high explosives and incendiaries. It is the impression of the informants there that these bombs were dropped only through error or from planes jettisoning their load after raids on near-by Frankfurt. The plant was intact and operating when first visited three days after the city was captured. The few hits caused only minor damage which was quickly repaired. Company records show that on June 30, 1940, several bombs dropped in series struck the administrative offices and caused a fire in one building; a short unimportant interruption of work followed. One man was killed and one seriously wounded. On September 12, 1940, and May 6, 1941, minor damage was done by high explosives. On March 18, 1944, during a heavy attack on Frankfurt, one heavy high explosive bomb struck the silo containing stores of nitrate of lime. From 1,200 to 1,500 incendiaries and from 80 to 100 phosphorous bombs struck the northeastern sec-

tion injuring five men and destroying the work shop and building repair department. During the attack of the night of March 22-23, 1944, which was also directed at Frankfurt, 3,000 incendiaries and 200 phosphorous bombs hit the plant. Wood working sheds and several small warehouses were burned but there was no significant interruption of production. On February 10, 1945, two high explosives were dropped and on March 17 two low flying light bombers dropped three sticks of bombs on the plant resulting in minor damage to five buildings and killing two of the workers.

While the extent of the damage inflicted on this unit of the I. G. Farben was insignificant and in no way interfered with their ability to produce, the strategic air offensive greatly affected the Hoechst plant through the destruction of German cities and chemical plants, and the disruption of rail and water transportation. The manner in which this was accomplished furnished a splendid example of the extent to which such indirect effects can cripple a large producer.

Hoechst supplied 60 per cent of all insulin produced in Germany. This represented 600,000,000 units during each peacetime year. The pancreas glands were supplied from slaughter houses in the cities of 150,000 population and over throughout Germany. The cities of central and southern Germany supplied most of the I.G.'s requirements while those in northern sections of the country supplied Schering, A. G., the other large insulin manufacturer. Purchases were made through brokers. The glands were shipped from the slaughter houses to Hoechst in special refrigerator cars making a scheduled circuit of the suppliers.

Until 1942 calves were used as the primary source of pancreas, according to Professor C. L. Lautenschlaeger, general director of the plant. From that time on the meat situation became critical causing a gradual shift to pork pancreas. Since the yield of a similar quality from porcine glands is but one fourth that of young beef the change caused a gradual decrease in the amount of insulin that could be extracted.

An increased demand for insulin accompanied the minor curtailment caused by the shift in source of supply livestock. The greater demand followed the gradual change of the nation from one containing large amounts of fat and protein to one having a preponderance of carbohydrates. Such a shift naturally made it more difficult to manage the diabetics dietetically. The situation was recognized

TABLE 49. LIST OF PRODUCTS, I. G. FARBEN, HOECHST

Indications given are those of enemy sources

MEDICAL PREPARATIONS

Anaesthesia.....	Anesthetic	Novalgin-Chinin.....	Antipyretic and analgesic
Antipyrin.....	Antipyretic, Analgesic, Antineuralgic	Novocain.....	Local anesthetic
Aspasan.....	Antiasthmatic	Novocain corbasil.....	Anesthetic
Cantan.....	Vitamin C	Ninhydrin.....	Diagnostic
Casbis.....	Injectable Bismuth Preparation	Orasthin.....	Oxytocic from the pituitary
Citrin.....	Permeability Vitamin, Factor P	Orexin.....	Stomachic
Corteneil } Corteneiletten }	Synthetic Adrenal Cortex Hormone	Panflavin-Lozenges } Trypflvetten }	Disinfectant for mouth and throat
Devegan.....	Antileukorrhic	Pantocain.....	Local anesthetic
Dolantin.....	Analgesic and Spasmolytic	Pellidol salve } Pellidol applicators }	Epithelializing preparation
Ebesal.....	Organic Copper Preparation	Postonal.....	Suppository base
Elityran.....	Thyroid Preparation	Preloban.....	Active principle of the anterior pituitary
Elityran K.....	Thyroid active synthetic	Priovit.....	Water soluble vitamins B and C
Emanal.....	Thyroid Preparation Enriched with Iodine	Pyramadon.....	Antipyretic, antineuralgic and analgesic
Ereton.....	Natural Vitamin E Preparation	Racedrin.....	Racemic ephedrine
Erugon.....	Hormone Preparation of the Male Gonad	Rephrin.....	Racedrin plus racemic suprarenin
Festal.....	Pancreatic Enzyme plus Hemicellulase	Revasa lozenges.....	Colorless disinfectant for mouth and throat
Gardan.....	Antipyretic and Analgesic	Rivanol.....	Iodine preparation
Hemodal.....	Vitamin K Preparation	Sajodin.....	Lipotrope iodine preparation
Hexophan.....	Antiarthritic and Antirheumatic	Salvarsan } Salvarsan natrium } Myo-salvarsan } Neo-salvarsan } Neo-silbersalvarsan } Solu-salvarsan }	Antisymphilitics
Hydronal.....	Hypersecretory Gastric Conditions	Spirocid.....	Arsenic acid preparation
Hypophysin.....	Oxytocic and Cardiovascular Tonic	Salyrgan.....	Diuretic
Icoral.....	Circulatory and Respiratory Analeptic	Solaesthin.....	Inhalation anesthetic
Iliren.....	Adrenalin free adrenal cortex	Nitrous oxide.....	
Impletol.....	Complex preparation of Novocain and caffeine	Suprarenin.....	
Insulin } Depot Insulin } Depot Insulin } Nativ Insulin }	Turbid } Clear }	Suprifen.....	Cardiovascular tonic
Lacarnol.....	Nucleosid preparation active on the circulation	Surfen.....	Superficial and deep antiseptic
Lubisan.....	Vermifuge	Tonephin.....	Posterior pituitary extract
Lutren.....	Corpus luteum hormone	Tonophosphan.....	Metabolic stimulant
Lopion.....	Gold preparation	Torantil.....	Extract from intestinal mucosa
Melubrin.....	Antirheumatic and antineuralgic	Trigemin.....	Analgesic
Migraenin.....	Analgesic and antineuralgic	Trypflavin.....	Wound antiseptic
Nosuprin.....	Local anesthetic	Tumenol-ammonia.....	Adstringent
Novalgin.....	Analgesic, antirheumatic and antipyretic	Varon.....	Synthetic oxytocic

SERA AND IMMUNIZING AGENTS

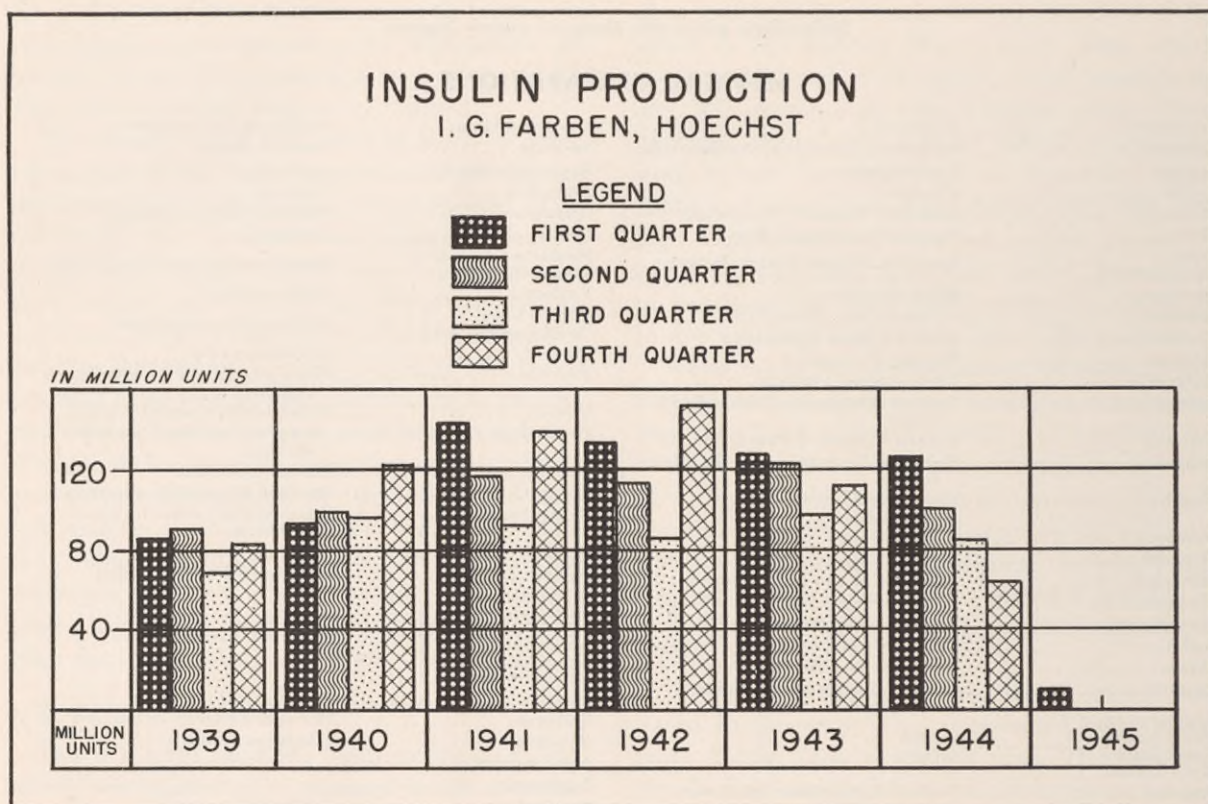
Dysentery Polyfagin.....		Omnadin.....	For nonspecific immunotherapy
Gripocolin Drops.....	Antigen administered for upper respiratory infections	Paragen.....	For immunotherapy
Leukogen.....	Staphylococcus vaccine	Phytossan Monovalent.....	Whooping cough vaccine
		Trichophytin.....	Polyvalent preparation

VETERINARY MEDICAL PREPARATIONS

Allegan Tablets.....	Vermifuge and ruborant	Methylenblue Med. "Bayer" } Methylviolet Med. }	Chemotherapeutic antiseptic
Anaesthesia.....	Anesthetic	Natrolletten.....	Virus disinfectant
Avomin.....	Vermifuge	Nemural.....	Vermifuge
Bovoflavin Salve.....	Disinfectant for coital infections of cows and bulls	Neosalvarsan.....	
Ciff Capsules.....	Vermifuge for horses	Novalgin.....	Analgesic and antispasmodic
Congasin.....	For disease of cattle and horses caused by Trypanosoma Congolense and Trypanosoma Vivax	Orasthin "strong".....	Local anesthetic
Derrophen.....	For dermatobium infections of cattle	Osmaron Milkfat.....	Germicidal
Elityran.....	Thyroid preparation	Pantocaine.....	Mucous membrane anesthetic
Entozon.....	Chemotherapeutic antiseptic preparation	Pellidol Salve.....	Epithelializing preparation
Erugon.....	Testicular hormone preparation	Rephrin.....	Racemic ephedrine & racemic suprarenine
Festal.....	Pancreas enzyme preparation and hemicellulase	Rivanol.....	Chemotherapeutic
Hypophysin.....	Pituitary preparation	Salyrgan.....	Injectible Diuretic
Igitol Powders and Pills.....	Choleric	Suprarenin.....	
Malix.....	Preparation from derris roots against ectoparasites	Tonophosphan Solution.....	Cardiovascular tonic
		Trypflavin.....	Chemotherapeutic antiseptic
		Trypanblue.....	Specific for piroplasma species

MEDICAL SUPPLIES

FIGURE 171



as a national problem when Dr. Conti established an insulin control commission under the *Aertze-kammer* or National Chamber of Physicians. This group ordered all diabetics to be registered and declared that physicians must reduce the number of patients receiving insulin by one third through use of diet. To control this distribution of the extract they then issued insulin ration cards to the certified 200,000 diabetics in the country.

The necessity for the rationing program is shown in Figure 171 by the fluctuation in output between 1945 and 1944. These data of the insulin production also reflect accurately the influence of bombing on the ability of Hoechst to obtain the necessary satisfactory raw materials. The yield when compared with the amounts of raw glands obtained (Table 50) is indicative of the extent of deterioration of glands and the drop in unit rate of recovery per kilogram of gland. The decrease in dead weight as well as the decrease in yield is the result of destruction of slaughter houses in German cities and the disruption of refrigeration facilities and transportation. The drop to a negligible amount in 1945 is, according to Lautenschlaeger, attributable to the

complete breakdown of transportation after the attacks by the Allied air forces in January, 1945.

TABLE 50. AVERAGE MONTHLY RECEIPTS OF PANCREAS BY HOECHST

District	1943		1944	
	kg.	%	kg.	%
Baden-Wurtemberg	1,660	5.4	1,168	4
Bavaria	4,080	13	4,246	14.7
Berlin, Flensburg and Luebeck, Vienna	4,529	14.5	4,764	16.5
Alsace-Lorraine and Luxembourg	992	3.2	878	3.2
Frankfort				
Pfalz and Saar	1,679	5.4	2,223	7.7
Central Germany	2,979	9.4	1,850	6.4
Hannover-Hamburg	2,387	7.6	3,123	10.9
Rhineland-Westf.	12,302	39.5	10,061	35
Sudeten	627	2	598	2.6
Total	31,235		28,911	



FIGURE 172. Air view of southern section of I. G. Farben at Leverkusen taken by Royal Air Force in 1944. Arrow in lower left points to pharmaceutical division where ampulling, granulating, tableting and packaging were done.

Table 50, the average monthly receipts, shows a yearly purchase of 374,820 kg. of pancreas in 1943 and 346,932 kg. in 1944, or a decrease of 7.44 per cent. The production figures in Figure 171 show a drop from 433,000,000 units in 1943 to 377,000,000 units in 1944. This is equivalent to a drop in unit recovery from 1,230 units for each kilogram of the glandular material received in 1943 to 1,090 units in the 1944 raw glands. It is an 11 per cent reduction in yield.

To make up for the growing deficit in insulin supply, Hoechst officials wanted to revert to dioxycetone, discovered by Van Noorden in 1921. It has been used in cases of acidosis and, they contended, will not raise the blood sugar although it is a sugar itself. Production difficulties, however, restrained them from starting manufacture.

The effect of the reduced supply of insulin on the treatment of diabetes in Germany became steadily worse until early spring of 1945, when physicians in several cities stated that patients with diabetes not amenable to dietary control were dying for lack of insulin. The rationing system did aid in reducing the demand by the required one third. All physicians were forced to report the number of patients under their care and to show that they had curtailed their use of insulin by one third. When this was presented they were then allowed to authorize insulin for their patients. Each case was reported to a commission of local physicians for approval. When the ration was granted the patient was given a card showing the number of units he could purchase monthly and was assigned an apothecary for his supplies. The num-

MEDICAL SUPPLIES

TABLE 51. QUARTERLY PRODUCTION OF SIX LEADING PRODUCTS OF
HOECHST PLANT OF I. G. FARBEN

	<i>l-Ascorbic Acid</i>	<i>Anaesthesin</i>	<i>Novocain</i>	<i>Pantocain</i>	<i>Neosalvarsan</i>	<i>Salyrgan*</i> (in liters) (20% sol.)
1939						
1st Quarter	0.3t	—	—	—	1.1t	2127
2nd “	0.3t	—	—	—	0.4t	2273
3rd “	0.2t	2.6t	0.5t	0.1t	1.5t	1253
4th “	0.2t	6.4t	2.2t	0.2t	1.0t	1789
1940						
1st “	0.25t	6.8t	2.7t	0.14t	1.9t	864
2nd “	0.1t	9.8t	2.4t	0.13t	1.9t	432
3rd “	0.5t	8.7t	3.0t	0.13t	1.4t	864
4th “	0.2t	5.7t	1.5t	0.23t	1.3t	1242
1941						
1st “	0.1t	5.7t	0.8t	0.33t	1.4t	1026
2nd “	0.04t	4.3t	0.8t	0.11t	1.9t	648
3rd “	0.28t	3.9t	3.1t	0.37t	2.2t	551
4th “	2.6t	7.8t	2.8t	—	1.7t	432
1942						
1st “	2.8t	10.1t	1.8t	0.29t	0.6t	1080
2nd “	2.4t	9.3t	1.8t	0.32t	1.3t	1134
3rd “	3t	10.2t	3.3t	—	2.5t	1404
4th “	3.1t	8.2t	2.3t	0.23t	2.2t	1944
1943						
1st “	3.3t	10.6t	3.2t	—	2.1t	1350
2nd “	2.0t	7.2t	1.5t	0.36t	2.2t	1890
3rd “	2.9t	11.5t	2.7t	—	2.2t	1998
4th “	2.4t	10.4t	2.1t	0.17t	2.2t	1705
1944						
1st. “	3.0t	10.15t	2.17t	0.32t	1.98t	1440
2nd “	2.49t	8.0t	2.16t	0.27t	2.1t	2160
3rd “	1.6t	11.6t	2.7t	0.43t	2.2t	1512
4th “	0.1t	4.6t	2.14t	0.14t	1.8t	1872
1945						
1st “	—	1.7t	1.1t	—	0.4t	—
2nd “	—	—	—	—	—	—

*All figures in metric tons (2208 pounds avoirdupois) except Salyrgan

ber of ration units assigned the pharmacist was the basis of the amount the wholesaler was permitted to release. The system of control went no higher than the wholesaler and did not extend to the manufacturer who was exhorted by the government to maintain maximum production. The estimated capacity for each quarter was reported to the Berlin office of the national physicians' association who calculated the total ration accordingly.

The chaotic conditions prevailing in the treatment of diabetes in the spring of 1945 clearly indicate that the system of rationing did not begin early enough and did not permit the accumulation of any reserve stocks against the day when Allied air power would wreck Germany's transportation system.

Vitamin C production at Hoechst did not show any marked drop until late summer of 1944. It could be traced directly to destruction of the large chemical plant at Ludwigshafen. The supply of potatoes employed for the extraction of sorbitol by the nickel reduction process became sporadic when increased amounts of potatoes had to be diverted for civilian consumption. Hoechst officials declared that all necessary supplies of ascorbic acid for the winter and spring of 1944-45 had been manufactured in the summer of 1944 so that shutdown in the late fall (shown in Table 51) was not immediately reflected in sales.

Ascorbic acid is but one of the many examples of the indirect effects of bombing on this rambling, intact plant. The ammonia used was made at Ludwigshafen and transported up the Rhine and the Main Rivers to Hoechst in an "ammonia" boat. When the ammonia boat was sunk supplies were interrupted. Acetanilid was made at the Knapsack plant outside Cologne until that plant was bombed out in 1942. From Leuna came dimethylether used in the production of barbiturates. The effect of this on the seven leading products (insulin given elsewhere) is shown in Table 51. The marked slump amounting to discontinuance of these items is an excellent example of how the bombing of key supply centers and transportation can all but end the production of a plant which is, in itself, virtually untouched.

Behringwerk, Marburg

This is the unit of the I. G. Farben combine responsible for the production of biologicals. Seventy per cent of the sera, vaccines and antitoxins produced at the Behringwerk were for export trade. The remaining 30 per cent of the capacity is suffi-

cient to meet 85 per cent of the German domestic demand for biologicals.

Despite the fact that on-the-spot inspection of this plant quickly revealed it was untouched by the air war and an investigation of the production data showed no changes from peacetime (Table 52), an examination of these facilities was something more than academic. The history of this plant in a country which was severely crippled by bombing emphasizes the most important factor for industrialists on the receiving end of a total war from the air. It is this: that in a large measure the ability of an industry not engaged primarily in armaments manufacture to withstand the impact of a strategic air offensive is directly related to its distance from an industrial center and the autonomy of its operation. The biologicals plant of the I. G. Farben is located in a picturesque wooded valley a mile north of the old university city of Marburg. The town itself is of no strategic value except as a rail-head of secondary importance. This was lightly bombed in 1945 but the attack did not greatly affect the community and concerned the Behringwerk only by destroying a small warehouse of biologicals awaiting shipment at the freight station.

Although there was little reason to expect a raid against the plant, the Behringwerk dispersed their essential supplies in twenty-three warehouses scattered throughout the farm country of Kurhessen. These housed reserve stocks of feed, agar, petri dishes, ampules and other glassware. According to Dr. Karl Demnitz, general director of the company, Professor Brandt, the Health Commissar, insisted upon this dispersal early in 1943. The Berlin authorities recognized the Behringwerk as the most vulnerable single target in their health defense. With but 20 per cent of their total output they were virtually the sole source of supply of sera and vaccines for the German Armed Forces. Neither the plant nor the area in which it was located was defended by anti-aircraft artillery or fighter interception. To have destroyed it would have been the most telling blow the Allies could have delivered against the health of the enemy Armed Forces and civilian population, if one may accept the opinion of German health authorities and the Behringwerk managers.

The Bayer Laboratories at Elberfeld

The Bayer organization is the largest division of the I. G. Farben engaged in the manufacture of pharmaceuticals. This facility is one of the most

important sources of vitamins, barbiturates, sulfonamides, and anti-malarials. No tableting or ampuling is done at Elberfeld, all products being sent to Leverkusen for finishing. The laboratories are also important for their research division which is discussed in a later section of this chapter.

The record of the Bayer laboratories during the war is the same in most essentials as that of the plant at Hoechst. It was not the target of any Allied attack, and the fluctuations in production which may be traced to air raids were the result of interference with delivery of essential ingredients and absenteeism following raids on the city of Wuppertal-Elberfeld itself. When Wuppertal was hit by one of the war's early area raids in May, 1943, the plant was forced to close for two weeks because of absenteeism. The Bayer buildings were hit by a few incendiaries but no damage was done. However, employees remained away from work to repair their houses, because of fear of new attacks, or because transportation in that Ruhr city had broken down. Dr. Clemens Luther, the production manager, said it was mid-July before full production could be resumed.

Throughout the war, Bayer was able to maintain most of its production. The most marked fluctuations occurred in those products requiring raw materials made at Ludwigshafen and Leverkusen. Periston is the product Professor Heinrich Hoerlein, the general manager, repeatedly referred to in discussing this subject. This synthetic blood substitute was discovered at Elberfeld during the war. It is produced from a by-product obtained in the manufacture of butadiene at Ludwigshafen. When production there was interrupted Bayer was no longer able to supply the German Armed Forces with periston, which had largely replaced dried plasma and other blood substitutes. Ludwigshafen also furnished 2,4 dichlorobenzoic acid for atabrine manufacture. The synthetic gasoline plant at Leuna supplied dimethylether used in production of barbiturates, thus attacks on these targets of greater strategic value immediately curtailed production at Elberfeld.

Pharmaceutical manufacture at Leverkusen

Leverkusen like Ludwigshafen was important to the Allied air planners as a producer of chemicals employed in fuels, propellants, and explosives, not as a pharmaceutical plant. It has been subjected to a searching investigation by the Oil, Chemical, and Rubber Division. What is presented

here is, therefore, but a supplement to that report.

Leverkusen was attacked repeatedly during the war but it was not until late summer, 1944, that the raids reached great intensity. In all the attacks, however, the large buildings housing the departments for granulating, tableting, coating and finishing the supplies from other plants did not suffer damage of any consequence (Figure 172). The destruction of chlorosulfuric acid facilities in the winter of 1944 arrested the production of sulfonamides at Elberfeld.

The sales of the twenty most important pharmaceuticals of the I. G. Farben industries are shown in the charts in Figures 173 to 192 inclusive.

Atabrine (Figure 173) sales increased from 7,400 kg. in 1939 to 101,800 kg. in 1943. In 1944 they dropped to 68,826 kg., the decrease being in export sales which is, in part, a reflection of the drop in production caused by failure of 2,4 dichlorobenzoic acid and oxytriethylamino hydrochloride to arrive from Hoechst. This, plus the damage from bombing to the Leverkusen plant as a whole, caused all production of atabrine to stop in November, 1944. A small amount of damage occurred to the roof and windows of the atabrine building from artillery fire but none from bombing. It is interesting to note that in 1944 sales to the Wehrmacht represented 83 per cent of total sales. *Plasmochin's* history (Figure 174) during the last years of the war is similar to that of atabrine. The steady decline in its use was checked in 1943 when export demands again increased.

No *aspirin* (Figure 175) was sold to the Wehrmacht by the Bayer Division of the I. G. Farben. The 7 per cent decrease in 1944 is attributable to over-all damage to the Leverkusen plant and was reflected in a cut in exports. *Pyramidon* (Figure 176) sales did not begin to increase markedly until 1943 when 52,000 kg. were sold as compared with 29,000 kg. in 1942. The greatest proportionate increase was in exports which fell off again in 1944, while the civilian sales in Germany continued to increase.

The production of *sulfonamides* (Figures 177-180) fluctuated in much the same way as did the other preparations manufactured at Leverkusen. The normal monthly production of *sulfathiazole* was approximately 12½ tons. The demand on the I. G. Farben was for tablets and an output of 20 tons a month was required. This capacity could never be reached. Indeed, in October, 1944, the heavy raids causing the general plant shutdown

TABLE 52. QUARTERLY PRODUCTION OF MOST IMPORTANT SERA AND VACCINES
BEHRINGWERK AT MARBURG/LAHN, DIVISION OF I. G. FARBEN

Amounts are given in liters

Year	Qtr.	SERA										VACCINES														
		Diph.*	Tetanus*	Gas Gangrene	Typhoid	Scarlet Fever	Ery- sipelas	Dysentery	Coli	Snake bite	Meningo- coccus	Diph.	Scarlet Fever	Typhoid	Dysentery	Quad- ruple	Diph- Scarlet "K"	Diph- Scarlet "E"	Fowl Plague	Typhus "E"	Typhus "P"	Cholera	Plague	Human Yatren	Yatren** and Cultures	
1939	I	5455	6338	1700	49	217	7422	1392	533	32	475	742	—	—	—	—	—	—	—	—	—	—	—	—	683	1965
	II	2980	5820	2342	36	234	6256	18	525	10	283	474	—	—	—	—	—	—	—	—	—	—	—	—	565	4018
	III	5463	6536	3570	26	256	5174	1278	568	37	238	—	—	2127	518	—	—	—	—	—	—	—	—	—	580	1623
	IV	5686	6537	3959	44	304	5461	359	381	66	486	—	—	1283	630	—	—	—	—	—	—	—	—	—	600	3127
	Total	19584	25231	11571	155	1011	24313	3047	2007	145	1482	1216	—	3410	1148	—	—	—	—	—	—	—	—	—	2428	10733
1940	I	5901	10927	6041	25	270	5045	548	521	4	437	453	—	1722	409	—	—	—	—	—	—	—	—	—	445	2626
	II	4901	15582	6109	42	291	4365	2223	644	42	515	604	—	—	541	—	—	—	—	—	—	—	—	—	285	3288
	III	4080	10952	6273	—	326	4557	2138	1089	69	762	370	—	—	1756	—	—	—	—	—	—	—	—	—	420	2096
	IV	2814	7513	3096	—	497	7140	1921	1136	56	715	155	—	—	—	—	—	—	—	—	—	—	—	—	115	2308
	Total	17696	44974	21519	67	1384	21107	6830	3390	171	2429	1582	—	1722	2706	—	—	—	—	—	—	—	—	—	1265	10318
1941	I	4758	6041	3032	—	526	11094	3028	1062	51	671	1289	—	—	—	—	—	—	—	—	—	—	—	—	363	1987
	II	4468	4232	4264	—	566	10306	3383	771	107	608	923	—	—	2366	—	—	—	—	—	—	—	—	—	455	4941
	III	5682	3513	6156	—	615	13395	3278	676	114	521	1570	—	—	881	—	—	—	—	—	—	—	—	—	725	2386
	IV	8186	2591	5959	35	943	12844	4788	527	119	413	1343	—	—	—	—	—	—	—	—	—	—	—	—	611	2713
	Total	23094	16377	19411	35	2650	47639	14477	3036	391	2213	5125	—	—	3247	—	—	—	—	—	—	—	—	—	2154	12027
1942	I	6671	2830	6087	31	1075	11733	5449	450	219	346	2321	—	—	5882	—	—	—	—	—	—	—	—	—	365	2497
	II	6725	2678	5622	42	1417	10702	4973	550	180	298	2878	360	3285	4965	—	—	—	—	—	—	—	—	—	355	4854
	III	6657	2679	5672	59	1498	10246	6834	581	135	268	3476	560	1978	5052	—	—	—	—	—	—	—	—	—	515	2707
	IV	4475	3465	5976	83	1465	8595	4233	619	160	239	2593	466	—	2011	—	—	—	—	—	—	—	—	—	1035	2794
	Total	24528	11652	23357	215	5455	41276	21489	2200	694	1151	11268	1386	5263	17910	—	—	—	—	—	—	—	—	—	193	12852
1943	I	7233	3879	8343	62	1488	7719	5344	720	138	268	2421	529	—	6827	—	632	46	—	—	—	—	—	—	755	2986
	II	5219	4552	9941	53	680	6807	563	794	129	322	4447	774	1986	9625	—	2549	256	—	—	—	—	—	—	650	5892
	III	5388	4345	11824	104	534	6768	808	1016	119	321	3835	1216	—	8351	1179	3158	495	—	—	—	—	—	—	769	5602
	IV	5783	4220	12073	62	441	7850	—	1119	92	324	3285	401	—	1400	6381	5243	46	—	—	—	—	—	—	1200	3234
	Total	23623	16996	42181	281	3143	29144	6715	3649	478	1235	13988	2920	1986	26203	7560	11582	843	—	—	—	—	—	—	3374	17714
1944	I	5288	4251	11241	62	459	6028	—	902	125	216	4525	170	—	15432	2407	3463	78	—	—	—	—	—	—	1250	4906
	II	5422	3806	11265	65	439	9510	—	979	80	65	4054	320	—	6411	2336	4294	788	—	—	—	—	—	—	550	6731
	III	7613	4343	10773	29	406	8594	—	803	72	60	3595	652	1416	4208	3672	2429	569	1124	—	—	—	—	—	810	5421
	IV	8138	4377	10355	—	307	11487	—	870	7	16	1692	—	4547	1500	—	—	1109	1632	—	—	—	—	—	990	6580
	Total	26461	16777	43634	156	1611	35619	—	3554	284	357	13866	1142	5963	27551	8415	10186	2544	2756	—	—	—	—	—	3600	23638

*Diphtheria serum is calculated on basis of 400 units per ccm and Tetanus serum on value of 600 units per ccm.

** Veterinary

reduced the output to 4 tons. None was produced in November and only 3 tons in December. This is reflected in the sales shown in Figure 177. *Sulfapyridine* was first produced in 1940 (Figure 178). It was subjected to a 29 per cent decrease in 1944 due, in part, to the lack of demand by the Armed Forces. *Prontosil* also fell off, although the Armed Forces continued to use large amounts in 1944, as shown by Figure 179. The decrease here is the same as that for other sulfonamides. *Marfanil*, which was discovered in the research laboratories at Elberfeld and developed for use in anaerobic infections, reached its peak production in 1943 (Figure 180). The 20 per cent decrease in 1944 was due to production difficulties at Elberfeld and some reduction in the requirements of the Armed Forces. Almost all production of sulfonamides was stopped in early 1945 because Leverkusen was dependent upon the chemical plants at Urdingen for aniline and at Ludwigshafen for ammonia. They were never able to re-establish effectively the sulfuric acid production after its destruction at Leverkusen in the winter of 1944 or to obtain adequate supplies of chlorosulfuric acid.

Neosalvarsan sales did not change materially during the period between 1939 and 1944 (Figure 181) except in 1943 when export sales advanced from 2,600 kg. to 3,900 kg. The Armed Forces demands steadily increased toward the latter part of the war. Officials at the I. G. Farben stated that in 1945 the demand of the Armed Forces increased 200 per cent.

The sales of *typhus vaccine* and *diphtheria serum* (Figures 182, 183) are a reflection of the production figures shown in Table 52. In 1943 the demand for typhus vaccine increased nearly twenty-fold and almost doubled again in 1944 due to civilian and Armed Forces requirements. The sales of diphtheria serum in 1943-44, when compared to the amount sold in pre-war years, is a result of the great increase in diphtheria among the civilian population described in Chapter Four.

The sale of vitamin preparations, *vigantol* (Figure 184) and *betaxin*, increased steadily from 1939 to 1943. The greater part of the sales was to civilian population, very little use of these being made by the Armed Forces. A 28 per cent drop in sales of *vigantol* occurred in 1944 due to the inability of Hoechst to obtain raw materials. *Betaxin* followed a similar trend showing a sharp decrease in 1944, most of which was taken up by a decrease

in exports, while civilian and Armed Forces supplies were maintained (Figure 185).

Novocain, also a product of Hoechst, showed a steady decrease during the war years and only a slight drop in production in 1944 when it was still 93 per cent of the peak year of 1942 (Figure 186).

Insulin sales follow closely production figures prepared by Hoechst as shown in Figure 171. These sales (Figure 187) decreased by 19 per cent in 1944 over 1943, which is less of a reduction than that of production and probably is represented by the sale of stored material. The decrease demanded by German Government health authorities was 33 per cent. The cause of the steady increase in demand from 1940 to 1943 is considered the result of changes in the national diet which have been described.

The sales figures of *gardan*, *rivanol*, *kresival*, *panflavin* and *dolantin* appear in Figures 188-192.

Leverkusen was also the principal source of supply in Europe for *phenacetin* and *salicylic acid*. The monthly average of 33 tons of phenacetin was reduced to 15 tons in October, 1944, and manufacture was discontinued entirely in December of the same year. Eight tons were produced in the early months of 1945. Salicylic acid showed the same fluctuations, from 125 tons a month to zero in the winter of 1944-45. Both of these cut-backs were the over-all results of air raids on the plant.

Among insecticides a water emulsion of DDT sold under the trade name *Lauseto* was the principal preparation. The average monthly weight of production was 70 tons, decreasing to 20 tons in November, 40 tons in December, 1944, and 25, 22, and 6 tons, respectively, in the first three months of 1945. *Chloromethyl parachlorophenyl sulphone* and *parachlorophenyl sulphinate* were two new insecticides being investigated. They were said to be more specific for insects and would not damage plants.

Plant Report Number 37 of the Oil, Chemical and Rubber Division of the Bombing Survey presents interesting data on the over-all production of tablets, ampules, and vials of all drugs at Leverkusen. According to this source, the plant had a capacity of 200,000,000 tablets a month. As has been stated, most of the products finished at Leverkusen came there from other plants so that some of the fluctuations in the production figures

FIGURE 173

ANNUAL SALES OF

ATABRIN

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

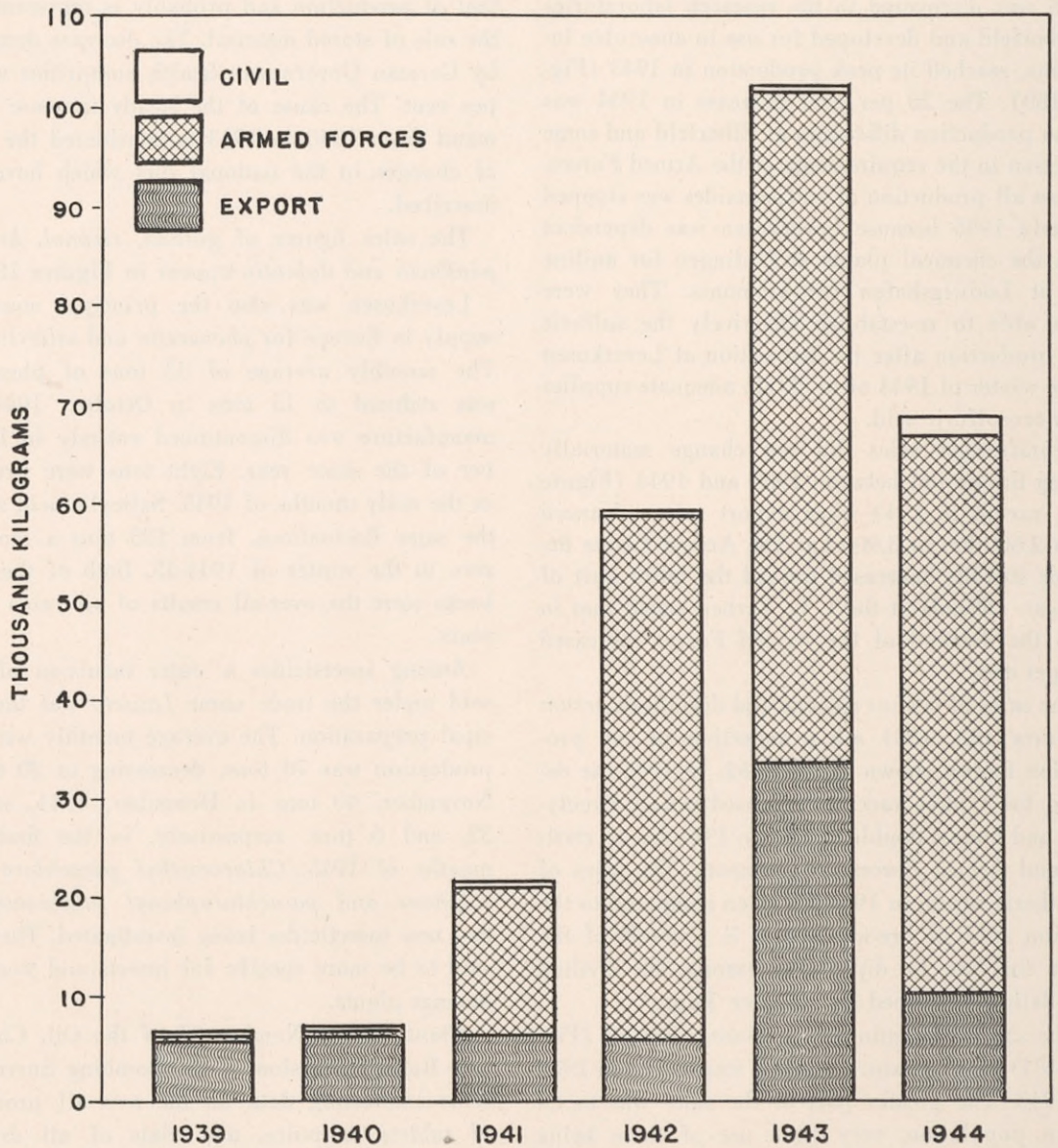


FIGURE 174

ANNUAL SALES OF PLASMOCHIN

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

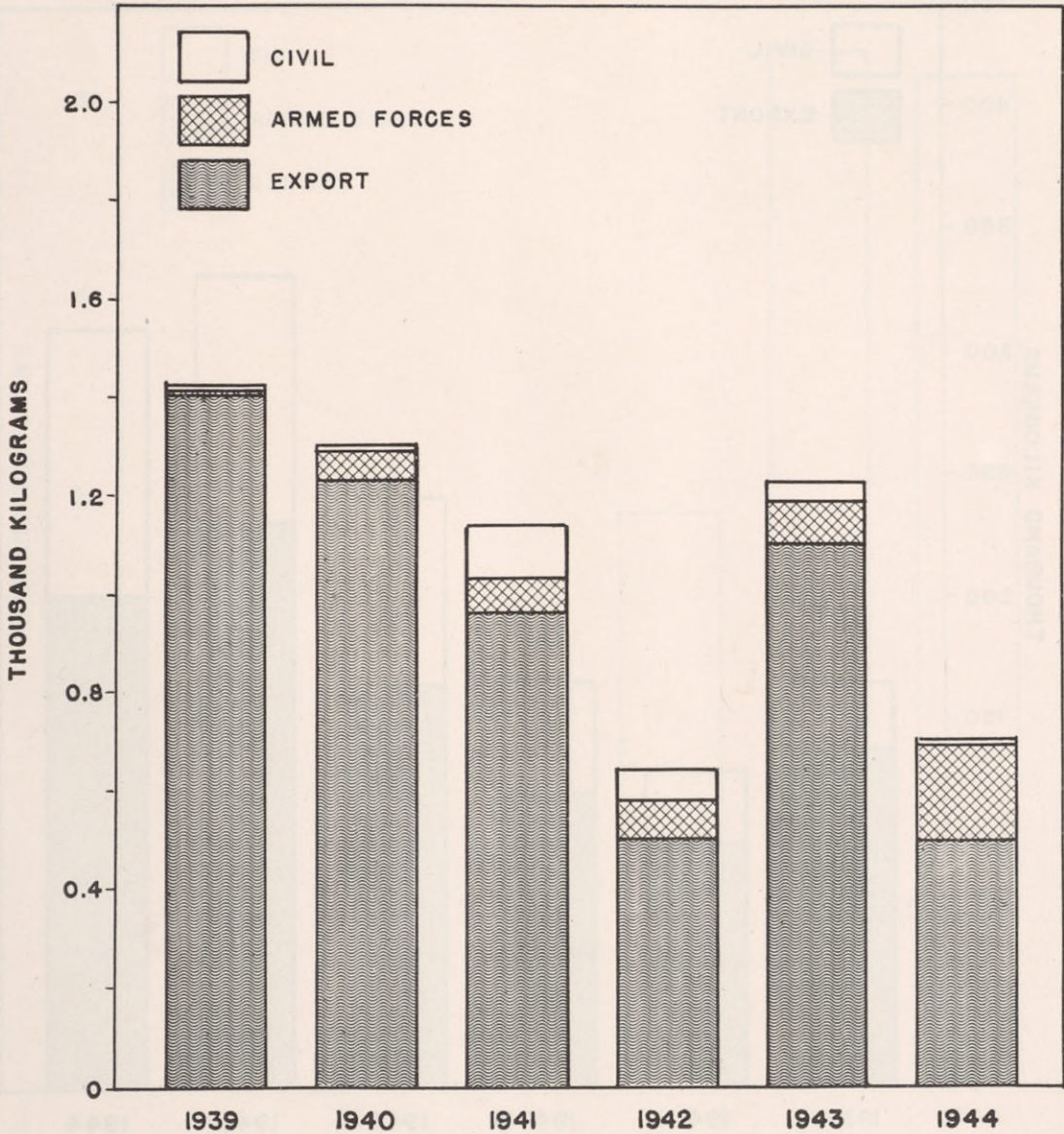


FIGURE 175

ANNUAL SALES OF

ASPIRIN

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

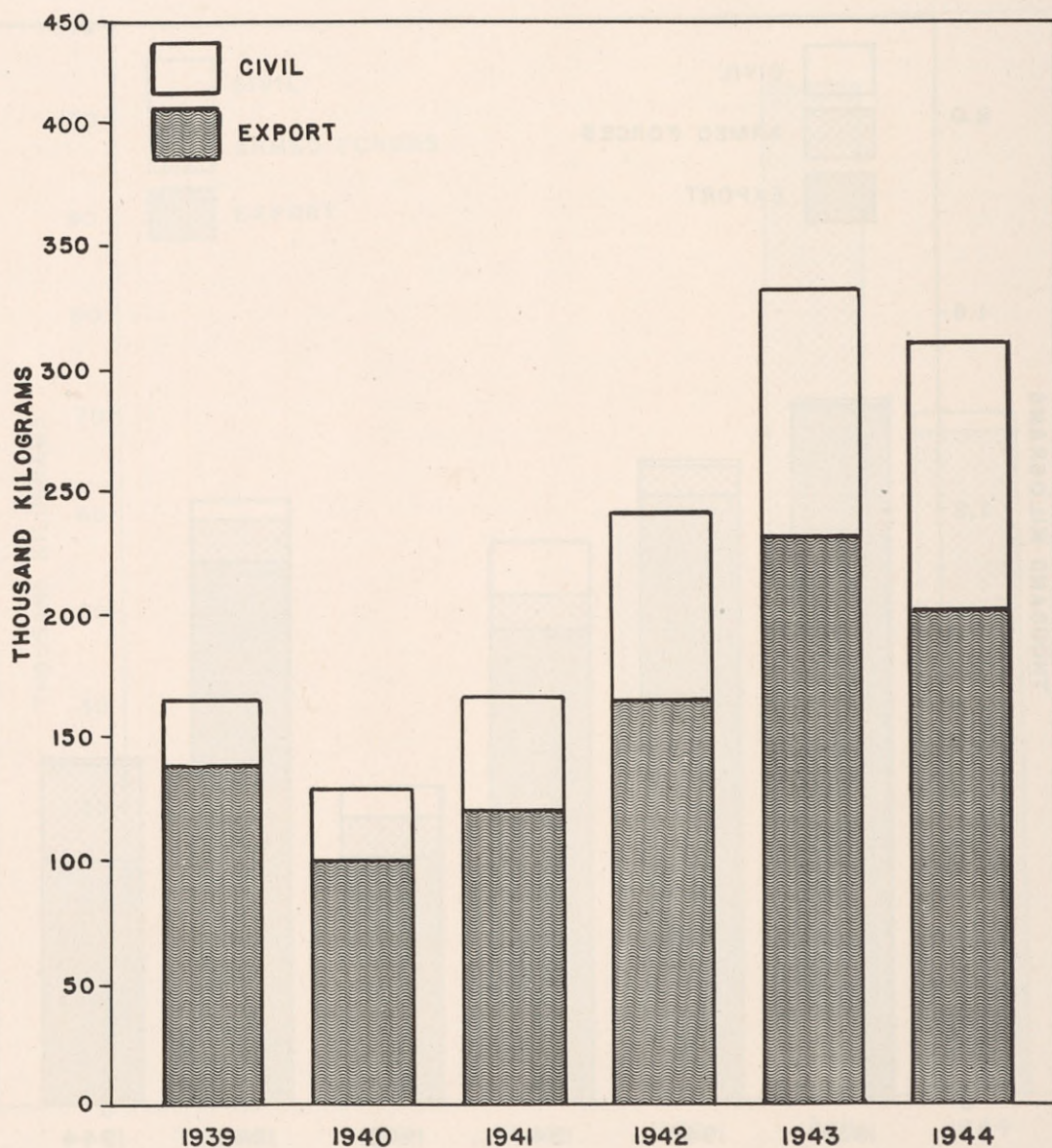


FIGURE 176

ANNUAL SALES OF PYRAMIDON

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

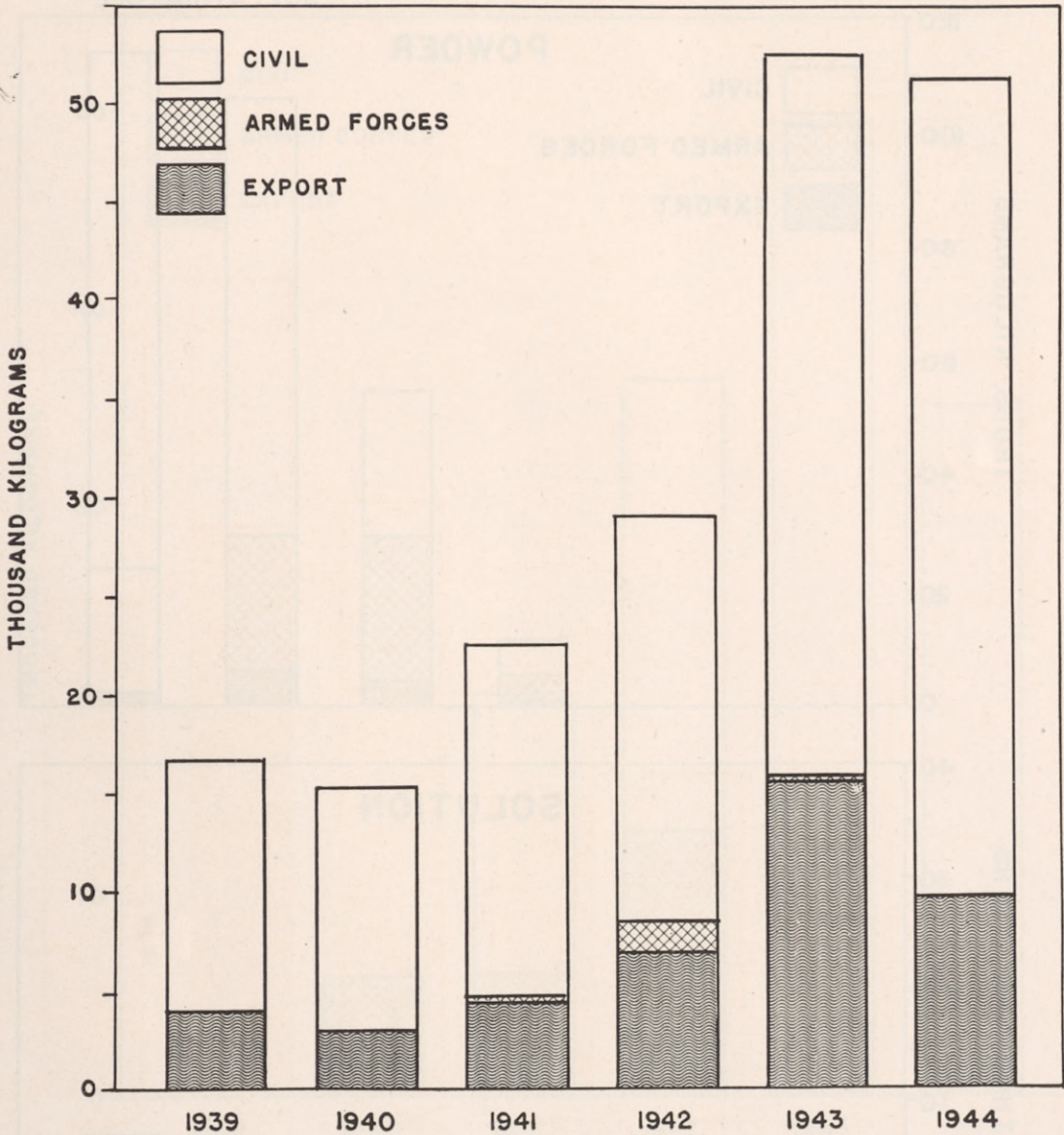


FIGURE 177

ANNUAL SALES OF ELEUDRON*

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

* SULFATHIAZOLE

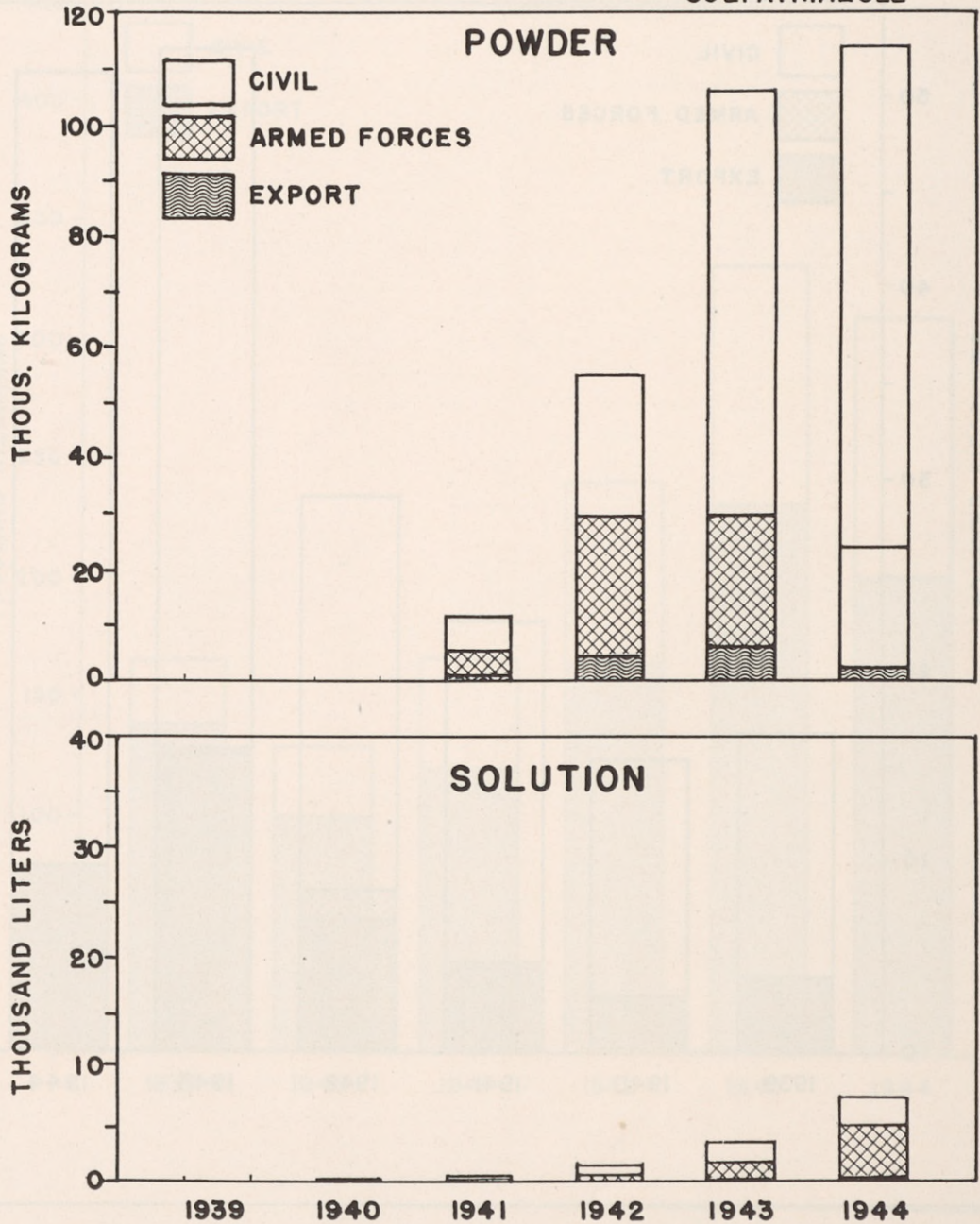


FIGURE 178

ANNUAL SALES OF SULFAPYRIDINE

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

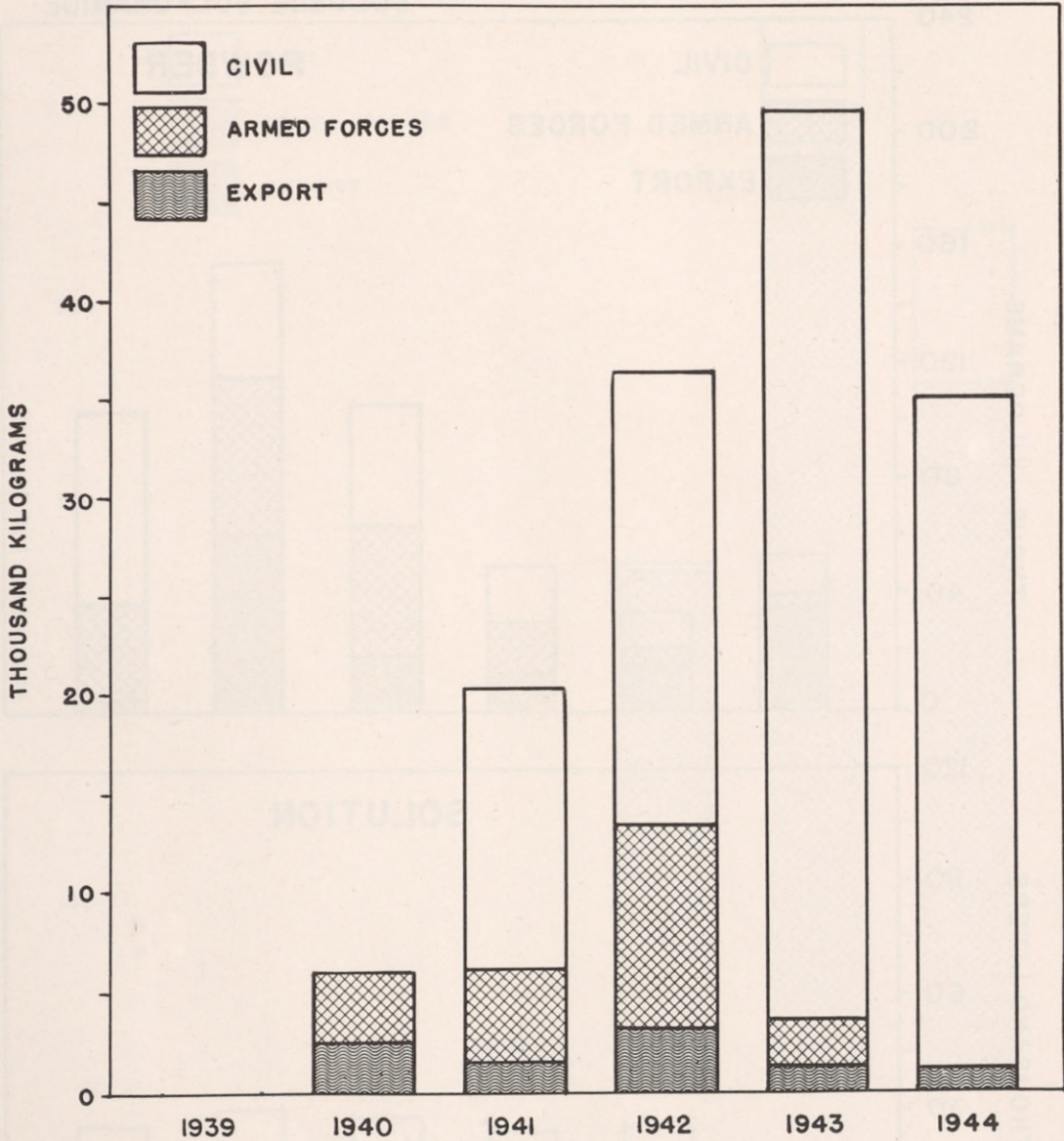


FIGURE 179

ANNUAL SALES OF
PRONTOSIL*
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN
1939-1944

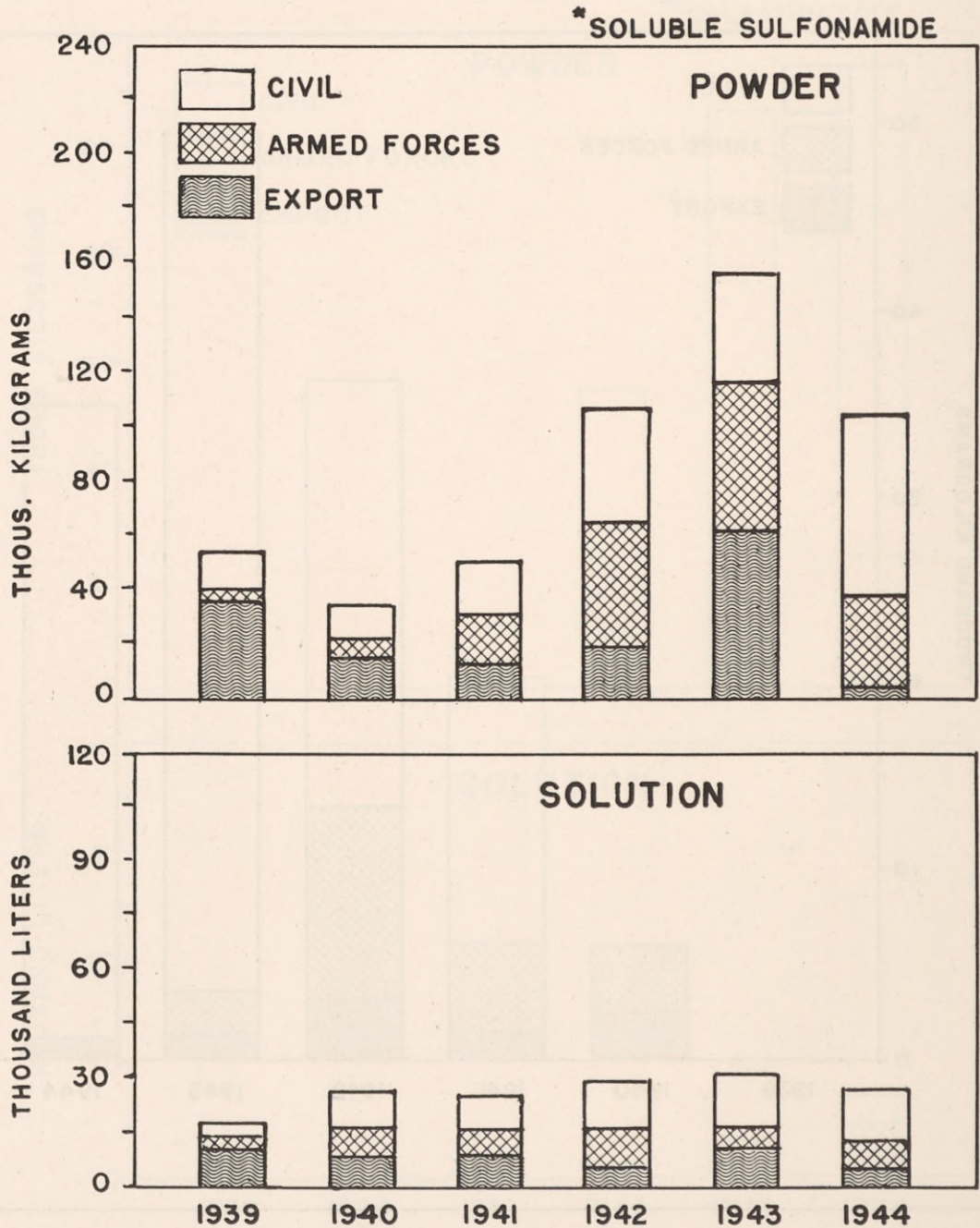


FIGURE 180

ANNUAL SALES OF
MARFANIL *
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

* NEW SULFONAMIDE-LIKE AGENT USED IN ANAEROBIC INFECTIONS

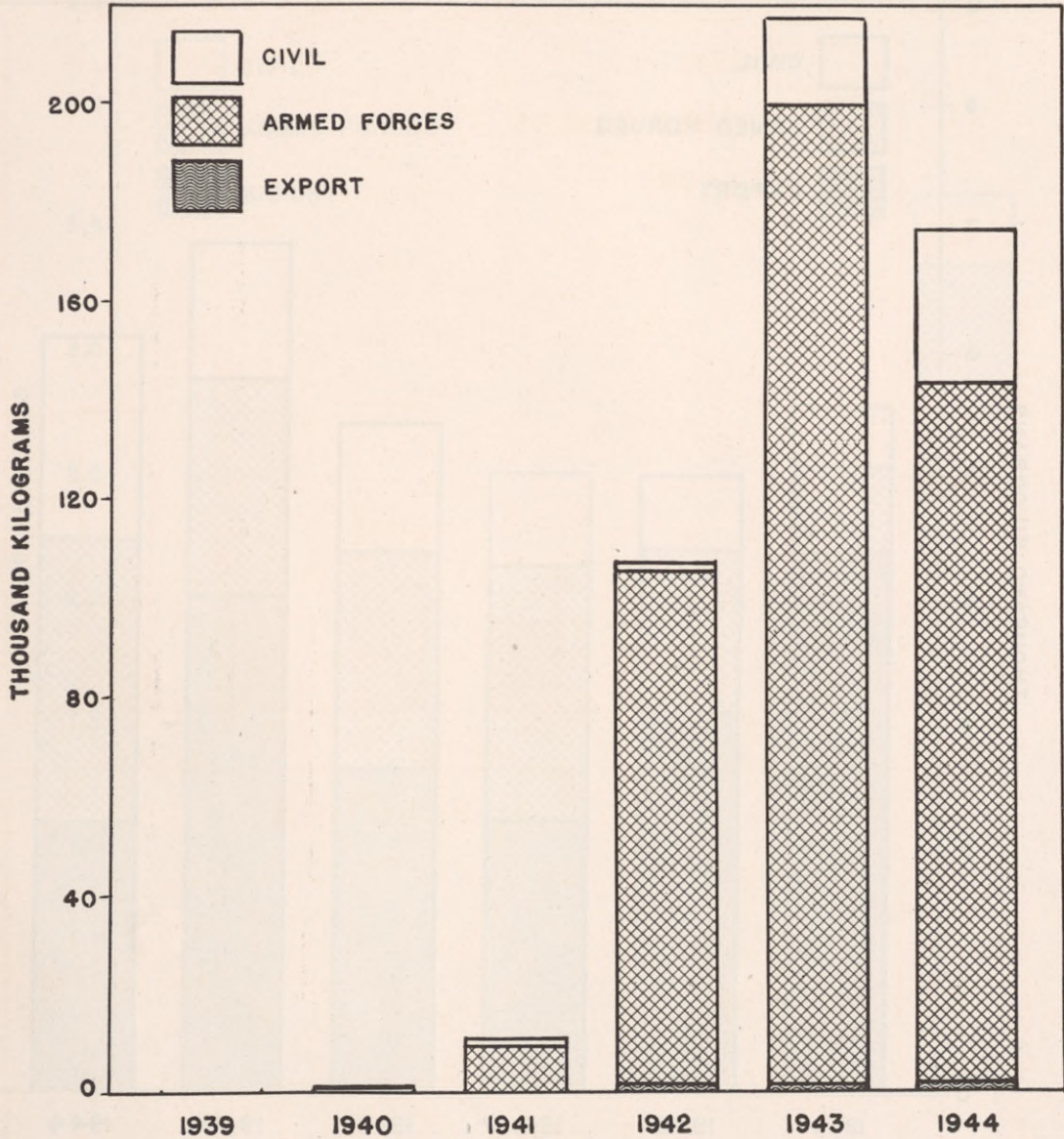


FIGURE 181

ANNUAL SALES OF NEOSALVARSAN

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

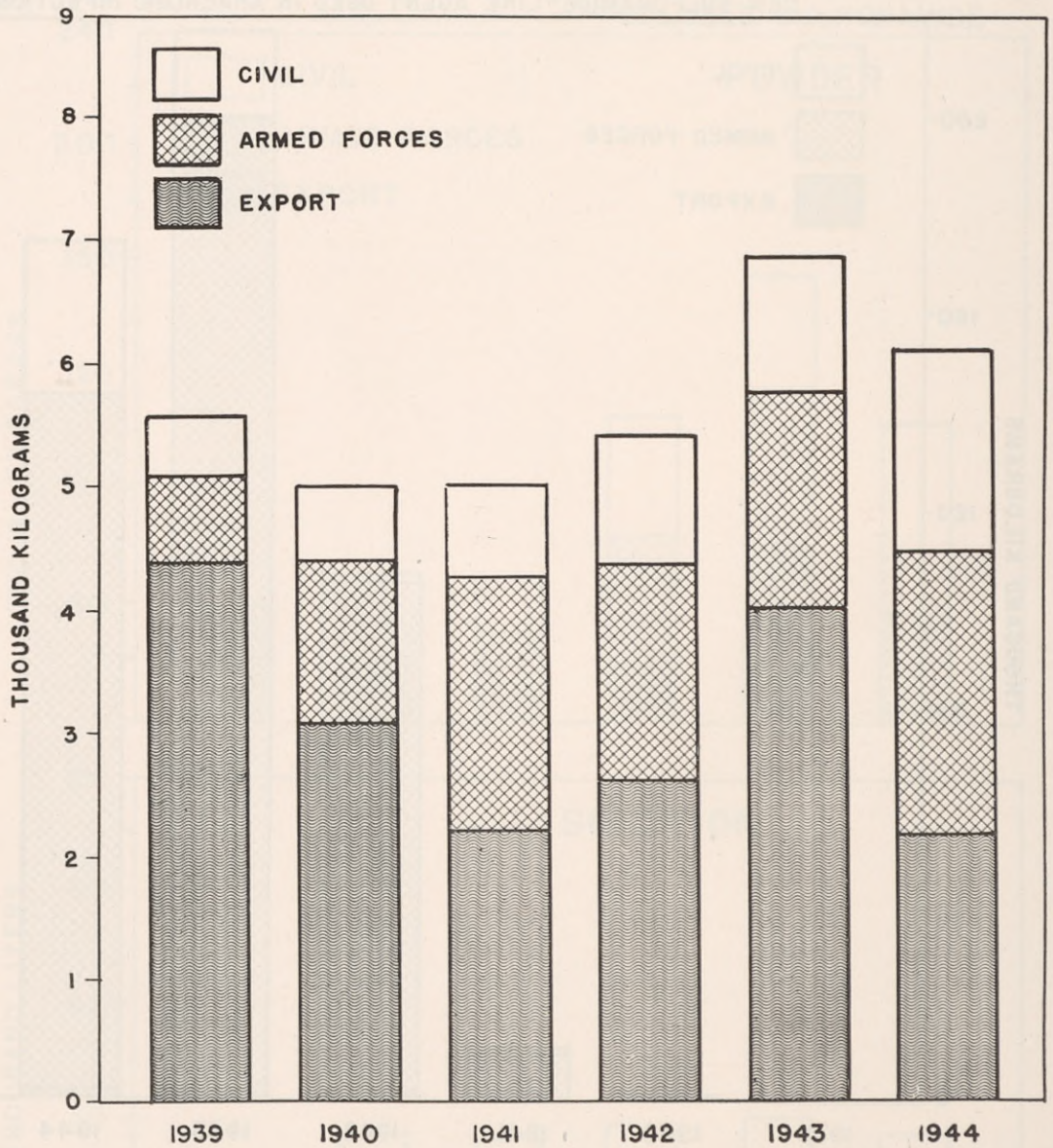


FIGURE 182

ANNUAL SALES OF
TYPHUS VACCINE
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

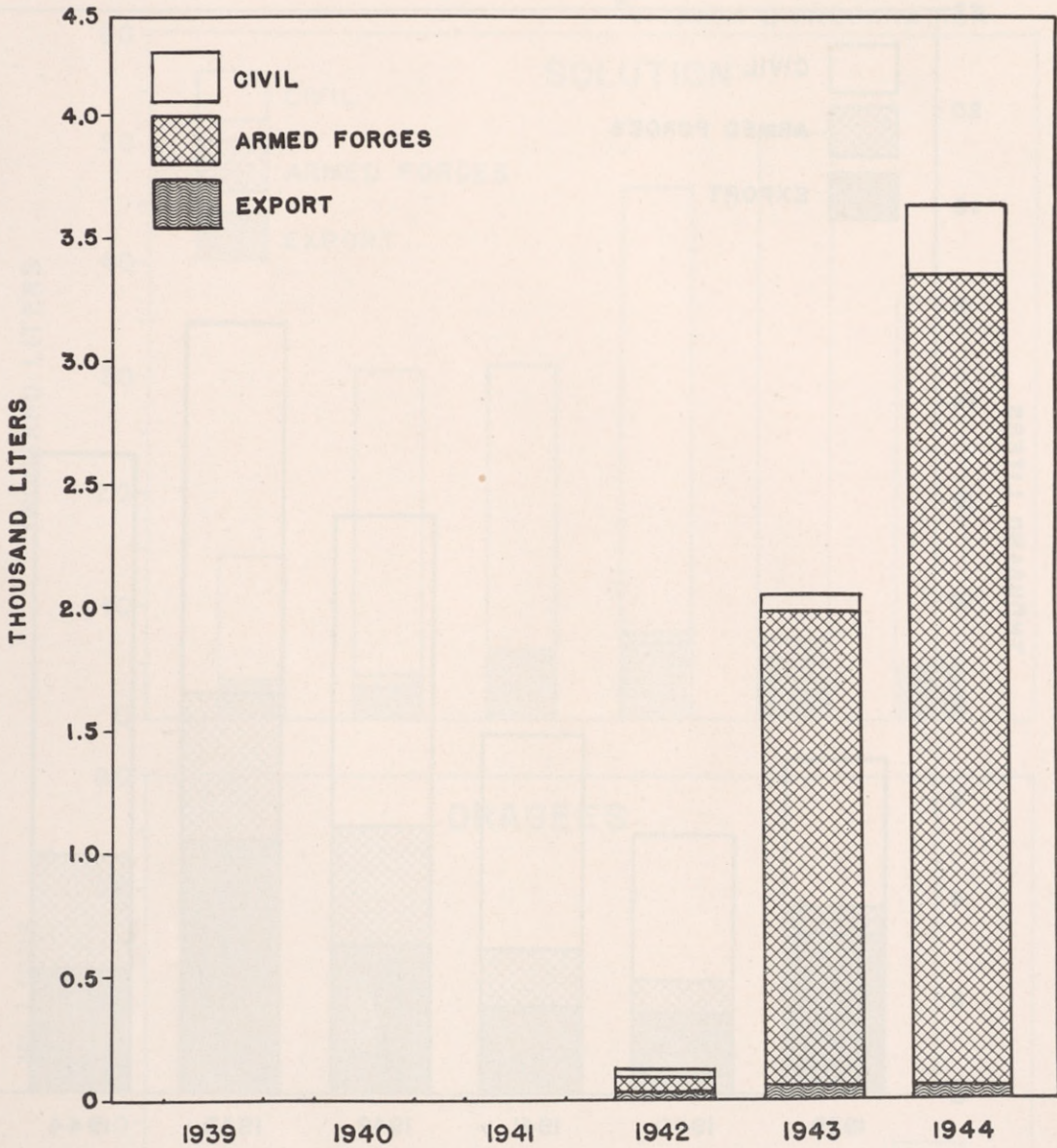


FIGURE 183

ANNUAL SALES OF
DIPHTHERIA SERUM
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

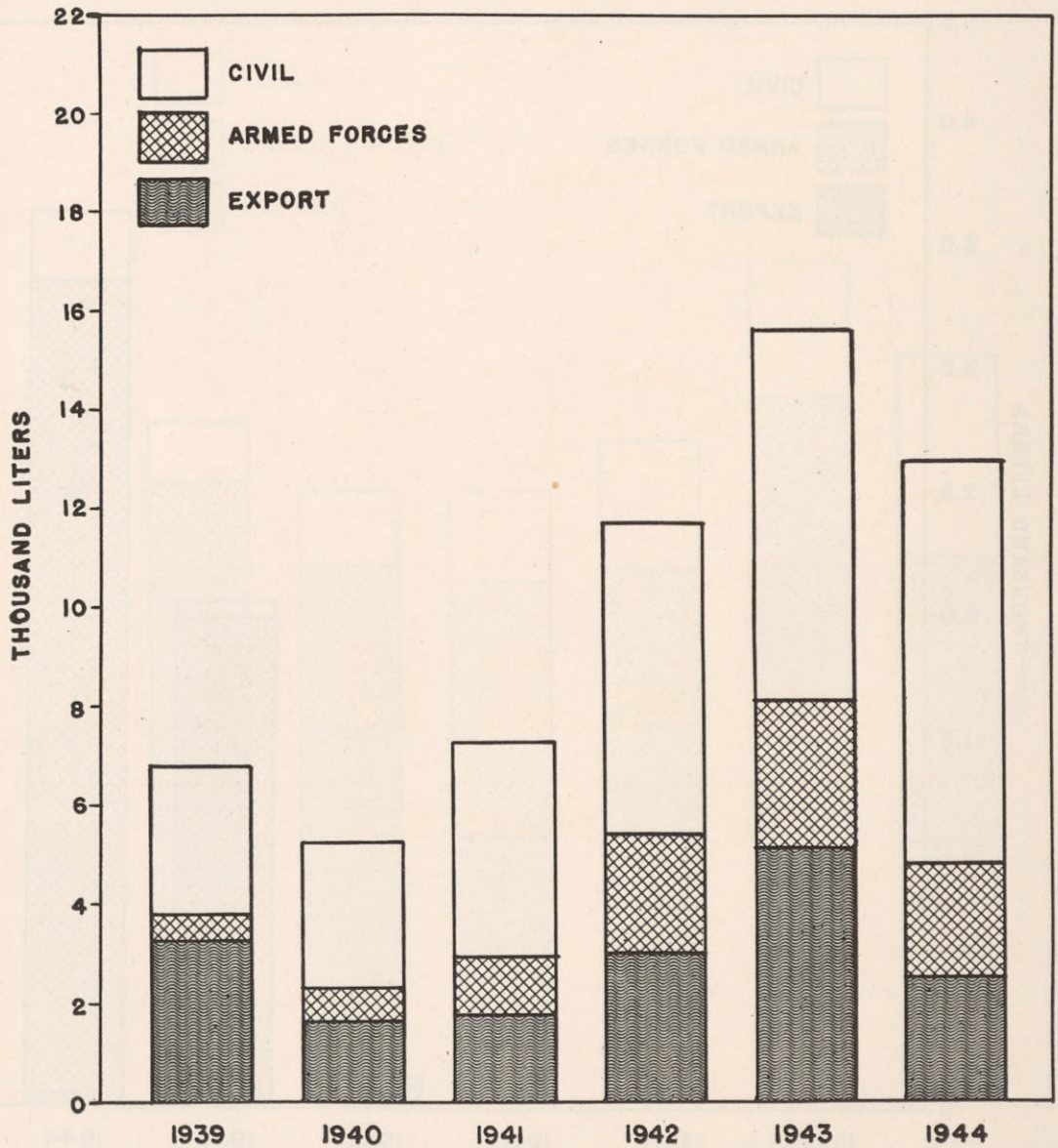


FIGURE 184

ANNUAL SALE OF VIGANTOL*

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

*VITAMIN D PREPARATION

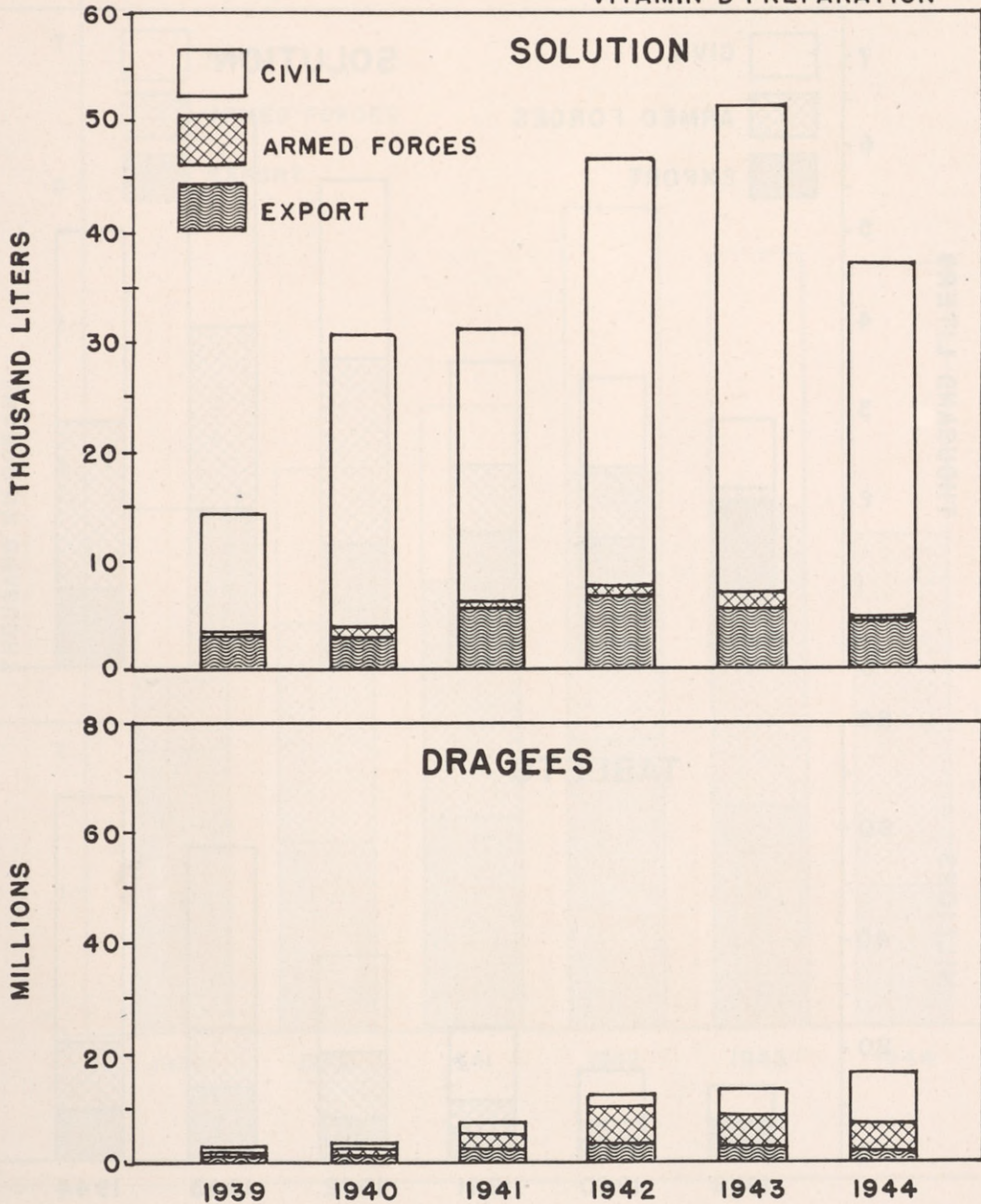


FIGURE 185

ANNUAL SALES OF
BETAXIN
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

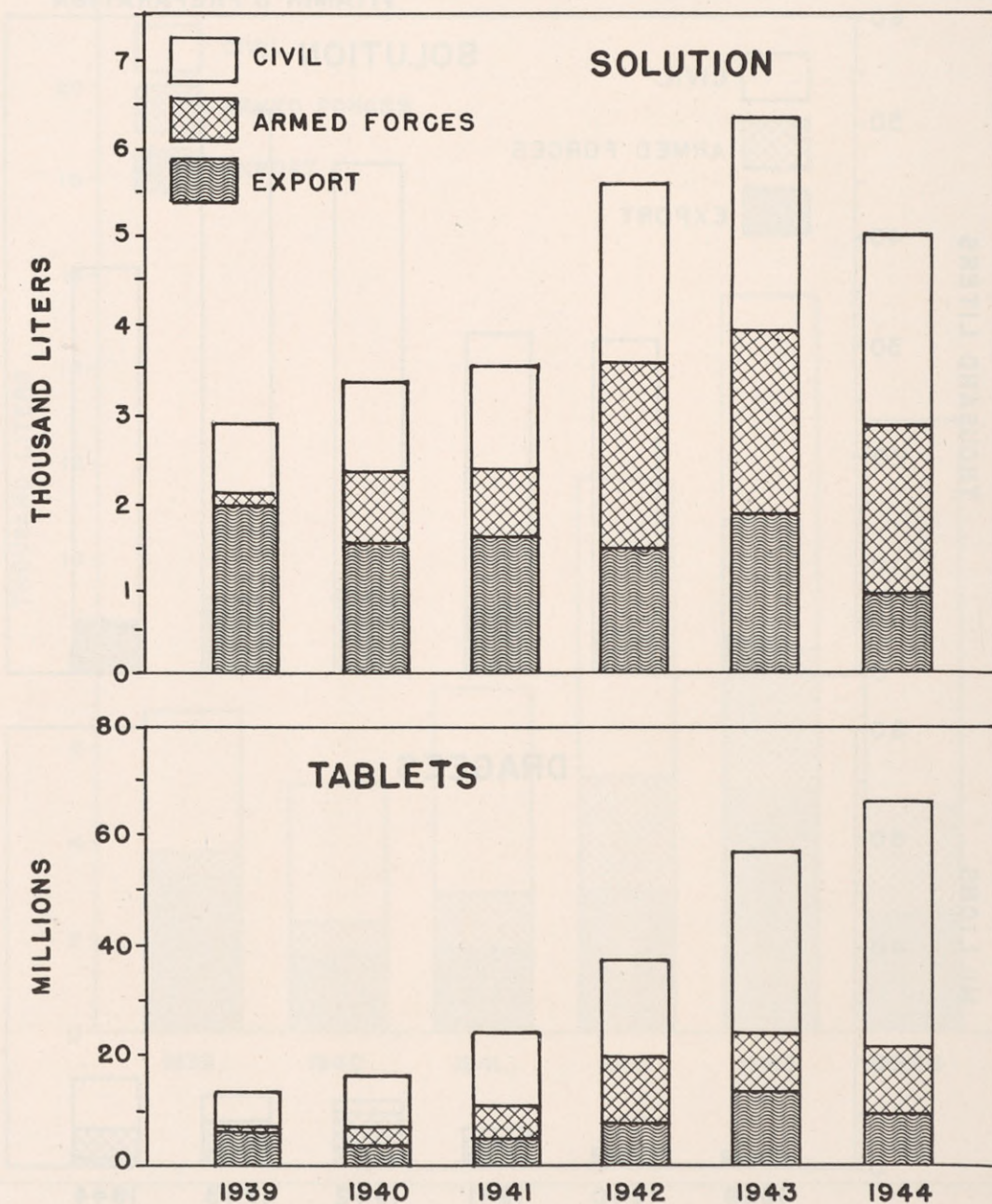


FIGURE 186

ANNUAL SALES OF
NOVOCAIN
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

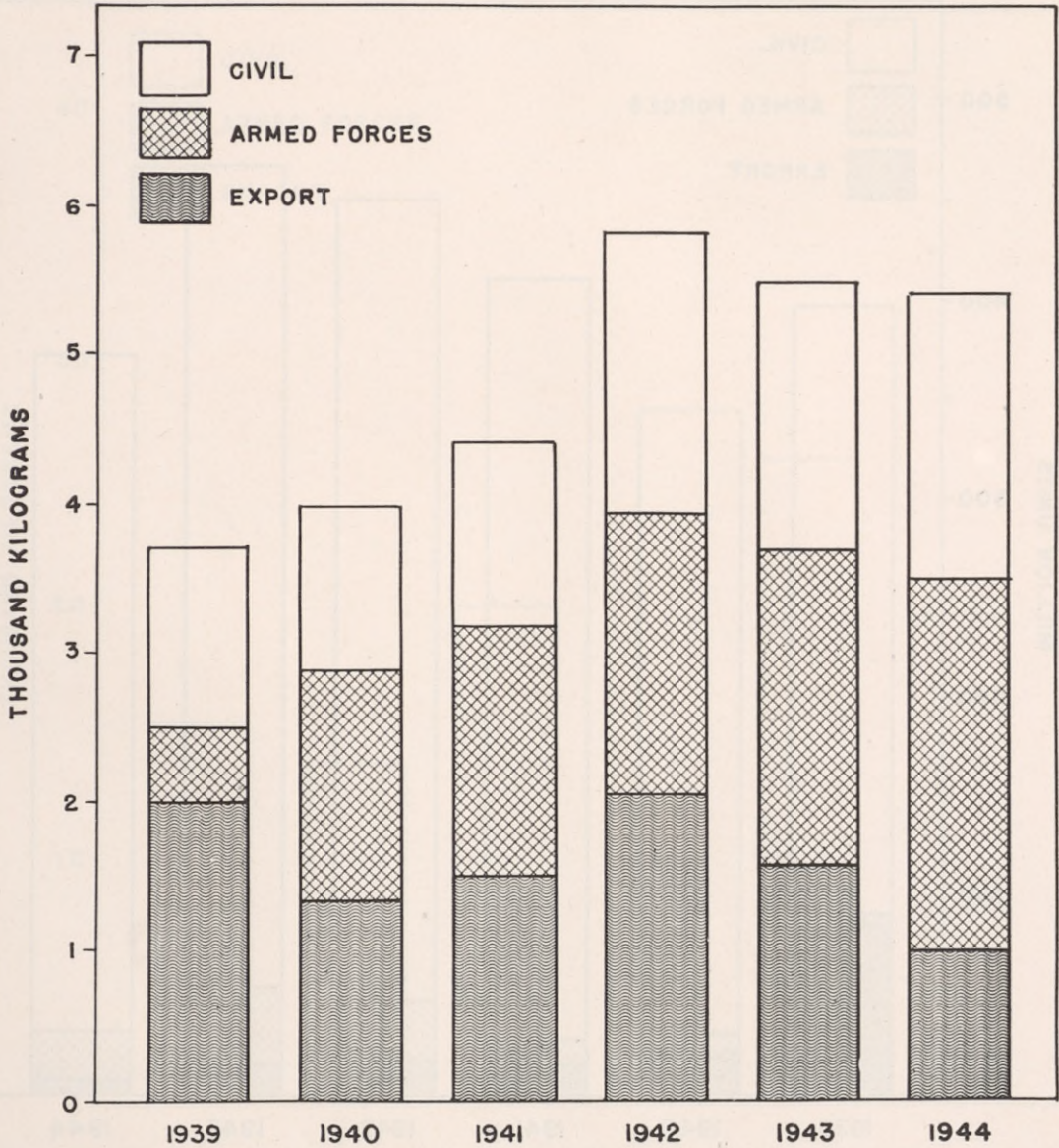


FIGURE 187

ANNUAL SALES OF

INSULIN

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

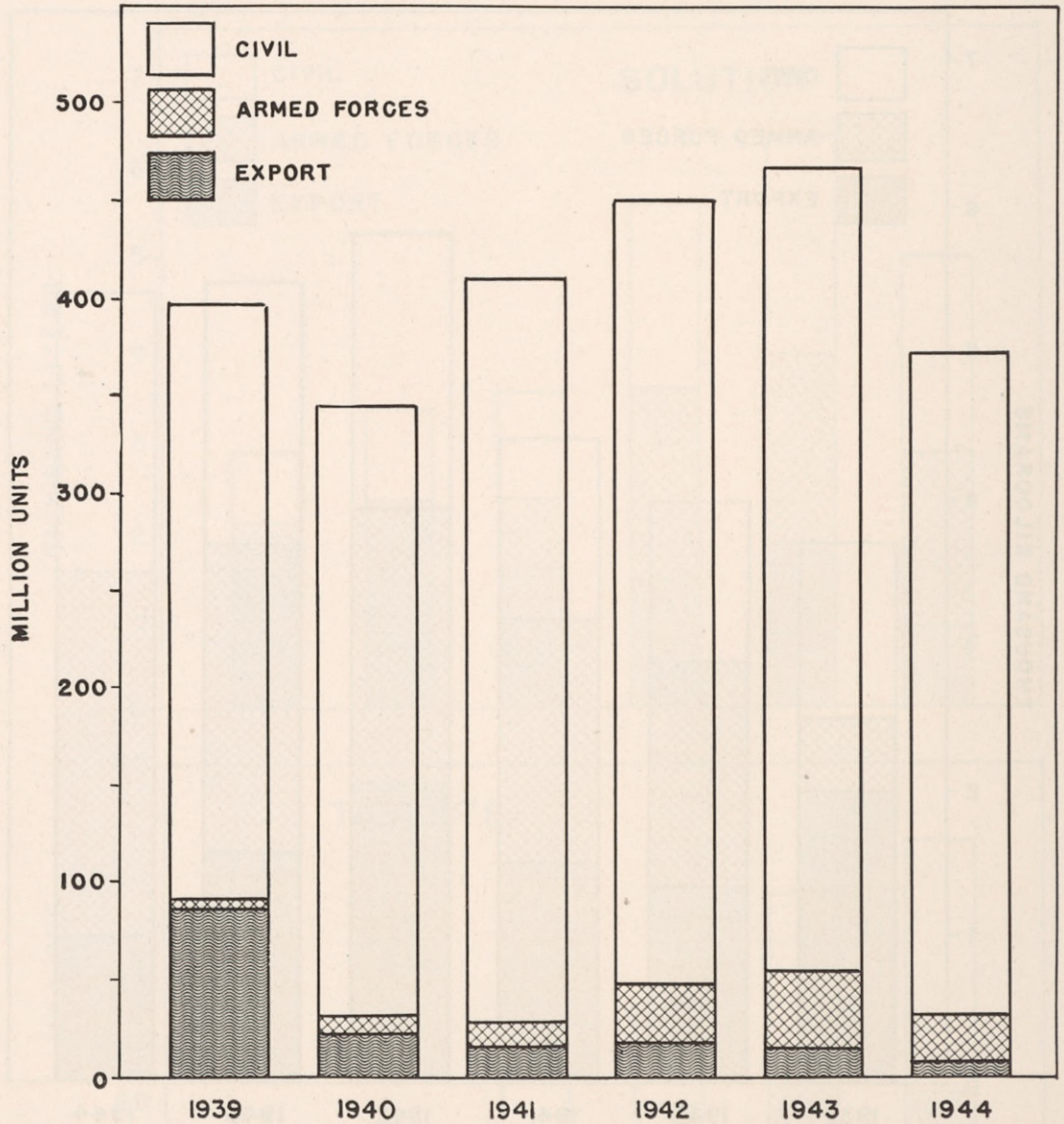


FIGURE 188

ANNUAL SALES OF
GARDAN*

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

* PYRAMIDON-NOVALDIN COMBINATION

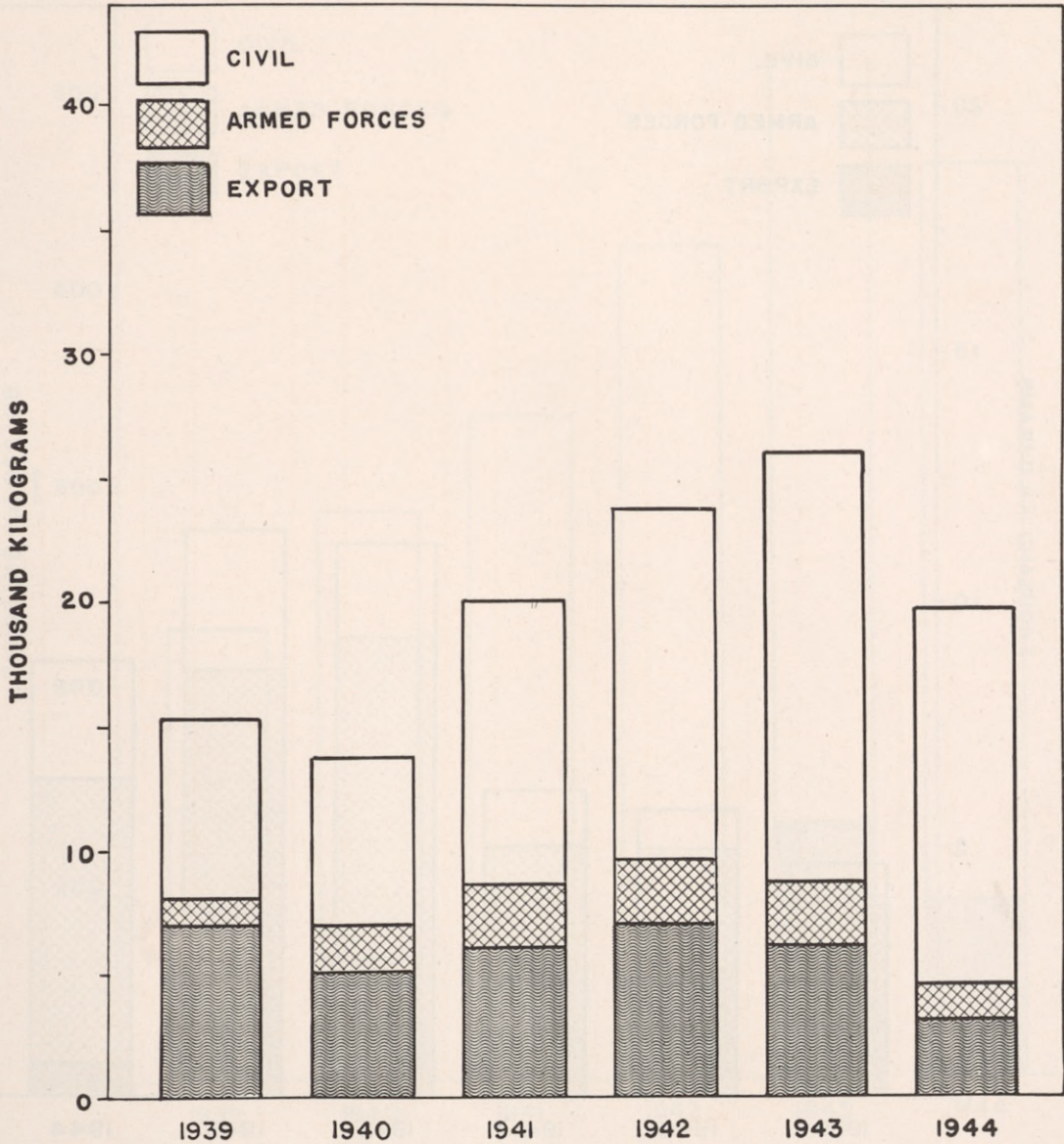


FIGURE 189

ANNUAL SALES OF
RIVANOL*
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.
1939-1944

* ANTISEPTIC

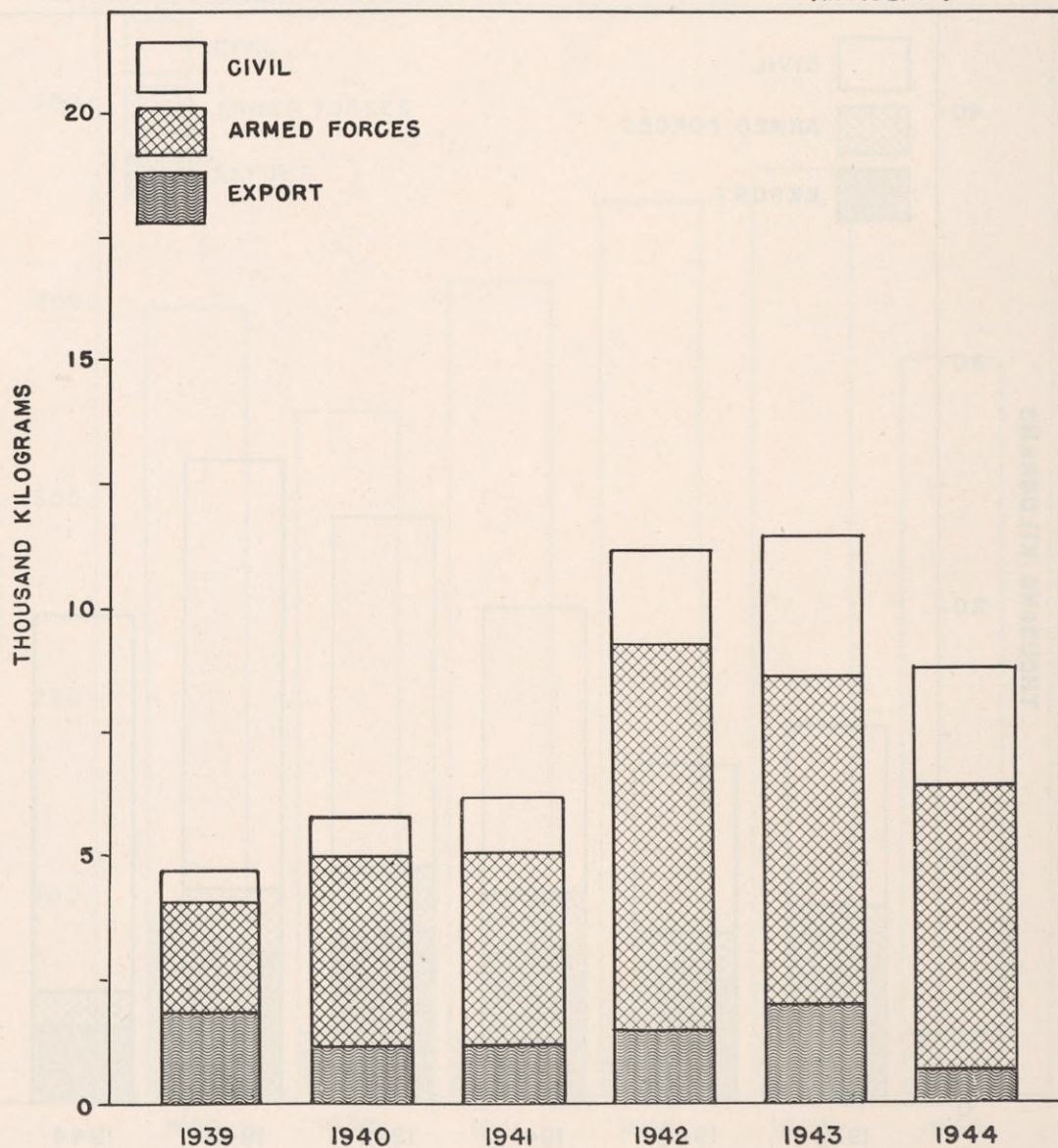


FIGURE 190

ANNUAL SALES OF
KRESIVAL*

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

* CREOSOTE AND LUMINAL GOUGH PREPARATION

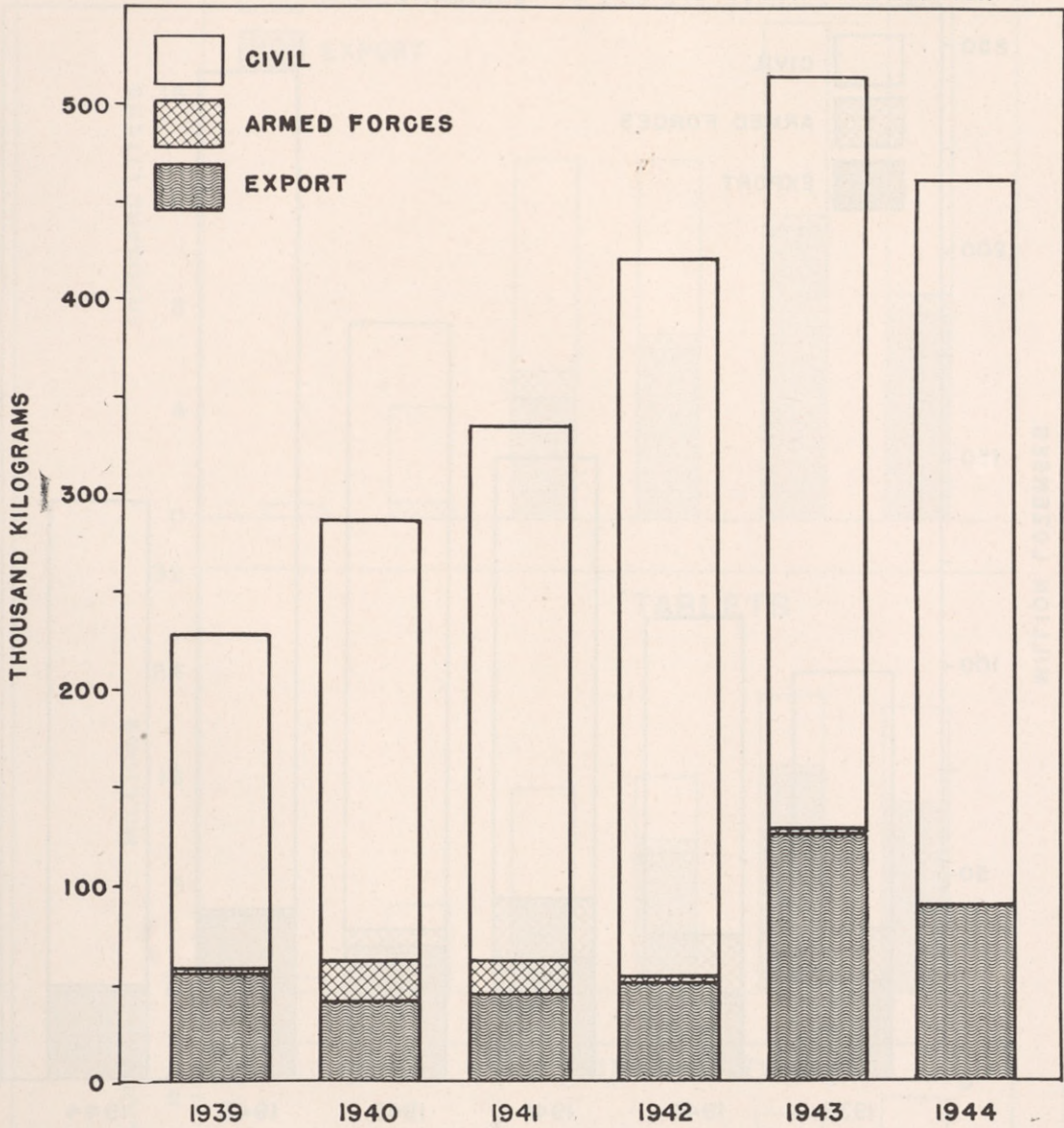


FIGURE 191

ANNUAL SALES OF PANFLAVIN*

BAYER DIVISION, I. G. FARBEN, LEVERKUSEN.

1939-1944

* ANTISEPTIC

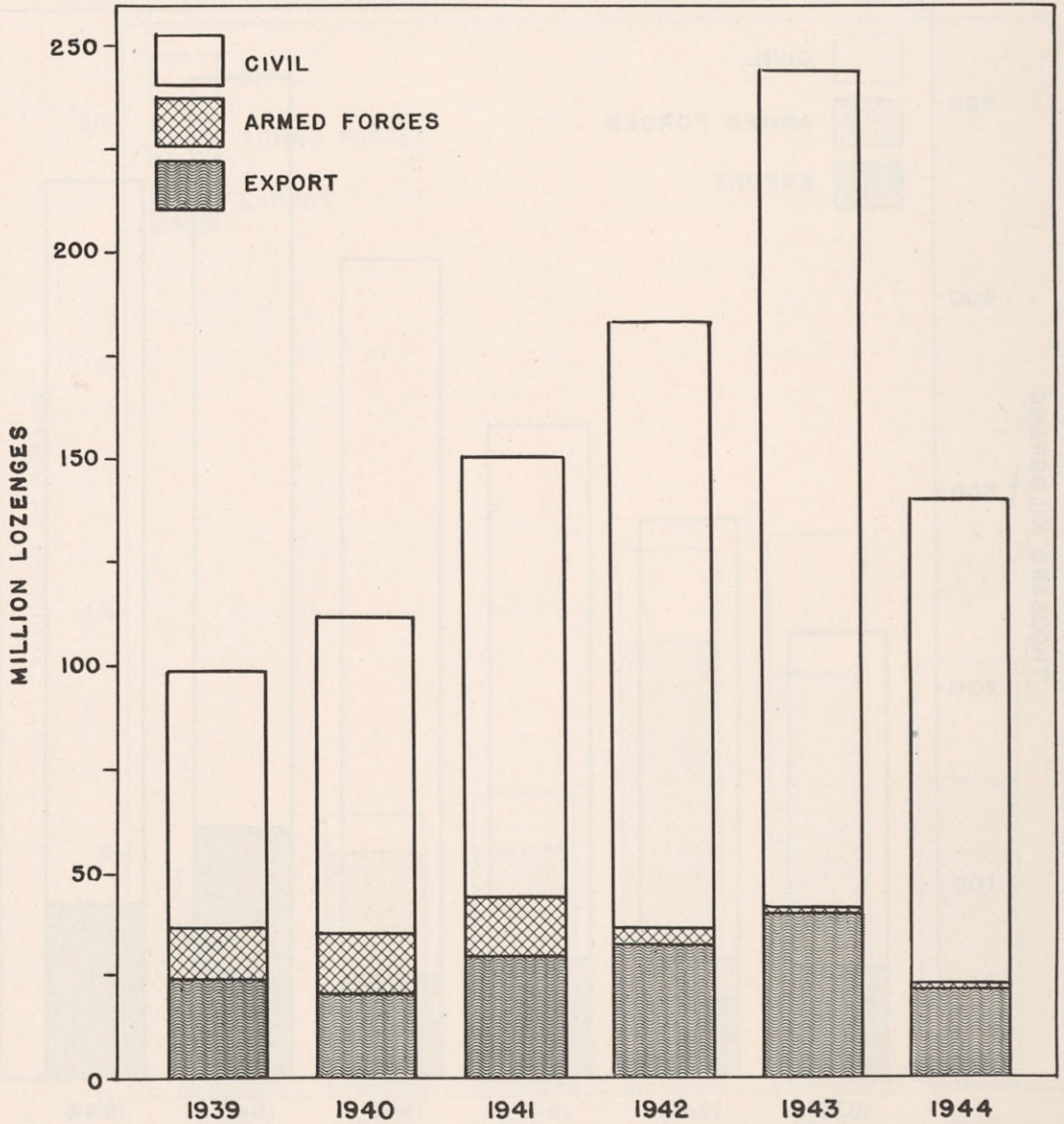
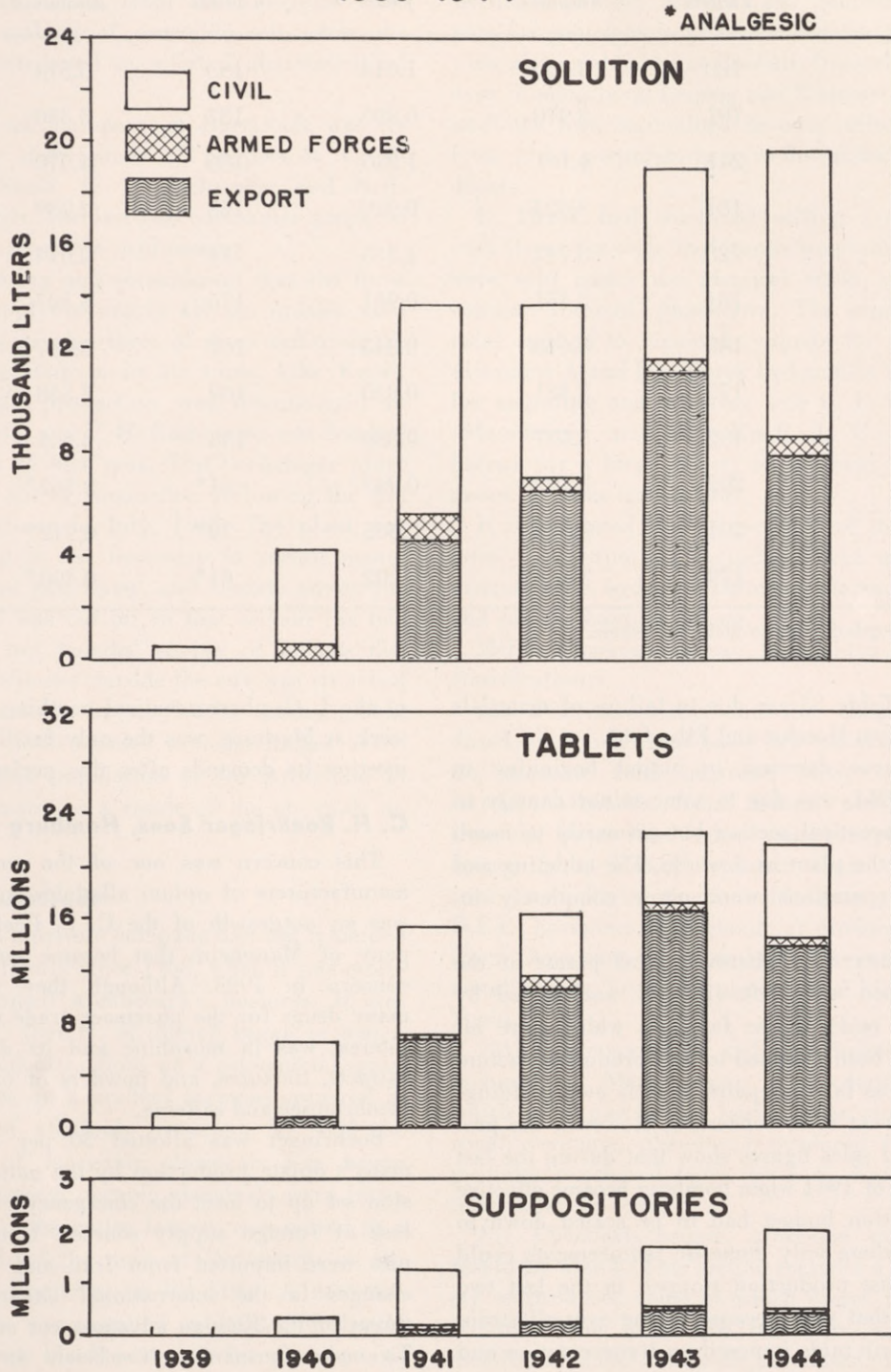


FIGURE 192

**ANNUAL SALES OF
DOLANTIN***
BAYER DIVISION, I. G. FARBEN, LEVERKUSEN
1939-1944



MEDICAL SUPPLIES

TABLE 53. PRODUCTION (IN MILLIONS) OF TABLETS, AMPULES, VIALS
I. G. FARBEN, LEVERKUSEN

	1943			1944		
	Tablets	Ampules	Vials	Tablets	Ampules	Vials
January	180	3.730	1.014	193	3.574	0.930
February	191	3.970	0.985	187	3.350	1.041
March	241	4.161	1.246	186	4.070	1.200
April	181	3.823	0.929	158	2.739	0.978
May	228	3.747	1.235	174	2.674	1.026
June	184	3.451	0.981	176	3.107	1.330
July	185	3.645	0.845	167	3.037	1.189
August	175	3.321	0.820	169	3.548	1.194
September	182	3.577	0.888	158	3.631	1.103
October	202	3.702	0.952	81*	2.162*	1.089
November	201	3.005	0.665	39*	0.912*	0.739*
December	179	3.625	0.202	61*	0.490*	0.301*

* Result of bomb damage to plant as a whole.

shown in Table 53 are due to failure of materials to arrive from Hoechst and Elberfeld.

The serious decrease in output beginning in October, 1944, was due to some minor damage to the pharmaceutical section but primarily to bomb damage to the plant as a whole. The tableting and ampuling operations were never completely interrupted.

Conclusions: The pharmaceutical plants of the I. G. Farben were left virtually undamaged by Allied air raids. Those facilities which were hit could have been returned to full production within one month as far as repairs to their own buildings and equipment were concerned. However, the production and sales figures show that during the last six months of 1944 when bombing became effective the production budget had to be scaled down to the point where only domestic requirements could be met. Most production stopped in the last two months of that year because of the over-all strain the Allied air raids imposed on transportation and the manufacture of essential raw materials and intermediates. The only truly self-contained unit

of the I. G. pharmaceutical combine, the Behringwerk at Marburg, was the only facility capable of meeting its demands after this period.

C. H. Boehringer Sons, Hamburg

This concern was one of the most important manufacturers of opium alkaloids in Germany. It was an outgrowth of the C. F. Boehringer Company of Mannheim that became an independent concern in 1923. Although they manufactured many drugs for the pharmacy trade their primary interest was in morphine and its derivatives, in extracts, tinctures, and powders of opium, and in theobromine and caffeine.

Boehringer was allotted 30 per cent of Germany's opiate production by the national commission set up to meet the emergency created by the loss of foreign supply sources. Until 1943 poppies were imported from Iran and Turkey when changes in the international situation and the threat of the Russian advances cut off the supply. To make Germany self-sufficient in opiates, the agriculture ministry launched a vigorous program of poppy culture. The yield from these domestic

plants was 0.1 to 0.2 per cent by weight, according to Herr Heinrich Schenkenberger, manager of Boehringer. The poppies were collected by school children and were grown mostly in Wurttemberg and Bavaria. The children were paid by the local food office. The seeds from these poppies were used in the making of vegetable oils while the hulls were distributed to selected pharmaceutical organizations.

The E. Merck Company at Darmstadt was responsible for distribution of poppies to C. H. Boehringer, Knoll, C. F. Boehringer and Hoffmann La Roche. The last two companies prepared only a small part of the requirement.

It is interesting and coincidental that the three companies supplying nearly all the opiates used in Germany were also three of those suffering the most extensive damage in air raids. Like Knoll, Merck alkaloid production was discontinued in December, 1944, and C. H. Boehringer was bombed on October 6 of that year. The Boehringer plant was also put out of production following the fire raids in Hamburg in July, 1943. The plant was not struck but it was necessary to curtail manufacture because gas, water, and electric power for industrial use was cut off in that section for two months. The two months' supply of opiates dispersed in warehouses outside the city was stretched to last four months by very strict rationing, but by Spring of 1945 opiates were no longer available for civilian population or for Army use in northern Germany as a result of the air raids on these plants.

E. Merck, Darmstadt

This firm is a private company and has remained in the Merck family since 1768, when it was established as a small apothecary's business. It was not until 1827 that H. M. Merck began to manufacture alkaloid extractions on a commercial scale. From this time on a gradual increase occurred in the number of alkaloids extracted. In 1850 the manufacture of inorganic chemicals was begun and soon afterward organic chemicals were introduced. In 1903 the entire factory was moved to a new site north of the town of Darmstadt, on the main road to Frankfort on the Main. A new testing laboratory was installed in 1902 and shortly thereafter a new block was built for packing and filling. In 1930 the organization began to manufacture synthetic vitamins; the biological section

was also created. By 1937 E. Merck possessed almost 1,000 patents. Their products were sold to wholesale dealers only, and offered no direct contact with hospitals, doctors, or pharmacists. Stocks were held at warehouses and supply depots in Berlin, Hamburg, Munich, and Schoenebeck. Depots for propaganda work, but not for actual sale, were also established at Breslau, Duesseldorf, Hanover, Koenigsberg, Leipzig and Stuttgart. At Darmstadt the firm maintained its own railway station, from which preparations were dispatched to supply depots.

E. Merck had combined selling arrangements with Bayer for some barbiturate preparations which were sold under the identical trade names, e.g., veronal, luminal, phanodorn. The same arrangement applied to vigantol (vitamin D) and vogan (vitamins A and D). Merck had similar agreements for ampuling and talbeting with C. F. Boehringer (Mannheim) and with Knoll A. G. (Ludwigshafen) for a large variety of products distributed under the same trade marks.

It is estimated that 30 per cent of the preparations were exported, including large amounts of bismuth salts, hydrogen peroxide, glycerophosphate and sodium hypophosphate.

Merck preparations can be divided into three classifications:

(1). Pharmaceuticals and fine chemicals produced by Merck from basic raw materials, including ascorbic acid, dextrose, lactic acid (from starch); alkaloids from natural plants, mainly from the Dutch East Indies, some exceptions being opium from Turkey, ephreda from Spain and coca from Peru; tannic acid from galls, from D.E.I.; hormones from glandular products obtained from Darmstadt and Frankfort slaughter houses; metallic salts, including mercury and bismuth from Spain.

(2). Pharmaceuticals and fine chemicals manufactured by Merck from intermediate products which were purchased: barbiturates (luminal, veronal, veramon, phandorn) produced from intermediates purchased from the I. G. Farben industries; salicylic acid.

(3). Chemicals bought, processed, purified and resold by Merck. This section includes a large variety of products, some of which Merck also manufactures from basic raw materials, e.g., lactose metallic salts. Solvents were purchased mainly from Alander Wacker, Munich. Merck shared with C.A.F. Kahlbaum G.M.B.H., Berlin, a virtual monopoly of

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FIGURE 193. Merck plant view of damage to buildings for manufacture of inorganic salts (foreground) and for reagents and rare chemicals (to right of tower). Buildings are numbers 11 and 12 in chart on Figure 194.

the production of analytic reagents supplied to institutes and laboratories for research and for testing purposes.

The staff of E. Merck consisted of about 4,000 employees, as follows: 150 chemists, 150 qualified engineers, 1,500 girls for packing, etc., 600 clerks, 2,600 workmen, and 400 foreign workers.

Production can be broken down as follows: 67 per cent medicinal preparations, 25 per cent fine chemicals, 5 per cent insecticides, and 3 per cent reagents.

The company produces 50 per cent of vitamin D₂ in Germany; 50 per cent of vitamin C; 30 per cent of vitamin E; and 75 per cent of vitamin B₁, as well as certain decontaminates used in chemical warfare. Eight per cent of their production capacity was devoted to pharmaceuticals manufactured for sale to the Army. This represents 15 per cent of the total income of the organization.

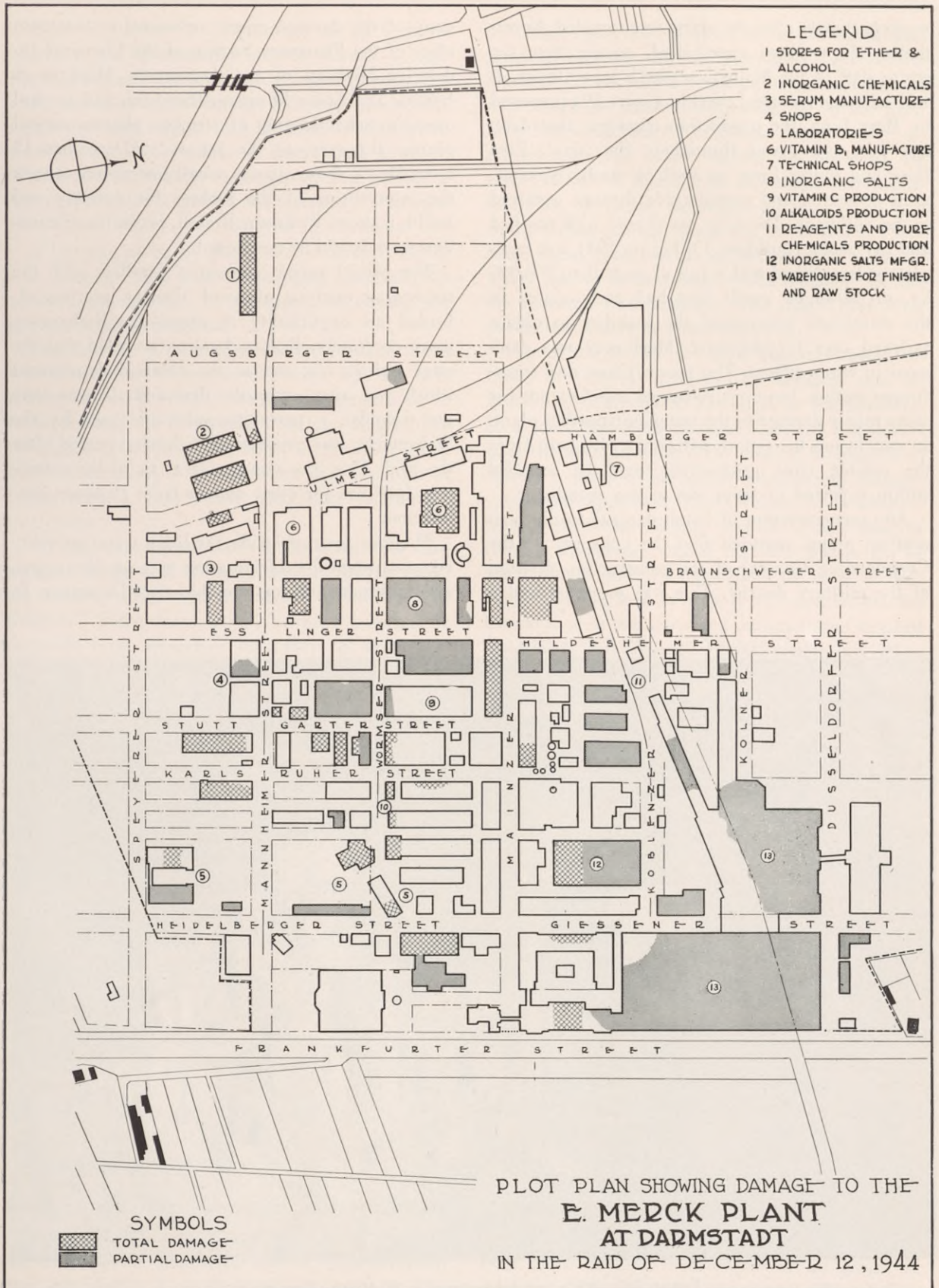
No DDT was prepared by E. Merck. Dr. Otto Dahlmer, who succeeded Herr Pfortenhauer as general director, stated that when DDT was discovered it was offered to the Germans by the Swiss

firm of Geige. Merck was unable to obtain the support of the central government in their negotiations for the patent. Dahlmer stated that the Schering A. G. at Berlin was able to use sufficient influence to make them the exclusive licensees of DDT. They then awarded licenses to other German firms.

Ninety-five per cent of the total air raid damage to the Merck plant occurred as a result of a raid at mid-day on December 12, 1944, causing complete destruction of one third of all the buildings and machinery. The official report of this raid to the Chemical Division of the Speer Ministry reveals that the plant officials considered this Allied raid was directed against their plant. Target information from the Eighth Air Force states that the primary targets were the rail installations near-by.

The Eighth Air Force comprising 446 bombers dropped 1321 tons of bombs. Within a half hour more than 200 high explosive bombs, each weighing 500 lb. or more, together with a large number of incendiaries, struck the Merck plant. The report states that the loss of life was considered comparatively small because the plant had been cleared of

FIGURE 194



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workers shortly after the alarm was sounded. Nevertheless, 50 workers were killed, among them the entire staff of the biologic research laboratories. It will be noted from the chart in Figure 194 prepared by Herr Jung, the production manager, that damage was widespread throughout the plant. Pipe lines and power lines, as well as sewage systems, were destroyed and considerable damage occurred to the buildings. The large warehouse with finished and raw stock (building 13, Figure 194) was completely demolished with a loss of more than 200,000 kg. of packaged goods that had accumulated in the storehouse because of the inability to obtain railroad cars for shipment. Machinery was damaged in many places. The power house and transformer station, however, remained intact except for some minor damage to the water purification plant. In conclusion the report states that with help from the outside most production could be resumed within a period of from one to two months.

Any reconstruction of bomb damage to pharmaceutical plants required first the approval by the Commanding General of the construction division of the military district. This was prepared and a

copy of the damage report submitted to the main office of the Pharmacy Section of the Chemical Industries Division of the Armaments Ministry at Berlin. The Speer Ministry, therefore, had control over the rehabilitation of stricken pharmaceutical plants. However, as the report of December 12 from Merck shows, it was usually necessary to seek the intervention of the fuhrer for sanitary and health matters, Professor Brandt, before reconstruction work would be sanctioned.

The official report somewhat conflicts with the succeeding analysis of bomb damage as time afforded an opportunity to assess the destruction more accurately. Reconsideration revealed that the most serious loss was in the alkaloid department which was very seriously damaged. It was here that eukodal, a morphine substitute used by the Wehrmacht, was produced. Production ceased after the raid. This was also the location of the extraction facilities for other opiates from *Papaver somniferum*.

Thiamin hydrochloride facilities were seriously crippled when the refrigeration unit was destroyed, and no production was possible after December. In



FIGURE 195. *Biological laboratories at E. Merck, Darmstadt.*

the Merck process a temperature of 18°C is required in the acet-amidine step of vitamin B₁ synthesis. The facilities for making thiamin hydrochloride were sufficiently damaged to end production. Merck was the largest manufacturer of this nutritional factor in Germany. Its destruction, however, would not be rapidly reflected in the health of the people since artificial reinforcement with vitamin B₁ in bread is not required in Germany.

All stocks of barbiturates were destroyed and it was estimated that with all required materials, six months' time would be necessary to restore the apparatus for production.

The damage to the rare chemicals department was assessed at 80 per cent. Merck was the sole source of many of the chemical reagents used in research and in industrial testing laboratories throughout Germany. The effect of the destruction of these facilities is therefore not proportionate in importance to their small percentage in Merck's total sales.

Air raid precautions taken at the plant were very meagre. There were no large shelters for the workers and only a few scattered retreats called "*Splitter Graben*." These were small, covered trenches or dug-outs, large enough to hold from 20 to 25 persons. Their sole protection was the earth around them and the 20 centimeters of thick layer of concrete overhead. The only other shelters were those provided by the cellars of the reinforced concrete and brick buildings. There was room enough in these cellars for all the workers but there was little evidence of anything additional having been done to buttress up the floors above or to provide ventilation or emergency lighting.

Conclusion: The raid of December 12, 1944, seriously crippled the chief source of chemical reagents and vitamins in Germany. Little reconstruction had been undertaken up to the time the American troops arrived in April. It was estimated that as a result of this raid, Germany would have been deprived of a great source of the essential reagents and supplemental food factors for at least one year. The aerial photographs of the plant accompanying Interpretation Report SA 2986 do not show that the railroad network immediately adjoining the plant suffered any damage.

Surgical dressings, supplies, and equipment

The problem of supply and distribution of surgical dressings is primarily one of transportation and secondarily a problem of coal supply. The

difficulties of transportation were the more pronounced because many of the plants were making synthetic cloth which required large amounts of coal and coke. These plants were not in the Ruhr area but were located in Silesia which is far removed from the zones bearing the brunt of the aerial offensive. Apart from this there were manufacturers of gauze bandages, adhesive tape and similar items in every large city in Germany. These items were produced from textile raw materials which had to come from a great distance, so that the moment transportation was interrupted their production had to be curtailed.

One of the largest and most important manufacturers of surgical dressings in Germany was the Scherrong Company at Tutlingen in Wurttemberg. In a small city some distance from the armaments industry they, like the plant making biologicals at Marburg, survived the war without serious damage.

Oberstabsapotheker Paul Weiser, a member of Section 4, of the supply section in the office of General Handloser, stated that the destruction of small plants scattered throughout the cities of Germany and the lack of supply of essential textiles for surgical dressings caused the amount of finished material to fall from 20,000,000 meters in 1939 to 5,000,000 meters in December, 1944. This was such a reduction that various Army installations had to resort to moss for use as absorbent material on wounds. The moss was first washed, then sterilized and placed directly on the wound with a thin layer of gauze over it. As a less drastic measure, in 1944 supply houses were ordered to fill all orders for bandage with one half the amount in paper bandage and the remainder in cloth. In many instances, wholesalers reported that they were forced to fill orders with paper products alone as all other stocks were depleted. Surgeons were of the opinion that the paper bandage worked quite well on cases that were stationary, such as a leg under traction. The primary difficulty occurred in ambulatory cases in which paper had a tendency to slip and tear.

Surgical instruments became increasingly difficult to obtain as the air attack against German cities interfered with transportation to and from the numerous small plants operating throughout the country. In 1942 it was estimated that there were 4,000 different types of surgical instruments. These types were gradually reduced, by order of the Brandt office, until in August, 1944, there were less than 1,700 surgical instruments of all kinds. In January, 1945, only 200 types were allowed. Sev-

eral of the authorities with whom this problem was discussed were of the opinion that curtailment came much too late and was not as drastic as it should have been. They seemed to think that surgeons would have been able to manage with very few instruments. They did not believe that as the situation became critical surgeons should have been permitted the luxury of dozens of different types of instruments for each operation.

Rationing of x-ray equipment was instituted in 1943, and manufacture was limited to three basic, simple models in August, 1944. The models were determined by the Brandt organization. The Speer Ministry allocated raw materials to manufacturers only for these models. Weiser, who was in charge of the supply of instruments and equipment to all the Armed Forces, stated that the drastic curtailment of surgical instruments and equipment which were finally unobtainable by January 1, 1945, was due to four causes which followed each other in succession and which ultimately led to the complete breakdown in the supply of essential equipment. These were (1) by 1943 the loss of the countries which the Germans had occupied reduced the quantities of essential ores and other raw material; (2) with the increasing tempo of the aerial offensives and the seriousness for the Germans of the ground situation, every manufacturer of medical equipment was required to release one half of its specialized craftsmen for induction into the armed services in August, 1944; (3) this was followed by the Allied attacks on the German transportation system, and (4) the final breakdown at local sources came when the mass air attacks against city areas overwhelmed the defenses of German target cities. This occurred in the late fall and early winter of 1944-45 and had the effect of making the replacement of destroyed essential medical equipment impossible.

The government's control organization

It has been stated in a previous chapter that the anticipation of interference with the supply of essential medicaments, dressings, instruments and equipment was one of the important reasons for Hitler's appointment of Brandt. The Brandt interview contains a conflicting explanation as to why he was appointed. It is, however, apparent that some co-ordinating office was necessary not only to allocate and control the distribution of medical care through the physician but to assist and guide

those industries supplying the civilian sector and the Armed Forces. From the beginning, the German Ministry of Armaments and Munitions contained one section devoted to allocating raw materials to the pharmaceutical industry. This was the "Specialists' Group Pharmacy" in the Chemical Division. Bandages and other types of surgical dressings were under the control of the textile group. The decentralization of the control of medical supplies in this Ministry went so far as to place operating room lights under room fixtures and surgical appliances in the section dealing with musical instruments. There was no section in the Speer Ministry where all the problems of medical supply were co-ordinated under one head.

It was repeatedly stated that Brandt's mission was difficult to fulfill because it was necessary to deal with so many different ministerial sections in the Speer organization, thus requiring endless conferences with each of the various departmental heads. They were necessary because Brandt was responsible for the ultimate supply of drugs, instruments and other equipment. He was, therefore, determined that plants manufacturing such items should not be overlooked when the Speer Ministry distributed chemicals and other critical raw materials. Figure 53 in Chapter Seven describes the close control he exercised in balancing the demands of the civilians and the military.

In theory, it was the mission of Admiral Fikentscher in the Brandt office to confer with the Speer group and then to estimate the potential supplies of all items which would be available for a given period. The estimated requirements of the military and of all civilian physicians in Germany were then presented to him by Conti and Handloser. In practice, however, there did not appear to be such clear-cut delineation, for the men of the Armed Forces worked directly with Speer, and Conti gained the impression that the civilians received only what was left over. Brandt made no direct distribution to military units, and except in cases where the Brandt Hospitals and the "Brandt Reserve" were concerned, he issued no supplies to hospitals or individual cities.

Under General Handloser the procurement and allotment of all medical supplies to the Army, Navy, and Air Forces were guided by Colonel Apothecary (*Oberstabsapotheker*) Exo. His division was divided into a section for drugs (*Sieke*), bandages (*Scriba*), and equipment (*Weiser*). This

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office at the high command of the German Armed Forces received the estimates from the various sanitary depots of the Army, Air Forces, Navy, SS, Todt Organization and the Labor Service. The requests were then examined and, when found justified, approved. In each case the approved request had to be planned against the total allocations made to the military for each item of equipment.

The civilian counterpart to Exo was Dr. Joseph Grunwald in Conti's office of public health in the Ministry of Interior. One section of his division controlled all functions that were necessary for the supply of drugs, bandages, surgical dressings, instruments and equipment to civilian facilities and to the population at large. It had no direct control over the pharmaceutical industry as this was retained by the Brandt organization. Furthermore, there was no such authority as is represented by the amended Food, Drug and Cosmetic Act in the United States for controlling the quality of medications and the claims made for medical preparations. The officials of the German public health service, including Dr. Conti, seldom were requested to participate in the discussions on allocations and received only what Brandt could persuade the Armed Forces not to take.

The office of Admiral Fikentscher, the retired chief medical officer of the German Navy was organized as follows:

Textiles	Fikentscher
Roentgenologic apparatus....	Fikentscher
Pharmaceuticals	Lupke
Precision instruments and optics	Geist
Liaison with the military.....	Hanstein
Liaison with Speer (war production)	Wanschure

In the Armed Forces the system was better organized and under stricter control than it was in the civilian sector. In the former, various medical supply depots would send their estimates to the chief of their branch of service. He would in turn forward them to Handloser's office where the requisition would be approved and deducted from the master allotment before being sent to the main sanitary depots. This main depot for each of the several branches of service went through the same procedure of dividing up their allocation and gave the orders directly to the industry for supplies to be delivered to the unit depots throughout the country.

In the Conti organization, on the other hand, it was only in the supply of such items as were never required in volume over which they were able to exercise absolute control. These would include operating tables, hospital beds, x-ray machines and similar equipment. The latter offers a good example of the procedure followed. When x-ray equipment was destroyed in an air attack the physician or facility involved would first attempt to obtain a replacement through local purchases or from their ordinary sources of supply. When this failed a request was sent to Berlin. It first required the approval of the local medical association, whence it was sent to Grunwald's office. The latter in turn forwarded the request to the "*Deutsche Roentgen Gesellschaft*" for consideration. If in each instance it was justified, it was then forwarded to the manufacturer of the apparatus who would deliver the order if possible.

The system of governmental control of medical supplies was developed in its final form only after the critical period of the air war had arrived. For some reason, which was not explained in all the interviews of German officials by members of this branch, the German drug, chemical and allied trades industry appears to have had a relatively free reign except in the allocation of raw materials until the intense phase of aerial attacks against the German homeland was reached. An air war of such magnitude was not anticipated. These officials repeatedly asserted that they organized too late to encourage the production of adequate reserves, to arrange the dispersal of sufficient stored material, and to institute the drug rationing and the simplification of medical instruments, equipment and pharmaceuticals which finally became necessary. By this delay or lack of prior planning they were unable to withstand successfully the impact of the combined air offensive on the production and distribution of these essentials to public health.

Counter-measures

Perhaps the most effective counter-measure instituted by the German Government was the so-called "Brandt Reserve Plan." According to this, all companies engaged in the production, distribution and sale of medical supplies were required to retain stockpiles on critical items. Manufacturing concerns were required to set aside an inventory representing a two months' supply over and above their normal inventory when the plan was instituted

in 1943. By the middle of 1944 this reserve was ordered increased to a six months' supply of all items which were, according to the directive, to be held in warehouses specified by Brandt. They were usually located outside of cities and beyond the area of danger from air attack. Title to the goods remained in the manufacturer's name. They became property of the government only when they were used, at which time the government reimbursed the manufacturer. It could not be learned whether the government considered paying interest on the frozen investment this represented. The items could be released only upon authority of the office in Berlin as they were considered reserves to be held for raids classed as "catastrophies."

Members of the directorate of the I. G. Farben in discussing this Brandt reserve plan stated that in establishing it Brandt ignored the increased demands which had already been made on the pharmaceutical industry. He did not seem to consider how such a tremendous bulk of idle stock, which had to represent 50 per cent of their annual production over and above the normal inventory, could be manufactured. Manufacturers were able to comply partially with the scheme because the demands for other products from other European countries steadily decreased. Late in 1943, the I. G. discontinued all civilian supply for one month in order to force the wholesaler to squeeze out his holdings. This had the effect of further building up the so-called Brandt reserve.

The wholesalers as well as each individual apothecary in Germany were required to maintain a two months' reserve of essential drugs, over and above their average normal inventory from 1935 to 1939. The wholesalers deposited their material in warehouses in outlying districts. Apothecaries were permitted to retain their reserve in their own buildings.

For a city health officer to un-freeze such supplies he had to send an official declaration to Berlin stating that a catastrophe had occurred. If the demands for emergency medical supplies were large, it was customary for Brandt to send a representative to the city to decide what supplies were necessary. Pharmaceuticals, surgical dressings and instruments were then released. Occasionally this elaborate system did not function well in the communities. For example, in the July raids of 1943 on Hamburg city health officers were forced to call upon the medical supply depot of the German

Navy at Wilhelmshafen for instruments and surgical dressings. Indeed, in some cities raids were of such magnitude that the Armed Forces were finally ordered to meet any demands made upon them by the civilian health authorities to satisfy the requirements in essential supplies after a heavy raid.

The apothecary and drug rationing

The system of rationing was extended to cover more and more pharmaceuticals until the spring of 1945 when 88 drugs and related items were on the restricted list. The plan was much the same as that governing the distribution of food; its purpose was to spread the thin reserves of the essential items over as wide an area as possible.

With a few exceptions all chemicals and drugs used in druggists' prescriptions were carefully controlled. Eight categories of substances were regulated: chemicals such as ether, theophyllin, and boric acid; drugs such as *folia digitalis* and *jalap*; ointment bases; fats and oils; suppository bases; ether oils; alcohol, sugar, *balsam peru*; and miscellaneous items such as *petrolatum* and *benzine*. To obtain these substances, the druggist had to submit his requirements to the local pharmacy control board (a section of the Apothecary's Chamber or *Aerztekammer*) every three months. His requests could not exceed his purchases for any quarter of 1938. These boards then consolidated their requirements and forwarded them to the district (*Bezirks*) board. The allotments of restricted substances were made to each district by the pharmacy section of the Speer Ministry on the basis of periodic estimates from the drug and chemicals industry.

With his purchase orders to the wholesaler, the apothecary was required to submit a requisition from his rationing board. One such requisition was necessary for each drug which was then charged against the druggist's allotment. Many apothecaries stated that only a few items were thus restricted and they were able to obtain most of their requirements until late summer of 1944.

Pharmaceutical specialties were not controlled by the government. No elaborate procedure was required by the pharmaceutical manufacturers who, for the most part, limited their wholesalers to the amounts of each item purchased in 1939. On critically short items, such as glandular extracts, the wholesalers limited their sales to hospitals. Thus



FIGURE 196. *Kaiser Wilhelm Institute for Medical Research at Heidelberg. During the war a building housing cyclotron was added for study of atomic energy.*

the sale by manufacturers direct to physicians and hospitals was largely abandoned. Because of this and because of their ability to disperse large stocks and to serve an area after a raid, the officials of Reichelt, A.G. at Hamburg believe the wholesaler became more important in the economy of the drug industry.

New developments

The air war did not greatly affect the progress of medical research until the last year of the European conflict. In the period when Germany's tide was running high and Allied planes were little more than a nuisance, the search for new therapeutic measures continued at its peacetime pace. Many scientists were deferred from military duty, equipment was plentiful and of high quality, raw materials were available and the war was sufficiently remote from the homeland to afford the tranquility essential to scientific research. Early in 1944, with the advent of the air war all this changed. Research slowed to a snail's pace in twelve months and, obviously, the overrunning of

the country by ground forces delivered the coup de grâce to all creative work in medicine.

During the war, German laboratories succeeded in developing several therapeutic agents which, when they have been fully tested by American and British authorities, may prove of outstanding value in the future of medicine. These include a synthetic blood substitute which should materially reduce the cost of shock therapy, a chemotherapeutic agent of value in anaerobic infections, a synthetic oxytocic, a colorless anti-malarial agent claimed to exhibit the same therapeutic efficacy as atabrine. German progress in medicine was carefully studied and much information was gained in every phase of medical investigations. However, a review of the nature and use of such new products does not come within the purview of this report.

Two examples will furnish an accurate picture of what happened to research efforts in Germany under large scale bombing. They serve to make it obvious to the casual observer why medical progress is impeded rather than stimulated by the events in a peoples' war.

It is now clear that bombing is the reason Germany was found to be without penicillin. This type of warfare interfered with the development of sufficiently potent strains of molds and greatly delayed the assembly of data by the central research organization at Berlin. The files of Professor Rostock, chief coordinator of medical research for the Reich, knew, however, that by June, 1944, the Germans had learned enough of the characteristics of these strains to permit them to go into production on an experimental basis. More than this, however, was never attained.

The German scientists with whom the matter of penicillin was discussed repeatedly referred to two points. First, they appeared surprised that the Allies had been able to withhold from scientific literature several essential details of information concerning this important discovery. Many of them also felt that present methods of manufacture were too cumbersome and complicated for production to be undertaken at the present state of knowledge. They believed that more time should elapse during which the problem of synthesis could be developed. They were reluctant to undertake the construction of such elaborate facilities as are presently required because of the constant threat that they would be destroyed overnight in an air raid. Penicillin was being manufactured on a laboratory scale at Hoechst, at Merck (Darmstadt) and in the laboratory of Hitler's private physician, Dr. Theodore Morrell. In passing, it is interesting to recall that during our interrogation of Dr. Erwin Giesing, who attended Hitler when his ear drums were punctured in the abortive plot of July, 1944, he stated that an independent analysis of the Morrell penicillin showed no antibacterial activity whatsoever.

Medical research was greatly impeded by the repeated breakdowns in communications and the inability of pharmaceutical concerns to maintain a steady supply of research materials. Difficulties of this sort were probably more responsible than anything else for the failure of Professor Richard Kuhn, Nobel prize winner and director of the Kaiser Wilhelm Institute for Medical Research at Heidelberg, to continue his work on new chemotherapeutic substances. Before the breakdown of Germany's transportation system Kuhn had made progress in the development of a sulphur, nitrogen, and metal free substance, for use in the treatment of all types of infections due to cocci and in those

in which penicillin is presently indicated. This substance is 2,2' dioxybenzyl which, when halogenated, forms a 2,2' dioxydibrombenzyl or "Salicil." This preparation is being studied by Dr. Gerhard Domagk. Work had to be abandoned on salicil in September, 1944.

The destruction of laboratories and equipment, the breakdown of communication, which is necessary for the exchange of scientific information and materials, the induction into the Armed Forces of almost every available man for the last push of the German Army in late 1944, and the psychological effect of the continuous air raids paralyzed medical research. Only two scientists were interviewed who were continuing clinical investigations.

Conclusions

From what has been reported it is apparent that the Germans established a well organized system for the control, manufacture, and distribution of essential medical supplies. The main error, and the one which may have been largely responsible for the ultimate breakdown of the system, was their delay in initiating the plan and their neglect in instituting drastic curtailment of the number and type of drugs, dressings, instruments and equipment permitted. The aerial war succeeded in seriously crippling many of the medical supply industries. It was not sufficient to interfere seriously with the ability of these industries to produce essential products. Transportation was the deciding factor.

The Brandt reserve plan was well conceived, but late. The manufacturers agreed, as did the wholesalers, that had they been given time to build up an inventory, they could have cushioned the effect of the air war on the health of the people. As it was, it appeared to be a stop-gap which in the end was inadequate.

Attacks in which production facilities and warehouses were damaged was one of the four reasons for the ultimate breakdown in the production and distribution of essential medical supplies to the German public. The three other contributing factors were the loss of sources of raw materials in foreign countries, the demand for manpower by the German ground forces which forced the drafting of skilled craftsmen, and the success of the Allied air attacks in the disruption of the distribution of supplies.

The series of events related above forced Professor Brandt to inform Hitler on April 2, 1945,

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that 20 per cent of all essential medical supplies throughout Germany had been destroyed, that 40 per cent of those in stock were only partially damaged or intact and would last two months, and that the remainder would maintain the supply for four additional months if transportation could be restored. If these conditions could not be met, Brandt

informed the Fuehrer, then the civilians and the Armed Forces could no longer be provided with even the barest essentials of medical attention. This succinct picture of the state of the German medical supply industry after the Allied Air raids was regarded as evidence of a defeatist attitude. For expressing it, Brandt was condemned to death.



APPENDICES

This section contains tabular matter and other information not pertinent to an understanding of the effect of the air assaults on the health of Germany but which may be of interest to those wishing to study the subject further.

- APPENDIX A**Individuals Interrogated
- APPENDIX B**Bombing and the German Armed Forces
- APPENDIX C-1**N.S.V. Action in Hamburg Catastrophe
- APPENDIX C-2**Rationing Regulation for Final War Period
- APPENDIX C-3**Food Stocks During War Years
- APPENDIX C-4**Daily Allowances of Rationed Foods
- APPENDIX C-5**Compilation of Nutritional Values

appendix A

INTERROGATIONS

The following is a partial list of the more important persons interrogated by the Medical Branch team whose opinions were a major source of information.

DR. ADENAUER,
Lord Mayor of Cologne

DR. AURNHAMMER,
Pediatrician, Augsburg

MR. BISCHOFF,
Architect, Brandt Hospital, Berlin

DR. BADIN,
Water Works, Dortmund

PROF. BANIECKI,
Pathologist, University of Hamburg

PROF. BAUER,
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- PROF. DEMNITZ,
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Surgeon General, SS.

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ALLIED BOMBING AND THE GERMAN ARMED FORCES

In mid-summer 1945 the Military Effects Division requested the Medical Branch to assemble what data it had relative to the effect of bombing on medical care in the German Armed Forces. This information which was supplemented by a number of interviews with high German military authorities was gathered in the following report submitted by Lt. Col. Richard L. Meiling, Chief of the Morale Division.

Medical services of the German Army (OKH)

Prior to 1941, the German Army Medical Service was, like all other services, divided between the Administrative Section of the German Army General Staff (this included the Army Inspectorates and the Army Reserve) and the German Field Army. The latter was composed of the tactical units in training in the homeland as well as all the tactical units in the combat zones.

In January, 1941, Major General Handloser was appointed Director of Medical Services in the German General Staff and upon his recommendation the medical services of both the Administrative Section of the General Staff and of the German Field Army were consolidated in his office. General Handloser, while holding this dual position, retained the respective staffs of the two former positions and these staffs continued throughout the remainder of the war to function as independent organizations under General Handloser and later under General Walter, who succeeded Handloser in August, 1944. Handloser was, in addition to his other duties, Director of Medical Services of the Armed Forces, which position he still held in May, 1945, on the cessation of hostilities.¹

Aerial warfare

During the Russian campaign in the winter of 1941-42 the German Ground Forces were first subjected to considerable amount of low level aerial strafing. This strafing proved a serious hazard to all combat troops and the medical services attached to them. The aerial strafing later inflicted by Allied airmen on the Western Front was stated by the

Germans to have been much more severe and devastating than that experienced on the Russian Front. No defense was possible against the round-the-clock British and American low level attacks with heavy caliber weapons.^{1, 2} During the Russian campaign the Germans suffered heavy casualties. Due to the very primitive conditions existing in that portion of Russia occupied by the Germans, it was necessary to evacuate casualties to the homeland during the summer of 1942. At this same time, the homeland was just beginning to gird itself to resist the increased tempo of aerial attacks from the west. This resulted in both the civilian and military authorities competing for the available sanitariums, hotels, schools and public buildings which might be converted to hospital use. This competition extended to the demands for hospital equipment, supplies, pharmaceuticals, and even to the demands for available physicians and nurses.

To control this impossible situation, Hitler designated General Handloser Director of Medical Services of the German Armed Forces in July, 1942. Under the Armed Forces were included the Army, Navy, Air Force, SS, Labor Corps, Police, Hitler Youth, Organization Todt, and all the other semi-military organizations, each of which maintained an independent medical service. At this same time, Hitler appointed Professor Karl Brandt, associate professor of Surgery at the University of Berlin, "Reichs Commissar for Military and Civilian Health and Medicine." In addition to the necessity of having a plenipotentiary direct the medical administration between the civilian and the military sectors someone was required who could restore the confidence of responsible German authorities in the medical services which were supposed to have been severely undermined because of the catastrophic losses on the Russian Front (1941-42) and the incompetent evacuation of wounded to the German homeland.

Brandt's powers were unlimited and he was responsible to Hitler alone. He was to coordinate on a national level all the civilian and military questions pertaining to medicine or health concerning

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personnel, research, education, production, distribution, storage and requirements of medicine and associated supplies, instruments and equipment as well as the allocation of raw materials to the medical and associated industries. Brandt's mission was declared successful by both Dr. Conti, head of the civilian medical sector and General Handloser, chief of the Armed Forces medical services.^{1, 3}

Patients and casualties

According to Handloser, there were approximately 5,000,000 wounded in the Armed Forces during the years 1939-1945. An additional 2,000,000 were missing and 2,030,000 were killed. Handloser stated that of the 2,000,000 missing approximately 50 per cent must be considered dead. This is due in part to the fact that a number were reported missing following aerial bombing or strafing and because the Russians did not report prisoners of war through the agencies of the International Red Cross. No record is available as to the actual number of Germans taken prisoner by the Russians.

Prior to 1943, infantry weapons were the leading cause of casualties. Artillery fire was second and aerial bombardment and strafing third. In the latter part of 1943, aerial strafing and bombardment shifted to first position, followed closely by artillery, and during 1944-45 aerial weapons (bombardment and strafing) were far ahead of either artillery or infantry weapons as a cause of casualties in the Wehrmacht.¹

In 1940-41, the ratio of wounded to killed in the German Army was eight to one. By 1943, this had shifted to five to one, and during 1944 and 1945 the records revealed that for every three wounded one was killed. The military authorities attributed this shift entirely to the devastating effect of aerial warfare. It must be remembered that in a great number of instances many were officially reported as missing who actually had been killed (destroyed or buried) by aerial bombardment.¹

Beginning in 1943, a definite shift in the type of hospital patients was noted throughout the Armed Forces as a result of aerial warfare. The patients received severe and multiple type wounds which resulted in longer periods of hospitalization and convalescence. There was a decided reduction in the number of those who could be returned to either full or limited military duty. In 1944, this trend became so serious that special medical commissions were established to visit all hos-

pitals of the Armed Forces every three months and to make spot checks at more frequent intervals for the sole purpose of clearing them of all patients who might "possibly be used for some further military service although their wounds were not completely healed."¹

Concurrent with these seemingly drastic measures, the Germans developed the so-called stomach battalions, amputee battalions, eye battalions, etc., composed of personnel whose medical condition placed them in the specified grouping. Special medical service and dietary arrangements were incorporated in the administrative direction of these units.^{1, 4}

Hospitals and medical installations

The actual destruction of military hospitals was, according to the German medical authorities, purely coincidental with aerial warfare. The Germans had the impression that the Air Forces of the Western powers did not respect the Geneva Convention insignia on hospital facilities, hospital trains, hospital ships, ambulances and field medical installations.^{1, 2} It is interesting to note that, in 1940, Hitler decreed that all Red Cross insignia were to be removed from military medical installations and equipment. This decision was made upon the recommendation of the leaders of the German Air Force who felt that enemy aviators could use the Red Cross insignia for the purpose of locating large troop concentrations and military installations. Early in 1944, as the result of questioning of both British and American aviators who fell into enemy hands as prisoners of war and because of the observed air policy of the Allies in the Mediterranean Combat Zone with respect to medical installations adequately marked with the Red Cross insignia, Hitler again issued a decree ordering all military medical installations to be remarked with the conventional Red Cross insignia.²

Inasmuch as at this time the home front was being subjected to severe bombings, the civilian authorities requested permission to place the Red Cross insignia upon the civilian medical installations. The German military authorities objected to this procedure and the question was referred to the International Red Cross Agency at Geneva. This agency advised the Germans that the civilian medical facilities should be marked with a large red square on a white field rather than with the red cross on a white field.

Although a great number of civilian and military hospital and medical installations were destroyed both in the combat zone and in Germany, the requisition of hotels, schools, etc., provided emergency hospital facilities. No reports or records were found to indicate that military patients could not be hospitalized due to lack of space.

"Open cities" and proposed "open medical zones"

In view of the destruction of hospitals from aerial bombardment throughout Germany and the terrific psychic trauma produced by continued air warfare upon combat patients who had been evacuated to the homeland for medical care and recuperation, General Handloser proposed a study to consider plans for the establishment of so-called "open medical cities" or "open medical zones." These, he thought, would be respected by the air forces of the Allied nations and not subjected to air attacks.¹

General Sauerbruch, Professor of Surgery, University of Berlin, aided in this study, as he was highly desirous of finding a city free of air attacks to which he could evacuate the amputee cases. Both Handloser and Sauerbruch were successful in presenting the problem to the Chiefs of Staff of the German Armed Forces, and received permission to present the plan through the Military Attaché Division to the German Foreign Office.

In the spring of 1944, the German Foreign Office, however, was extremely reluctant, for political reasons, to give full and open support to the idea of establishing "open cities" through international negotiations. The Medical Services of the Armed Forces, the General Staff and the Foreign Office finally agreed to the selection of specific cities which were to provide a haven for hospitals, both military and civilian, and for the production and storage of certain critical and essential medical supplies. These cities or zones were to be free from all armament industry and military barracks and, as far as possible were to be in no way connected with rail or motor transportation centers.

By August, 1944, the negotiations had developed sufficiently to permit contact with the Swiss legation at Berlin. The negotiations continued throughout the fall and winter months. By December the original 42 proposed German cities were reduced to 12 which could meet the conditions established for international negotiations with the United States and Britain as well as meet the strategic require-

ments of the German General Staff for the defense of the homeland.

Due to the political as well as military and international complications which had developed during the initial phases of these negotiations, the Swiss government made a counter proposal. It proposed, for humanitarian reasons, to accept at any one time a total of 20,000 German military or civilian patients in Switzerland for hospital or convalescent care. According to General Handloser, the Swiss were to feed, house, and provide medical, surgical and rehabilitation services for these patients. The political significance and the international negotiations involved so delayed the two plans that at the end of December, 1944, the military proposed the city of Constance (which was used for a similar purpose in 1914-1918), located on the Swiss-German border, as an "open city," available for the mutual exchange of repatriated prisoners of war between the Germans and the Allied powers (except Russia) and for the purpose of establishing military and civilian hospitals where patients would be free from the constant fear of aerial attacks. All the interested German military and civilian governmental agencies concerned agreed to the use of Constance. In January, 1945, final approval was requested of Hitler. This approval was not given. Whether the decision could actually be attributed to Hitler or to his political deputy, Bormann, could not be determined by the German military authorities. They were unanimous in their belief that the stated reason for the refusal, namely that Constance was on the Swiss border, was purely to cover the real reason, i.e., an international request would be an admission of defeatism and the success of the Allied air offensive. Negotiations were also undertaken through the International Red Cross and the Swedish Government for the establishment of Flensburg on the German-Danish border as an "open city." These negotiations likewise were unsuccessful probably because of fear of the brand "defeatism."

Medical supplies

The Wehrmacht maintained medical supply depots in each of the various Army, Navy or Air Force districts. The German Field Armies also maintained medical supply depots within each Army and Army Group area. During the disastrous incendiary raids on Hamburg in July and August, 1943, one of the largest military medical supply

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depots in Germany was completely destroyed. After this disaster and because of the increasing destruction of other medical supply depots throughout Germany, orders were issued to all commands that medical depots and medical supply dumps of field armies should be dispersed into eight to fifteen separate units, depending on military circumstances, and that each unit should contain at all times complete and identical stocks of supplies. It is evident that this program made a tremendous increased demand upon the pharmaceutical and medical industry and national stockpile.^{1, 2, 5} This increase came at a time when the air raids on cities throughout Germany necessitated more medical supplies for civilian use. The key cities in the German pharmaceutical and medical supply industry were being crippled by bombing. The textile industry, the absorbent material industry, the glass industry and other associated industries were being damaged and in many cases destroyed by aerial bombardment. In addition to this, the roads, bridges and railroads, the rolling stock, the trucks as well as gasoline and oil dumps were being attacked and severely crippled. This resulted in acute shortages which became most noticeable in 1943 for both the civilian and military sectors of the German nation. It became increasingly difficult to provide ether, plaster of paris, serums, bandaging material and morphine after the fall of 1943. To conserve the dwindling supply of critical raw materials, Professor Brandt, in 1943, reduced the production of approximately 30,000 various pharmaceuticals to approximately 600 on the military supply lists. At the same time the production of 40 different types of x-ray equipment was limited to nine, and 137 different types of hemostats were reduced to six. Only Army field operating room tables were manufactured for both civilian and military hospitals. Brandt's organization established similar controls over all production of medical, pharmaceutical and hospital supplies. Had the Allies destroyed the Behring Works at Marburg, the German people, both civilian and military, would have been without tetanus and diphtheria serums.^{1, 5} With reference to shortages, Professor Brandt stated that all types of hypodermic needles, knives, scissors and bandages were the most urgently needed. Heart stimulants, narcotics, analgesics and anesthetics were the most critical items. An instance is cited of both military and civilian hospitals near Flensburg being entirely without anesthetics in May, 1945, a shortage which was due

more to transport difficulties than to lack of production.^{4, 6, 7}

Textile manufacture was also hit. There were seven factories in Germany which produced absorbent material. By the summer of 1944, six had been completely or partially destroyed by bombing. Those still in operation found it impossible to continue production due to the lack of transportation required to supply raw materials and coal. In October, 1944, the Armed Forces directed commanding officers to send their troops into the forests to gather a specific type of moss to be dried and sterilized for use in the preparation of absorbent surgical pads. Paper bandages were introduced as early as 1940-41. The rewashing of cloth bandages was a standard procedure.⁵ The destruction of homes, hotels and hospitals and the increase in military and civilian patients made operating room and bed linen a very scarce article by October, 1944. New hospitals were issued a total of only one set of linen per bed.⁶

In December, 1944, Brandt ordered the release of the six months' reserve of medical supplies which had been set up earlier in the year. Further releases were made in January, February and March, 1945, when replacements were no longer produced. On April 2, 1945, Brandt personally appeared before Hitler in Berlin to inform him that more than 20 per cent of all essential medical items were totally depleted; that another 40 per cent of essential items would last two months, and that the remainder would last four months provided transportation could be restored, sufficient guards could be placed at the storage areas to prevent looting and to assure equitable distribution between the Wehrmacht, SS, and civilians, and no additional requirements would be made upon existing stocks. Hitler gave no reply and Brandt withdrew from the conference room, later to be arrested and condemned to death as a defeatist and a traitor.⁶

As to the effect of the Russian campaigns of 1941 and 1942 on the medical supply situation, Handloser believed that although the losses were severe there would have been no particular replacement problem had the Germans not been subjected to the combined bomber offensive which began in the summer of 1942.¹

By 1944, the destruction of the production and storage facilities for medical supplies and equipment as well as the terrific toll of aerial warfare upon the German transportation system resulted in

establishing a so-called critical medical item list in the Armed Forces. This contained approximately 350 individual articles. Each medical installation in the Armed Forces was assigned a monthly quota which could not be exceeded on monthly requisitions. A maximum of 60 days' supply in these items was permitted as a stock on hand.⁵

After 1943 both the military and the civilian agencies had to submit their requisitions and requirements to a National Commission charged with establishing the requirements and distributing the available critical pharmaceutical and medical materials to all agencies.⁵

Several senior medical officers of the German Armed Forces stated that at no time prior to 1945 were they actually without essential items required to maintain the medical services of their particular units in the combat zone.² They all admitted, however, that they often received repeated complaints from the civilian home front as to acute shortages there. In February, 1945, the medical services were directed by the Chief of the Armed Forces not only to care for civilian patients on an equal basis with military patients, but also to share wherever possible available medical supplies with civilian medical installations. This order specifically stated that the Armed Forces would not receive deliveries from factories or warehouses of any medical supplies during the succeeding six months as all available supplies would be consigned to civilian need.¹

Evacuation services in the army

The German Army at divisional level used both animal-drawn and motor ambulances. At the level of army and army groups there was a medical regulating officer attached to the Transportation Corps to control the distribution and use of hospital trains. Within the communication zone, which for the Germans was the homeland, there were medical regulating officers attached to the staff of the Transportation Corps Officer with each railroad directorate. The office of the Director of the Medical Services of the German Armed Forces received weekly reports as to available beds together with actual and anticipated patient loads accruing at all of the various fronts and in the military districts. These reports, submitted in code or by teletype apparatus, were broken down into various medical and surgical groupings.

All the medical officers interviewed stated that aerial strafing was the most serious problem con-

fronting the medical evacuation services; that it was impossible after the Normandy campaign to move patients in the combat areas except at night, and that this was accomplished at considerable risk to the patients and attendants. The medical evacuation service was forced to use country roads, which caused increased delay in transport between the various medical installations. This, in addition to the rough roads, contributed greatly to the increased hardships of the patients and the higher mortality rates experienced in 1944-45 by the German medical services. Wherever possible, transportation of patients by cargo and transport airplanes was accomplished (air evacuation of casualties was first undertaken in the Russian campaign), but in 1944 and 1945 lack of air superiority on the part of the Germans greatly interfered with such air service.²

Aerial bombardment was considered in the same light as artillery bombardment so far as the medical services in the forward areas were concerned.² However, the aerial bombardment of cities and the resulting destruction of hospitals and disruption and destruction of rail and motor transportation facilities had a severe effect on the maintenance of an adequate functioning medical service.

It is estimated that in the first months of 1945 with more than 1,000,000 patients in German military hospitals inside Germany there were less than 10,000 "available beds." At a time when rail transportation was receiving its most devastating aerial blows, when the roads were safe only at night for motor travel and when the available gasoline was at a very minimum, this meant that the various military hospitals were so crowded that they could never accept at any one time more than from 20 to 25 patients (less than one carload). By March, 1945, the medical regulating system was completely bogged down and it was no longer possible to distribute correctly diagnosed patients to the proper medical or surgical centers. The only way out from then on was to find a hospital bed for each military and civilian patient in any available location.¹

The German medical plan for the anticipated Allied invasion of the Continent

German medical authorities cognizant of the staff plans for resisting the Allied invasion, prepared their medical plan in the early part of 1944. Due to the increasing intensity of aerial attacks upon north and northwest Germany and the Rhineland, the destruction of the Rhine bridges by aerial

appendix B

attacks and the overtaxed and partially paralyzed German rail transportation system, the military medical authorities decided to set up a so-called "hospital-basis" inside France. This "hospital-basis" was to be "self-sufficient" and would evacuate only the most serious cases into the Black Forest region, southern Germany and Austria, by utilizing transportation routes across the Rhine between Karlsruhe and Basle.^{1, 2}

Forty thousand new hospital beds were requisitioned throughout the towns and cities of France in an area extending from Paris to the Swiss border and north as far as Strassburg. In addition to the 40,000 beds, the commanders of the hospital centers at Paris and at Brussels were ordered to maintain 28,000 "available" beds, to handle casualties during the initial six weeks of the campaign. The military commanders of Württemberg, Baden and Bavaria were ordered to maintain a reserve of 20,000 beds for the most severe casualties from the "hospital-basis" in France.^{1, 2}

The increasing tempo of air warfare against the invasion coast and throughout France in April and May, 1944, had practically filled the 28,000 "available" beds in the Paris and Brussels centers prior to the Normandy invasion in June, 1944.^{1, 4}

The rapid progress of the campaigns on both Western and Eastern Fronts in the summer of 1944 forced the High Command to make a decision to expend all available effort, equipment and personnel to remove military patients from the onrushing Russian forces and to abandon all military patients to Allied Forces west of the Rhine. This decision was apparently made not only because of the recognized "humanitarian attitude" of the Western Allies, as stated by army medical officers, but it was also apparently the only possible military solution to the medical evacuation problem. By this time the destruction of the Rhine bridges and the rail and motor transportation in the area between Germany and the western combat zone had become, according to Field Marshal von Kesselring, a "transportation desert."^{1, 4}

The medical plan for the "Bulge" in December, 1944, was handled entirely by a medical officer, Major General Haubenreiser, of von Rundstedt's staff. No special plans were made for the anticipated casualties in the office of the director of medical services of the German Army.

Morale of troops

According to the German military medical

authorities interviewed the most terrifying phase of aerial warfare as far as combat troops are concerned was aerial strafing with heavy caliber weapons. They stated that aerial bombardment had approximately the same morale and psychologic effect on the troops as an artillery barrage.^{1, 4} While officers and enlisted men alike were concerned about their loved ones and their homes which they knew were being bombed, it was impossible for them to discuss the matter with each other due to the constant threat of the political party informers scattered throughout the Armed Forces. That aerial bombardment did have a severe effect upon the morale of the troops is to be found in the following two incidents. After 1943, the names of towns or villages subjected to aerial bombardment were no longer listed in the official reports sent to the combat troops when their relatives were known to live in zones endangered by heavy air raids.⁸ In the fall of 1943, provisions were made for the dependents of military personnel to secure certification from the local police authorities as to casualties suffered within the family or property damage suffered by members of the immediate family. The police dispatched this report over military telegraph communications to the field forces. Military personnel receiving such a telegraphic notice (this was the first time that the German military communications were made available for personal wires) were granted furloughs to visit their homes as far as militarily feasible. This furlough was computed according to the following four possibilities: (1) death within the immediate family; (2) serious injury within the immediate family; (3) serious damage to the home of the immediate family, and (4) total destruction of the home of the immediate family.⁹ From five to fifteen days' furlough was granted in each case.

The reference to the so-called "war neurosis" which in the last war was described in various forms of stuttering, paralysis, tremors, as well as spastic disturbances of the stomach, bowel and bladder, is very difficult to find in the reports of the German Armed Forces medical services between 1939 and 1945. As far as could be ascertained, Dr. Bumke, Professor of Psychiatry at the University of Munich, was in charge of the only section of a military hospital available for the so-called war neurotics. Professor Bumke stated in an interview that there was not a sufficient number of these war neuroses or hysterical patients to

maintain such a section of the military division of his hospital. The director of medical services of the Armed Forces issued instructions in 1942 stating that similar departments would not be established in military hospitals. Such patients were not to be isolated but should be hospitalized in the same facilities as provided for other military patients.

According to the material found in the official documents of the consulting psychiatrists to the medical director of the Armed Forces, the diagnosis of war neurosis, shell shock, combat fatigue and war hysteria was absolutely forbidden. In place of the above-mentioned diagnoses they used such terms as "psychogenic speech deformity" or "psychogenic muscle paralysis."

It must be recalled that release from military service had a definite effect on the standard of living of the individual German and it was far better as far as the food and housing were concerned to be a member of the Armed Forces than to be assigned to a labor battalion or similar organization. Medical officers could not release from active duty a patient who had developed a psychosis or neurosis in military service; they were required to

recommend his placement at some duty station with the service elements.

No attempt was made in this study to explain the low incident of the so-called psychogenic disorders as reported in the German Armed Forces, even among the personnel subjected to the heaviest artillery barrages and to the devastating effect of Allied aerial strafing and bombardment.

REFERENCES

USSBS Interviews

1. No. 75, Maj. Gen. Siegfried Handloser, July 27, 1945.
2. No. 76, Maj. Gen. Walter, July 20, 1945.
3. No. 82, Brig. Gen. Paul Wuerfler, June 29, 1945.
4. Col. Joedicke, July 20, 1945.
5. No. 46, Capt. Heinz Gluck, June 15, 1945.
6. No. 64, Prof. Karl Brandt, June 17-18, 1945.
7. No. 78, Walther Hartman, June 30, 1945.
8. No. 63, Brig. Gen. Hans Goldbeck, June 15, 1945.
9. No. 77, Maj. Gen. Schroeder, June 20, 1945.

Abstract of NSV Action in the GREAT HAMBURG CATASTROPHE (JULY 24 TO AUGUST 3, 1943)

(NSV-Aktion in den Hamburger Grosskatastrophentagen von 24 Juli bis 3 August, 1943)

Food

(p. 6) Though right after the all clear signal, in the middle of the night, preparations were made to use those cooking facilities and foodstuffs put down in the "G.K."—plan, it was found that extremely high percentages of cooking placed and food raw materials were destroyed. The zone warehouse, too, with its great stores of food and textiles was severely damaged by fire. If in spite of all, it was possible to isolate the textile warehouse from the adjacent blazing food warehouse and in this way save it, this is due solely to the fearless action of a few co-workers.

To care for the people in the particularly heavily hit districts 2 and 7 became urgently necessary. From the beginning on, the situation was aggravated due to the destruction of Kreisamt 7, and the further destruction of a number of Ortsgruppenaemter located in the Kreisaemter 7 and 2. In spite of this, in the course of the first day there was a relatively orderly distribution of almost 200,000 portions of hot and cold food by approximately 500 emergency kitchens and 160 distribution stations.

appendix C-1

(p. 11) After the night 27-28 July, 1943, which in intensity far surpassed the one of 24-25 July, five large collecting centers were established. They were: on the Moorweide, in the City Park, on the Horner race-track, the Farmsener race-track, and in Billstedt. Immense crowds gathered there. It was the task of the City commandant to put to use all available forces and means. Up to the evening 1,200,000—among them evacuees, those who remained behind, policemen and members of the Armed Forces were fed. Among other things approximately 500,000 loaves of bread, 160,000 liters of whole milk, tens of thousands of bottles of beer, sodas and enormous quantities of coffee and tea in pitchers were distributed. The collecting centers became large, well stocked warehouses. Huge staples of cheese, rows of barrels filled with butter, immense quantities of boxes of canned meat and fish and other food-stuffs made an impressive picture. There was nothing missing, even stocks of fruit, jam, cigarettes and ice cream were distributed. Food was procured through requisitions from the Landwirtschaftsamt. It arrived by express from far away places, some of it was even confiscated. Mention must be made of huge stocks saved from destroyed warehouses.

Preparation of hot food, however, became a still more difficult problem, since in those parts of the town that were bombed again and almost completely destroyed practically no cooking facilities existed. More and more field kitchens of the Armed Forces had to be used, likewise five large kitchens, including one each of the Gauleitungen Ost-Hannover Mecklenburg and Schleswig-Holstein. (p. 12) The kitchen train Bavaria delivered food temporarily from Hagen in Westfalen. Particularly helpful, in addition, were four food railroad trains. The food train that was in the station in Hannover was almost completely wrecked during that night. Only through uninterrupted work by its own crew, lasting several hours, was it possible to save the largest part of the train, and in this way approximately 18,000 liters of hot food could be prepared daily.

Besides the procurement of insulated containers for the transportation to the food distribution places, it was difficult to obtain water and dishes. In addition, working girls, women and other help had to be obtained for peeling potatoes, cleaning vegetables, etc., etc.

(p. 20) Special NSV figures.

The following were distributed:

From 25-27 July 1943 daily 200,000 portions each of hot and cold food.

On 28 July 1,200,000 people	}	received cold and hot food
On 29 July 1,000,000 people		
On 30 July 800,000 people	}	received cold and hot food
On 31 July 400,000 people		

From 25 July to 14 September 1943 the following items were distributed:

6.5 million portions cold food

6 million portions hot food

22 million $\frac{1}{2}$ liters of beverages

On 28 July alone 500,000 loaves of bread were given out. The following kitchen and cooking places were in operation from 25 July-14 September:

126 field kitchens (3 of the Armed Forces and 15 owned by the Zone)

5 big kitchens belonging to the Zone

3 railroad food trains and

340 emergency kitchen in place of business, restaurants, schools, etc.

(p. 23) The carefully planned erection of decentralized emergency kitchens within the entire town was of no avail, because all of a sudden gas, water and electricity ceased to function. The feeding of the homeless as well as the entire population was of such decisive significance that the immediate removal from the interior of the town and the inclusion of large collecting stations became a necessity. If cold food is being procured, it appears advisable to deliver the goods if possible in

smallest quantities or packed, i.e. canned meat and sausage in small cans, since these cans may be used as a hot dish if heated. Too many precautions for the serving of warm food cannot be taken, in order that food may be cooked and issued in sufficient vessels even when normal supply of electricity and water fails.

(p. 24) Rooms should be kept available in temporary camps and places in which children may be sheltered, washed and fed. Midwives and nurses should be provided in these places. Baby food (canned milk, tea, zwieback, Naehrmittel, sugar), baby laundry (particularly diapers), bottles, nipples, sanitary napkins and similar things must be at hand.

Minister for
Food and Agriculture
(Der Reichsminister fuer
Ernaehrung und Landwirtschaft)

Berlin, February 20, 1945

To

The Provincial Governments }
The Prussian State Presidents } Provincial Food Offices

Through Channels to District Presidents and Corresponding Offices.

REGULATION GOVERNING THE RATION SYSTEM FOR FOOD
FOR THE 74TH RATION PERIOD
FROM 2 APRIL-29 APRIL 1945 (WITH SUPPLEMENTS
FOR THE 73rd RATION PERIOD)

THIRD PART

Orders and other regulations

CHAPTER ONE

Reorganization of Food Ration cards

Since it cannot be estimated with certainty to what extent food can be distributed to consumers, food ration cards will no longer show kind or quantity of food because of the present supply and transportation situation. The food to be distributed to consumers will be publicly announced. The Food Offices (Ernaehrungsaeemter) are to announce before the beginning of each distribution period the food to be distributed in accordance with the orders given by me in conformity with available quantities. The retailer is directed to announce these quantities by displaying a poster in his windows. Con-

appendix C-2

cerning the possibilities of exchange of food, I refer to my publication of January 29, 1945, II B 1-500II, in which I gave the necessary authority to the Provincial Peasant Leaders (Laudesbauernfuehrer).

The food ration cards, therefore, comprise blank coupons identified solely by a number denoting the respective distribution period, and with a consumer group mark, for instance, K for Kind (child).

Appendix

1-3

(Anlagen

1-3)

Appendix

17

(Anlage

17)

However, in order to avoid the announcement of small quantities required for eating in restaurants, the food ration cards contain coupons for bread and fat imprinted with the quantities 50 grams for bread and 5 grams for fat. The cards look like the samples enclosed. The further enclosure shows which coupons are provided for the uniform distribution of food for the entire Reich, which coupons are at the disposal of the Reichsminister for Economy for the distribution of soap products, and finally which coupons can be disposed of by the Food Offices (Landesernaehrungsamter) for local distributions.

The announcement of the quantities of food by the Food Offices makes it necessary further to simplify the ration card system. Basic and supplementary cards are therefore consolidated into collective cards. The classification of age groups has been simplified so that food ration cards are issued only for:

Children up to 6 years (K)

Children and adolescents from 6 to 18 years (JGD)

Adults over 18 years (E)

Appendix

4-11

(Anlagen

4-11)

Appendix

12

(Anlage

12)

For partial self-suppliers and full self-suppliers, collective cards are also issued patterned on the principles applied to non-self-suppliers. The partial self-suppliers are also divided into three age groups, while the full self-suppliers receive cards only for children up to 6 years (K) and for consumers over 6 years. Besides, the full self-suppliers receive, in accordance with prevailing rules, bread rations, the quantities of which are also to be announced publicly. Enclosed is a sample of the new Reich bread card for self-suppliers. As far as the Reich milling cards are concerned, a separate decree will be issued.

Likewise, for the issuance of the different kinds of food, further simplifications are necessary. Regarding bread, the classification into zones and the differentiation between wheat and rye bread has been omitted beginning with the 74th ration period. The consumer, therefore, will receive only bread for his bread coupons, or, as far as provided, flour at the rate of 100:75; as far as fat is concerned, the differentiation into fat categories will be omitted.

It is the responsibility of the retailer to distribute the available food supplies in a just and equitable manner. If wheat flour is available, it will be distributed against bread ration points first to the sick who are entitled to it in accordance with the decision of the local medical board, and then to small children. Lard, melted butter or salad oil are to be distributed, if available, against fat ration points at the rate of 100:80.

Food coupons are valid only if attached to the food ration card. The food ration card contains a remark to that effect. My decree of 30 August 1944-II B 1-68 regarding loose coupons of basic and supplementary ration cards is voided.

Appendix

14-16

(Anlagen

14-16

Supplementary cards for long- and night-workers will be eliminated in the future. However, weekly supplementary cards are issued for heavy and very heavy workers, in accordance with the principles established for collective cards. The quantities to be distributed to these two groups are also to be announced publicly. The same applies to the AZ (foreign civilian workers), sample cards of which are included.

Those fed communally receive principally the same rations as normal con-

sumers. Insofar as those communally fed should receive higher or lower rations, adjustments will be made by a special decree.

The issuance of ration cards is simplified on similar lines. The clearing houses have to account for the coupons of the ration cards as to the quantities either printed or announced publicly; for instance, if a loose coupon has been designated for the purchase of bread, it passes as a bread ration point. But in the future, ration cards are to be issued only for flour, fat and Naehrmittel. Further subdivision of these foodstuffs is to be omitted. The retailers, on the basis of these cards, may purchase the required quantities from wholesalers. For the issuance of wholesale ration cards the same principles apply. To the extent that the card distribution centers are authorized to issue wholesale ration cards, they regulate the methods themselves.

The distribution of potatoes will conform with existing regulations. The ration coupons for whole milk and skimmed fresh milk remain valid for the 74th period, with the provision that children up to 6 years receive whole milk and non-self-suppliers over 6 years skimmed fresh milk. The whole milk ration for children up to 6 years has been fixed uniformly at $\frac{1}{2}$ liter daily. To compensate for the smaller quantities given to children under 3 years and the omission of whole milk for children between the ages of 6 and 14 years, increased fat rations will be issued. Order forms for whole milk and skimmed fresh milk are attached to the respective cards. Otherwise, the existing regulations remain valid.

In order to avoid difficulties arising through the transportation of the mats for printing the food ration cards, I desist from producing them uniformly for the Reich. The Provincial Food Offices themselves are directed to print ration cards in accordance with the enclosed samples. The printing must be done in such a manner that the consumers receive the cards in time. Yellow paper (color No. 4) must be used for the collective food cards pertaining to the 74th Ration Period. The existing regulations remain valid for the printing of the other ration cards. Accordingly, Reich bread cards for self-suppliers will be printed on green paper (color No. 30), Reich milling cards on green paper (color No. 30), supplementary cards for heavy and very heavy workers on brown paper (color No. 160), weekly cards for foreign civilian workers on dark yellow paper (color No. 22).

I wish to point out that the rationing system must be maintained to insure equal distribution of food for the entire population. The chiefs of the Provincial Food Offices have been authorized by my circular of January 25, 1945-II/1-4018 g-M 291/45 to print the ration cards in case of emergency in a very simple manner, i.e. on ordinary paper of a different color, and if necessary, without watermarks.

Due to the fact the 72nd and 73rd ration period had been extended to last an additional week, supplementary cards for heavy and very heavy workers as well as AZ cards, were issued only for the second, third and fourth week. Modifying my order of February 1, 1945-II B 1-256, civilian foreign workers are to receive for the 73rd distribution period, in accordance with the mats sent out, four AZ weekly cards which are to last until April 8, 1945.

SECOND PART Final Decisions

The consumers are directed to turn in the order forms No. 74 for whole milk and skimmed fresh milk to the distributors during the week of March 26-31, 1945; if the Food Offices (Ernaehrungsamter) do not limit the date to any one day of this week.

The directives of this decree regarding the distribution for the period from

*Turning in of
coupons.*

Validity.

appendix C-3

April 19, 1945, to April 29, 1945, will be enforced on April 9; the other orders, if nothing else has been decreed, immediately.

It is directed that the Food Offices and card distribution centers be informed immediately by dispatching a copy of this decree. The decree will be published in the "Deutschen Reichsanzeiger." Copies are enclosed.

Charged with the conduct of affairs:

(signed) BACKE

appendix C-3

FOOD STOCKS IN GERMANY DURING THE WAR YEARS

Bread-Grain Balances
for Greater Germany as of 1 Sept. 1939
(in 1000 T grain-value)

Fiscal Year 1.8. - 31.7.	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44
<u>A. Available quantities</u>						
1. <u>Supply</u> at the beginning on 1 Aug.						
Rye incl. flour	1750	3624	3682	1017	632	829
Wheat	1550	2760	2504	966	422	418
Total	3300	6384	6186	1983	1054	1247
2. <u>Harvests</u>						
Rye	9701	9301	7091	8003	6222	8391
Wheat & Spelt	6435	5597	4558	4799	4025	4888
Total	16136	14898	11649	12802	10247	13279
3. <u>Barley for Bread</u>						
From harvest	-	-	-	-	1566	100
4. <u>Imports</u>						
Rye incl. Flour Unmilled	146	344	543	1248	1640	1947
Wheat incl. Flour Unmilled	1016	1126	866	1784	1914	1930
Barley for Bread	-	-	-	-	38	-
Total	1162	1470	1409	3032	3592	3877
1.-4. <u>Total Available</u>						
Rye	11597	13269	11316	10268	8494	11167
Wheat	9001	9483	7928	7549	6361	7236
Barley	-	-	-	-	1604	100
Total	20598	22752	19244	17817	16459	18503
<u>B. Consumption</u>						
	14214	16566	17261	16763	15212	16368
<u>C. Balance as of 31 July</u>						
	6384	6186	1983	1054	1247	2135

Bread-Grain Consumption
(in 1000 T grain-value)

Fiscal Year 1.8. - 31.7.	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44
I. Seed						
Rye	720	733	730	738	713	700
Wheat	430	429	415	427	381	400
Total	1150	1162	1145	1165	1094	1100
2. Food consumption						
a) Bread						
Non self-suppliers	7450	7829	7527	6718	6153	7580 ^{2) 3)}
Self-suppliers	2905	2798	2604	2579	2385	2410
Armed Forces (incl. Naehrmittel)	1)	1132	1785	2238	3070	3220
b) Naehrmittel w/o. Armed Forces	350	459	430	530	438	530
c) Substitute Coffee Rye	50	188	195	121	15	60
a)-c) total						
Rye	5534	6901	7240	7122	6007	7535
Wheat	5221	5505	5301	5073	4507	5645
Barley	-	-	-	-	1547	620
Total	10755	12406	12541	12195	12061	13800
2a)-c) in flour values						
Rye	4300	5380	5830	6200	5660	7080
Wheat	4160	4250	4170	4350	3980	4625
Barley	-	-	-	-	1270	515
Total	8460	9630	10000	10550	10810	12220
Index 1938/39 = 100		114	118	125	125'	145
3. Deficient territories						
	12	308	1200	1305	1002	1115
4. Consumption ⁴⁾						
a) Armed Forces	-	60	-	263	11	-
b) Civilians	2297	2630	2375	1835 ⁴⁾	1044	353 ⁴⁾
1.-4. Total consumption						
Rye	7973	9587	10299	9636	7665	9522
Wheat	6241	6979	6962	7127	5943	6746
Barley	-	-	-	-	1604	100
Total	14214	16566	17261	16763	15212	16368
Balan_{ce} as of 31 July	6384	6186	1983	1054	1247	2135

1) Contained in consumption of Non-self suppliers.

2) Including 450,000 T in exchange for potatoes.

3) Including 50,000 T in exchange for potatoes.

4) Consumption figures are based on official harvest results.

Assuming that by enlarging the hectarage in 1941/42 the rye harvest was higher by some 300/500,000 T; the actual consumption must have been higher by that amount. For 1943/44 one can figure on an increased rye harvest of 600,000 T, and on an increased wheat harvest of 400,000 T, totaling one million T.

Meat Balances
for Greater Germany, as of 1 Sept. 1939
(in 1000 T Dressed Meat)

1. Summary

Fiscal Year 1.9 - 31.8	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44
<u>A. Available Quantities</u>						
1. Supplies at the beginning of the year.	111	24	118	52	100	33
2. Inland returns						
a) industrial	2607	2320	1984	1584	1299	1336
b) house-slaughtering	687	669	601	500	465	432
Total	3294	2989	2585	2084	1764	1768
3. <u>Imports and deliveries of occupied territories.</u>	290	463	544	662	741	673
Total at hand	3695	3476	3247	2798	2605	2474
of which industrial	3008	2807	2464	2298	2140	2042
<u>B. Consumption</u>						
1. Self-suppliers from home slaughtering	687	669	601	500	465	432
2. Non self-suppliers and other civilian needs.	2984	2077	1894	1386	1257	1125 ⁴⁾
3. Armed Forces		589	637	750	802	727 ³⁾
Consumption within Germany	3671	3335	3132	2636	2524	2284
4. <u>Deficient Territories</u>	-	23	63	62	48	35
Total Consumption	3671	3358	3195	2698	2572	2319
<u>C. Stocks at the end of the year</u>						
	24	118	52	100	33	155

- 1) =Dead weight, plus chargeable part of the intestines, minus killing losses, shrinkage and raw fat deliveries.
 2) =Without regard to changes of stocks of self-suppliers.
 3) =Incl. 16,000 T canned which were already delivered for the VI. War Year.
 4) =Of which deliveries to fat economy, issuance of appr. 76,000 T meat in lieu of fat.

Meat Balances
For Greater Germany, as of 1 Sept. 1939
(in 1000 T Meat)

2. Meat Yield from Slaughtering of Domestic Livestock.

Fiscal Year (1.9 - 31.8)	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44
<u>a. Slaughtering of German live stock per 1000 head</u>						
Pigs						
industrial	15014	15132	10265	6957	3670	6073
home-slaughtering	10027	9840	9410	8840	7805	6712
Total Pigs	25041	24972	19675	15797	11475	12785
Cattle	4489	3784	4088	3698	3569	2683
Calves	5654	6001	6356	6512	6276	6239
Total Cattle	10143	9785	10444	10210	9845	8922
Sheep	2257	1641	1706	1320	1167	1189
Horses	168	162	228	164	142	168
<u>b. Average dead-weight in kg per head</u>						
Pigs						
industrial	102	96	95	92	98	96
home-slaughtering	114	113	106	94	99	107
Total Pigs	107	103	100	93	99	
Cattle	252	247	242	231	218	229
Calves	42	39	36	35	33	32
Sheep	24	24	23	23	23	23
Horses	262	258	253	233	229	223
<u>c. Returns from slaughtering of German animals in 1000 T dead-weight</u>						
Pork						
industrial	1529	1253	978	638	358	581
home-slaughtering	1141	1111	998	831	773	716
Total	2670	2564	1976	1469	1131	1297
Beef	1133	933	991	854	779	615
Veal	235	236	229	226	208	203
Mutton	55	38	39	30	27	27
Horsemeat	44	42	58	38	32	37
Total	4137	3813	3293	2617	2177	2179
of which industrial	2996	2702	2295	1786	1404	1464
<u>d. Returns from slaughtering of German animals in 1000 T of dressed meat</u>						
Pork						
industrial	1269	1196	812	530	304	500
home-slaughtering	687	669	601	500	465	432
Total	1956	1865	1413	1030	769	932
Beef	1038	856	908	790	746	589
Veal	220	220	212	211	201	197
Mutton	55	38	39	30	27	27
Horsemeat	15	14	20	13	11	13
Venison	10	10	10	10	10	10
Total	3294	2989 2)	2585 2)	2084	1764	1768
of which industrial	2607	2320 2)	1984 2)	1584	1299	1336

1) Dead-weight, incl. chargeable part of intestines; minus killing losses, shrinkage and raw-fat delivery.

2) September 1939 to May 1941 without horsemeat, since not rationed.

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Fat Balances
of Greater Germany, as of 1 Sept. 1939
(in 1000 T Commercial Fat)

Fiscal Year 1.8 - 31.7	1939/40	1940/41	1941/42	1942/43	1943/44
A. Available Quantities					
1. On hand 1 August					
a) Butter and melted butter as butter fat.	28	82	65	44	96
b) Slaughter fat (as raw fat)	23	42	12	6	18
c) Margarine-raw materials	576	361	244	170	112
Total supplies	627	485	321	220	226
2. <u>German production</u>					
a) Butter	681	686	685	710	682
b) Slaughter fat (as raw fat)	443	374	299	228	241
c) Tallow	30	39	38	36	25
d) Oil harvest as margarine	25	20	110	67	273
e) Meat fat	-	-	-	-	35
Total Domestic Production	1179	1119	1132	1041	1256
3. <u>Imports</u>					
a) Butter	124	121	88	148	139
b) Slaughter fat (as raw fat)	57	26	12	4	1
c) Margarine-raw materials	265	233	159	223	63
Total Imports	446	380	259	375	203
<u>Available quantities total</u>					
a) Butter	833	889	838	902	917
b) Slaughter fat	523	442	323	238	260
c) Margarine	896	653	551	496	473
d) Meat fat	-	-	-	-	35
Total Available	2252	1984	1712	1636	1685
B. Consumption					
a) Butter	751	824	794	806	852
b) Slaughter fat (in raw fat)	481	430	317	220	246
c) Margarine	535	409	381	384	364
d) Meat fat	-	-	-	-	31
Total Consumption	1767	1663	1492	1410	1493

Fat Consumption
(in 1000 T Commercial Fat)

Fiscal Year (1.8 - 31.7)	1939/40	1940/41	1941/42	1942/43	1943/44
1. <u>Civilian Population</u> on cards and ration coupons					
a) Butter	546	585	513	488	528
b) Margarine	355	287	287	243	211
c) Slaughter fat (as raw fat)	191	148	85	29	51
d) Meat fat	-	-	-	-	16
Civilian Population Total	1092	1020	855	760	806
2. <u>Self-Suppliers</u>					
a) Butter	158	163	160	160	157
b) Slaughter Fat (as raw fat)	255	245	209	184	177
Self-Suppliers Total	413	408	369	344	334
3. <u>Armed Forces</u>					
a) Butter	40	63	95	136	134
b) Margarine	29	21	33	44	59
c) Slaughter Fat (as raw fat)	35	35	21	6	14
d) Meat fat	-	-	-	-	9
Armed Forces Total	104	119	149	186	216
4. <u>Deficient Territories</u>					
a) Butter	7	13	26	22	22
b) Margarine	29	56	61	67	56
c) Slaughter fat	-	2	2	1	1
d) Meat fat	-	-	-	-	6
Deficient Territories Total	36	71	89	90	85
5. <u>Technical Sector</u>					
Margarine-Raw Materials	122	45	-	30	33
6. <u>Loss through enemy action</u>					
	-	-	-	- ²⁾	19
7. <u>Total Consumption</u>					
a) Butter	751	824	794	806	852
b) Margarine	535	409	381	384	364
c) Slaughter fat (as raw fat)	481	430	317	220	246
d) Meat fat	-	-	-	-	31
Total Consumption Total	1767	1663	1492	1410	1493
Index	100	94	84	80	84
Total Consumption ¹⁾ of Food in Reich	1609	1547	1403	1290	1356
Index	100	96	87	80	85

- 1) Less subsidy territories and 5. Technical Sector
2) Contained in civilian consumption.

appendix C-3

Potato-Balance
of Greater Germany as of 1 Sept. 1939
(in 1000 T)

Fiscal Year 1.7 - 30.6.	1938/39	1939/40	1940/41	1941/42	1942/43	1943/44
A. Available quantities						
1. Harvests	55983	56273	57447	47690	54423	29500
1a. Estimated increased harvests	-	-	-	-	-	3000
2. Imports						
a) of the Reich	136	514	475	596	1300	750
b) of the Armed Forces from occupied territories	-	-	422	1310	2320	1970
Total available quantity	56119	56787	58344	49596	58043	45220
Index 1938/39 = 100	100	101	104	88	103	81
B. Consumption						
1. Shrinkage	4800	6600	5700	4800	4350	3400
2. Seed	7000	6900	6800	6800	7000	6800
3. Potatoes (for eating)	14000	16000	19422	21310	26320	22470
Index 1938/39 = 100	100	114	140	152	188	157
of which a) self-suppliers	7000	8000	9000	9500	9500	8000
b) non self-suppliers	7000	7250	8700	9300	13000 ¹⁾	10700
c) Armed Forces total						
of which	-	-	1722	2610	3820	3770
c1) Armed Forces in Reich	-	750	1300	1300	1500	1800
c2) Armed Forces in occupied terri- tories	-	750	422	1310	2320	1970
4. Distilleries	2416	2044	1949	994	1150	400
5. Starch-industry	1576	1400	1200	1000	1350	430
6. Drying-industry	978	655	905	625	1215	225
7. Fruit-starch & baking powder	100	100	100	100	100	20
8. Deliveries to deficient terri- tories	28	16	680	538	1227	524
Total consumption	30898	33715	36756	36167	42712	34269
C. Fodder						
1. Fresh potatoes (Remnant)	25221	23072	21588	13429	15331	10951
2. Potato-flakes (Raw potato-value 1:4)	922	560	500	200	500	160
Fodder total (Raw potato value)	26143	23632	22088	13629	15831	11111
Number of pigs (Sept.)	26200	29034	25114	22229	18142	18561
T potatoes per pig	1.0	0.81	0.88	0.62	0.86	0.60

- 1) Probably including considerable quantities for smaller animals.
2) Without dehydrated potatoes, which are contained in eating-potatoes.

Sugar-Balances
of Greater Germany as of 1 Sept. 1939
(in 1000 T)

Fiscal Year 1.10.-30.9.	1939/40	1940/41	1941/42	1942/43	1943/44
A. Available quantities					
1. on hand 1 Oct.	162	202	214	96	265
2. German production	2051	2061	1778	2022	1900
3. Imports	287	389	443	572	390
Total Stock	2500	2652	2435	2690	2555
B. Consumption					
1. Sugar for civilian consumption	1166	911	969	939	915
2. Jam	100	205	200	197	205
3. Sugar for Armed Forces	175	160	200	209	220
Edible Sugar Total	1441	1266	1369	1369	1340
4. Industrial consumption					
a) Civilian	504	584	474	542	492
b) Armed Forces	140 1)	140 1)	150 1)	170	160
5. Glycerine (Armed Forces)	5	5	5	12	20
6. Sugar for preserves	36	74	-	72	36
7. Christmas Supplement	-	10	-	18	18
8. Cultivation premiums	-	6	6	7	7
9. Exports	152	328	317	213	217
10. Losses (ca 1%)	20	20	18	20	18
11. Losses by bombing	-	-	-	26	78 2)
Total consumption	2298	2438	2339	2425	2386
of which in Reich territory (without exports)	2146	2110	2022	2212	2169
Index 1939/40 = 100	100	98	94	103	
C. Balance on 30 Sept.	202	214	96	265	169

1) = estimated.

2) = inc. Führerpaketaktion (5) and additional untraceable consumption.

appendix C-3

Industrial Sugar Consumption

(in 1000 T)

Fiscal Year (1.10 - 30.9)	1939/40	1940/41	1941/42	1942/43	1943/44
1. Sugar Goods					
of which:					
civilian needs	-	-	114	109	61
Armed Forces	-	-	76	119	113
artificial honey (civ.)	-	-	39	39	39
Total	253	269	229	267	213
2. Horticulture	183	221	210	228	241
3. Brewing industry	10	18	28	56	51
4. Bee sugar	34	39	23	30	33
5. Viticulture	41	24	42	26	27
6. Milk and fat economy	14	8	12	13	20
7. Fish	0	0	0	0	0
8. Distilleries	8	13	7	5	3
9. German Apothecaries Assn.	3	3	3	3	3
10. Bread industry	3	4	3	4	3
11. Specialist Groups, Physical Hygiene, Chemistry, Optics	1	1	1	1	1
12. Naehrmittel industry	8	8	9	10	10
13. Meat industry	1	1	1	1	1
14. Tobacco industry	4	5	4	5	3
15. Pharmaceuticals	8	8	9	9	9
16. Confectioners	14	22	16	18	14
17. Bakers	51	75	40	45	33
18. Inns	25	30	14	20	10
19. All others	30	30	20	25	25
Consumption incl. incorporated Eastern and Western territories	691	779	671	766	701
7% for Eastern and Western territories	48	55	47	54	50
Consumption in Reich territory as of 1 Sept. 1939	644	724	624	712	652
of which: Civilian	504	584	474	542	492
Armed Forces	140 ¹⁾	140 ¹⁾	150 ¹⁾	170	160

1) estimated.

DAILY ALLOWANCES OF RATIONED FOODS IN GERMANY FROM 1939 TO 1945

1. Ration Period from 3/28 - 9/24, 1939
Daily Allowance in Grams

	Children								
	Very Heavy Workers	Heavy Workers	Long and night Workers	Normal Consumers	Adolescents 11-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread = flour	Same as in peace-times								
Flour supplement for southern Germany	-								
Mehrmittel	21.4	21.4	-	21.4	21.4	21.4	21.4	21.4	21.4
Sugar	40	40	-	40	40	40	40	40	40
Jam	16	16	-	16	16	16	16	16	16
Artificial Honey	-	-	-	-	-	-	-	-	-
Meat - products	170	100	-	100	100	100	100	100	100
Fats - total	98.6	48.6	-	48.6	48.6	48.6	48.6	48.6	48.6
of which butter	12.9	12.9	-	12.9	12.9	12.9	12.9	12.9	12.9
Margarine	42.9	17.9	-	17.9	17.9	17.9	17.9	17.9	17.9
slaughter-fats	42.9	17.9	-	17.9	17.9	17.9	17.9	17.9	17.9
Whole milk (kgal)	200	200	-	200	200	200	200	200	200
Cheese	11.4	11.4	-	11.4	11.4	11.4	11.4	11.4	11.4
or Quarg	22.9	22.9	-	22.9	22.9	22.9	22.9	22.9	22.9
Coffee substitute	9	9	-	9	9	9	9	9	9
Cocoa mix powder	-	-	-	-	-	-	-	-	-
Eggs	-	-	-	-	-	-	-	-	-

Nutritional Content of the Daily Consumption including Ration-Free Foods

Physiological Norm									
Total Calories	4500	3600	-	-	-	-	-	-	-
Grams protein	112	97	-	-	-	-	-	-	-
Grams fat	152	99	-	-	-	-	-	-	-

10. Ration Period from 5/6 - 6/2, 1940
Daily Allowance in Grams

	Children								
	Very Heavy Workers	Heavy Workers	Long and night Workers	Normal Consumers	Adolescents 11-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread = flour	Same as in peace-times								
Flour supplement for southern Germany	-								
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	39.2	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam	21.4	21.4	21.4	21.4	21.4	28.5	28.5	21.4	21.4
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	171.4	142.9	85.7	71.4	71.4	71.4	71.4	35.7	35.7
Fats - total	105.3	56.2	41.2	38.4	38.4	37.1	37.1	26.8	17.9
of which butter	20.5	20.5	-	20.5	26.0	26.0	26.0	26.8	17.9
butter or Margarine	-	-	31.5	-	-	-	-	-	-
Margarine	29.0	20.1	-	11.2	11.2	11.1	11.1	-	-
slaughter-fat	55.8	15.6	-	-	-	-	-	-	-
Lard	-	-	6.7	6.7	6.7	-	-	-	-
Whole milk (kgal)	-	-	-	-	-	250	250	500	750
Cheese	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
or Quarg	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9
Coffee Substitute	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4

Nutritional Content of the Daily Consumption including Ration-Free Foods

Physiological Norm									
Total Calories	4168	3416	2610	2347	2347	2342	2091	1701	1795
Grams protein	113.2	94.5	69.2	61.1	61.1	63.9	56.7	49.3	57.9
Grams fat	107.4	67.4	59.7	44.5	44.5	52.5	51.4	46.8	47.6
Physiological Norm									
Total Calories	4500	3600	-	2400	2400	2050	1750	1400	1200
Grams protein	112	97	-	64	64	56	49	41	38
Grams fat	152	99	-	67	67	56	50	50	47
Difference from Norm	-332	-186	-	-53	-53	292	341	301	595
Total Calories	1.2	-2.5	-	-2.9	-2.9	7.9	7.7	8.3	19.9
Grams fat	-44.6	-31.6	-	-22.5	-22.5	-3.5	1.4	-3.2	0.6
Total % of Norm									
Total Calories	93%	95%	-	98%	98%	114%	119%	121%	150%
Protein	101%	98%	-	95%	95%	111%	115%	120%	152%
Fat	71%	68%	-	66%	66%	94%	103%	94%	101%

5. Ration Period from 12/18/1939 - 1/14/1940
Daily Allowance in Grams

	Children								
	Very Heavy Workers	Heavy Workers	Long and night Workers	Normal Consumers	Adolescents 11-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread = flour	Same as in peace-times								
Flour Supplement for southern Germany	-								
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	39.2	39.3
Sugar	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7	35.7
Jam	14.3	14.3	14.3	14.3	14.3	21.4	21.4	14.3	14.3
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	175.9	147.3	90.2	75.9	75.9	75.9	75.9	40.2	40.2
Fats - total	105.3	56.3	41.2	38.4	38.4	37.0	37.0	26.8	17.9
of which butter	20.5	20.5	-	20.5	20.5	25.9	25.9	26.8	17.9
Margarine	29.1	20.2	-	11.1	11.1	11.1	11.1	-	-
slaughter-fats	55.7	15.5	-	6.6	6.6	-	-	-	-
Whole milk (kgal)	-	-	-	-	-	250	250	500	750
Cheese	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
or Quarg	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
Coffee Substitute	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Cocoa mix powder	-	-	-	-	-	4.5	4.5	4.5	4.5
Eggs	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9

Nutritional Content of the Daily Consumption including Ration-Free Foods

Physiological Norm									
Total Calories	4216	3422	2587	2343	2343	2330	2078	1689	1783
Grams protein	108.8	92.9	66.8	60.0	60.0	63.4	56.2	48.8	57.5
Grams fat	122.6	71.7	51.2	46.5	46.5	52.5	51.4	46.8	47.6
Physiological Norm									
Total Calories	4500	3600	-	2400	2400	2050	1750	1400	1200
Grams protein	112	97	-	64	64	56	49	41	38
Grams fat	152	99	-	67	67	56	50	50	47
Difference from Norm	-284	-178	-	-57	-57	280	328	289	583
Total Calories	-284	-178	-	-4.0	-4.0	7.4	7.2	7.8	19.5
Total protein	-3.2	-4.1	-	-20.5	-20.5	-3.5	1.4	-3.2	0.6
Total fat	-29.4	-27.3	-	-	-	-	-	-	-
Total % of Norm									
Calories	94%	95%	-	98%	98%	114%	119%	121%	150%
Protein	97%	95%	-	94%	94%	113%	115%	119%	151%
Fat	81%	72%	-	69%	69%	94%	103%	94%	101%

15. Ration Period from 9/23 - 10/20, 1940
Daily Allowance in Grams

	Children								
	Very Heavy Workers	Heavy Workers	Long and night Workers	Normal Consumers	Adolescents 11-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread = flour	Same as in peace-times								
Flour supplement for southern Germany	-								
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	39.3	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam	21.4	21.4	21.4	21.4	21.4	28.5	28.5	21.4	21.4
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	171.4	142.9	85.7	71.4	71.4	71.4	71.4	35.7	35.7
Fats - total	105.5	56.3	41.3	38.5	38.5	37.9	37.9	26.8	17.9
of which butter	25.1	25.1	-	25.1	25.1	26.8	26.8	26.8	17.9
butter or Margarine	49.7	40.7	-	31.8	31.8	37.9	37.9	26.8	17.9
Margarine	-	-	9.5	-	-	-	-	-	-
slaughter-fat	-	-	6.7	-	-	-	-	-	-
Lard	55.8	15.6	-	6.7	6.7	-	-	-	-
Whole milk (kgal)	-	-	-	-	-	250	250	500	750
Cheese	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
Coffee Substitute	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8

Nutritional Content of the Daily Consumption including Ration-Free Foods

Physiological Norm									
Total Calories	4118	3365	2539	2296	2351	-	2097	1704	1797
Grams protein	112.0	95.2	66.5	59.8	62.2	-	57.1	49.9	58.0
Grams fat	107.4	67.4	49.2	44.5	44.3	-	51.6	46.9	47.8
Physiological Norm									
Total Calories	4500	3600	-	2400	-	-	1750	1400	1200
Grams protein	112	97	-	64	-	-	49	41	38
Grams fat	152	99	-	67	-	-	50	50	47
Difference from Norm	-382	-235	-	-104	-	-	-34.7	-303	597
Total Calories	0.0	-3.8	-	-4.2	-	-	8.6	8.9	20.5
Grams fat	-44.6	-31.6	-	-22.5	-	-	-1.5	-3.1	0.8
Total % of Norm									
Total Calories	92%	94%	-	95%	-	-	113%	122%	150%
Protein	100%	98%	-	93%	-	-	116%	120%	156%
Fat	71%	67%	-	66%	-	-	103%	94%	102%

appendix C-4

20. Ration Period from 2/10 - 3/9, 1941

Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Bread ¹⁾ = flour	654.3	521.4	407.1	321.4	371.4	371.4	282.9	157.1	157.1
Flour Supplement for Southern Germany	26.8	26.8	26.8	26.8	26.8	-	26.8	26.8	26.8
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	39.3	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat, -products	171.4	142.9	85.7	71.4	71.4	71.4	71.4	35.7	35.7
Total fats	105.5	56.3	41.3	38.5	42.9	37.9	37.9	26.8	17.9
of which butter	20.1	20.1	20.1	20.1	20.1	26.8	26.8	26.8	17.9
Margarine	29.6	20.5	14.5	11.7	16.1	11.1	11.1	-	-
Slaughter fat	55.8	15.6	6.7	6.7	6.7	-	-	-	-
Whole milk (kg ⁻¹)	-	-	-	-	-	250	250	500	750
Cheese	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Nutritional Value of the Daily Consumption Including Ration Free Foods									
Total calories	4120	3367	2511	2298	2391	2557	2099	1705	1799
Grams protein	111.4	92.6	65.9	59.2	61.8	72.3	56.5	48.8	57.4
Grams fat	106.8	66.8	48.6	43.9	47.9	54.9	51.0	45.4	47.2
Physiological Norms									
Total calories	4500	3600		2400		2050	1750	1460	1300
Grams protein	112	97		64		56	49	44	38
Grams fat	152	99		67		56	50	50	47
Difference from Norm									
Total calories	-380	-233		102		349	305	599	
Grams protein	-0.6	-4.4		-4.8		7.5	7.8	18.4	
Grams fat	-45.2	-32.2		-23.1		1.0	-3.6	0.2	
Total % of Norm									
Total Calories	91%	94%		96%		125%	120%	122%	150%
protein	99%	96%		93%		129%	115%	119%	151%
fat	70%	67%		66%		98%	102%	93%	100%

35. Ration Period from 6.4. - 3.5.1942

Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Bread ¹⁾ = flour	628.6	485.7	371.4	285.7	371.4 ²⁾	371.4	282.9	171.2	128.2
Flour supplement for Southern Germany	470.2	364.3	278.5	214.3	278.5	278.5	182.1	128.5	96.3
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat, -products	121.4	85.7	64.3	42.8	50.0	50.0	50.0	21.4	21.4
Total fats	82.2	43.8	32.4	29.6	38.4	37.9	37.9	26.8	17.9
of which butter	17.9	17.9	17.9	17.9	22.3	29.0	29.0	26.8	17.9
Margarine	26.4	14.7	12.2	9.4	13.8	8.9	8.9	-	-
Slaughter fat	37.9	11.2	2.3	2.3	2.3	-	-	-	-
Whole milk (kg ⁻¹)	-	-	-	-	-	250	250	500	750
Cheese	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Potatoes	357.1	357.1	357.1	357.1	357.1	357.1	357.1	357.1	357.1
Nutritional Content									
Total calories	3061	2329	1912	1635	1929	2062	1740	1576	1562
Grams fat	94.7	55.4	41.4	35.3	44.2	49.6	48.5	41.7	40.6
Grams protein	77.6	62.3	51.5	42.0	49.4	53.8	45.0	44.0	51.1
of which animal	27.3	21.8	18.6	15.5	16.6	20.5	20.5	25.2	22.8
Grams carbohydrate	453.3	379.2	319.7	275.1	320.1	335.3	271.5	243.7	241.1
Total Available									
Total calories	3542	2775	2342	2052	2428	2507	2178	1959	1958
Grams fat	105.9	63.6	48.6	42.5	52.6	57.8	56.6	49.0	47.7
Grams protein	89.9	74.3	63.2	53.3	61.4	64.8	55.8	53.6	61.1
of which animal	33.6	27.8	24.5	21.2	22.4	26.3	26.3	30.8	39.1
Grams carbohydrate	533.5	457.9	393.5	350.3	412.7	416.2	350.9	313.6	310.8

¹⁾ See Vierwochensätze

²⁾ pregnant and lactating women, post-partum patients and special professions receive 500 g whole milk, sick persons up to 750 g whole milk.

30. Ration Period from 17.11. - 14.12.1941

Daily Allowances in grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children		
						6-14 yrs.	3-6 yrs.	0-3 yrs.
Bread ²⁾ = flour	664.3	521.4	407.1	321.4	371.4	212.9 ³⁾	157.1	157.1
Flour supplement for Southern Germany	496.9	391.1	305.4	241.1	278.5	182.1	-	-
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	39.3	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Artificial honey	-	-	-	-	-	4.5	4.5	4.5
Meat, -products	142.9	114.3	85.7	57.1	57.1	57.1	57.1	35.7
Total fats ⁴⁾	105.4	56.2	41.2	38.4	42.8	37.9	37.9	26.8
of which butter	17.9	17.9	17.9	17.9	22.3	26.8	26.8	17.9
Margarine	33.9	24.9	18.8	16.0	16.0	11.1	-	-
Slaughter fat	53.6	13.4	4.5	4.5	4.5	-	-	-
Whole milk (kg ⁻¹) ⁵⁾	-	-	-	-	-	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Cocoa Mix Powder	-	-	-	-	-	2.2	2.2	2.2
Eggs	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Nutritional Value of the Daily Consumption.								
I. Rations								
Total-calories	3018	2271	1830	1548	1710	1512	1384	1476
Grams-protein	83.6	65.3	51.7	41.1	45.3	40.1	40.4	48.8
Grams-fat	104.2	64.2	48.7	42.7	47.0	49.9	46.3	46.9
II. Total-consumption								
Total-calories	4023	3276	2835	2319	2640	2126	1859	1921
Grams-protein	109.4	91.1	77.5	61.7	69.7	57.2	50.0	58.4
Grams-fat	106.0	66.0	50.5	44.5	48.8	51.7	47.0	47.4

^{1) - 4)} see Vierwochensätze.

⁵⁾ pregnant and lactating women, post-partum patients and special professions receive 500 g whole milk, sick persons up to 750 g whole milk.

25. Ration Period from 30.6. - 27.7.1941

Daily Allowances in grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children		
						6-14 yrs.	3-6 yrs.	0-3 yrs.
Bread ²⁾ = flour	664.3	521.4	407.1	321.4	371.4	212.9 ³⁾	157.1	157.1
Flour supplement for Southern Germany	496.9	391.1	305.4	241.1	278.5	182.1	-	-
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	39.3	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
Artificial honey	-	-	-	-	-	4.5	4.5	4.5
Meat, -products	142.9	114.3	85.7	57.1	57.1	57.1	57.1	35.7
Total fats ⁵⁾	105.4	56.2	41.2	38.4	42.8	37.9	37.9	26.8
of which butter	17.9	17.9	17.9	17.9	22.3	26.8	26.8	17.9
Margarine	29.5	20.5	14.4	11.6	13.8	8.9	-	-
Slaughter fat	53.6	13.4	4.5	4.5	4.5	-	-	-
Whole Milk (kg ⁻¹) ⁶⁾	-	-	-	-	-	250	500	750
Cheese ⁷⁾	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee Substitute	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2
Eggs	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7
Nutritional Value of the Daily Consumption								
I. Rations								
Total-calories	3099	2352	1911	1629	1790	1593	1465	1557
Grams-protein	85.9	66.6	54.0	43.4	47.6	42.3	42.7	51.1
Grams-fat	105.6	65.6	49.9	44.1	48.4	51.3	47.7	48.3
II. Total-consumption								
Total-calories	4104	3357	2916	2400	2728	2207	1940	2002
Grams-protein	111.7	92.4	79.8	64.0	72.0	59.4	52.3	60.7
Grams-fat	107.4	67.4	51.7	45.9	50.2	53.1	48.5	49.0

Notes: 1-7 see Vierwochensätze.

40. Ration Period from 24/8 - 20/10, 1942
Daily Allowances in Grams.

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread ¹⁾ = flour	623.8 470.2	485.7 361.3	371.4 278.5	257.7 211.3	371.4 ²⁾ 278.5	371.4 278.5	242.9 182.1	171.2 123.5	128.2 96.3
Mehrwertmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	42.3	50.0	50.0	50.0	21.4	21.4
Total fats of which Butter	82.2 17.9	43.8 17.9	32.4 17.9	29.5 17.9	38.4 22.3	37.9 25.8	37.9 26.8	25.8 26.8	17.9 17.9
Margarine	28.6	17.0	14.5	11.6	16.1	11.1	11.1	-	-
Slaughter fat	35.7	8.9	-	-	-	-	-	-	-
Whole milk (KG-1) ³⁾	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	11.2	11.2	11.2	11.2	11.2	11.2	11.2	-	-
Cocoa mix powder	-	-	-	-	-	-	2.2	2.2	2.2
Eggs	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9
Potatoes	612.9	612.9	612.9	612.9	612.9	612.9	612.9	612.9	612.9

Nutritional Content

Ration	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Total calories	3268	2536	2119	1842	2135	2272	1990	1755	1792
Grams fat	94.4	54.9	40.8	34.8	43.5	49.4	48.3	41.4	49.3
Grams protein	82.9	67.6	56.8	47.8	64.7	59.3	50.3	49.3	66.0
of which animal	28.0	22.4	17.0	16.1	17.2	21.1	21.1	25.6	34.1
Grams carbohydrate	499.6	425.5	366.1	321.4	356.4	351.5	317.7	290.0	287.7
Total available	3621	2854	2421	2131	2506	2637	2308	2130	2129
Grams fat	105.6	63.1	48.6	41.8	51.9	57.6	56.4	49.7	57.1
Grams protein	92.5	76.9	65.8	56.4	74.0	67.4	59.4	58.1	65.5
of which animal	34.3	28.3	22.9	22.9	26.9	26.9	26.9	31.2	39.7
Grams carbohydrate	532.1	467.5	415.8	368.9	431.3	428.2	379.9	357.5	358.7

Notes: 1.) See Vierwochensätze

2.) See Vierwochensätze

3.) Pregnant and lactating women, post-partum patients and special professions receive 500g whole milk, sick persons up to 750 g whole milk.

45. Ration Period from 11.1. - 7.2.1943
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread ¹⁾ = flour	661.3 496.9	521.4 391.1	407.1 305.4	321.4 241.1	371.4 ²⁾ 278.5	371.4 278.5	242.9 182.1	171.2 123.5	128.2 96.3
Mehrwertmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	135.7	100.0	78.6	50.0	57.1	57.1	57.1	28.6	28.6
Total fats of which butter	82.2 17.9	43.8 17.9	32.4 17.9	29.5 17.9	38.4 22.3	37.9 25.8	37.9 26.8	25.8 26.8	17.9 17.9
Butter fat ²⁾	4.5	4.5	4.5	4.5	4.5	4.5	4.5	-	-
Margarine	28.1	12.5	10.0	7.2	11.6	11.6	11.6	-	-
Slaughter fat	35.7	8.9	-	-	-	-	-	-	-
Whole milk (kg-1) ³⁾	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	-
Cocoa mix powder	-	-	-	-	-	-	2.2	2.2	2.2
Eggs	-	-	-	-	-	-	-	-	-
Potatoes	571.4	571.4	571.4	571.4	571.4	571.4	571.4	571.4	571.4

Nutritional Content

Ration	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Total calories	3351	2615	2191	1905	2114	2250	1920	1765	1844
Grams fat	95.4	56.0	41.9	35.0	43.4	49.1	48.0	41.1	49.2
Grams protein	85.8	70.4	59.6	49.6	64.2	59.6	49.8	49.7	59.3
of which animal	27.1	21.3	18.4	14.4	15.4	19.4	19.3	23.7	32.2
Grams carbohydrate	514.2	439.9	380.6	345.9	372.3	377.5	315.3	286.1	290.8
Total available	3704	2933	2493	2198	2485	2615	2285	2109	2181
Grams fat	106.6	64.2	49.1	42.0	51.8	57.3	56.1	48.4	47.0
Grams protein	95.4	79.7	68.6	58.3	83.5	67.9	58.9	57.5	67.1
of which animal	34.3	27.3	24.3	20.1	21.2	25.2	25.1	29.3	37.8
Grams carbohydrate	566.7	490.9	430.3	391.4	437.2	441.3	376.0	347.6	359.8

1, 2, 3) See Vierwochensätze.

3) Pregnant and lactating women, post-partum patients and special professions receive 500 g whole milk, sick persons up to 750 g whole milk.

57. Ration Period from 13/12, 1943- 9/1, 1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread ¹⁾ = flour	587.3 516.9	505.4 409.8	405.4 334.8	306.4 259.8	397.4 ²⁾ 297.2	397.4 297.2	257.7 182.1	182.1 136.6	128.2 96.3
Mehrwertmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats of which butter	84.0 17.9	45.5 17.9	34.2 17.9	31.4 17.9	40.2 24.5	39.7 26.3	39.7 26.3	28.6 26.3	19.7 19.7
Butter-fat ²⁾	4.1	4.1	4.1	4.1	4.1	4.1	4.1	-	-
Margarine	24.1	12.5	10.0	7.2	11.6	11.6	11.6	-	-
oil ³⁾	2.2	2.2	2.2	2.2	4.5	-	-	-	-
Slaughter fat	35.7	8.9	-	-	-	-	-	-	-
Whole milk ³⁾ (KG-1)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	-
Cocoa mix powder ⁷⁾	-	-	-	-	-	-	2.2	2.2	2.2
Eggs	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Potatoes ⁶⁾	595	595	595	595	595	595	595	595	595

Nutritional Content

Ration	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Total calories	3513	2778	2394	2071	2295	2431	2155	1916	2025
Grams fat	98.9	59.5	45.5	38.5	47.0	52.6	51.6	44.8	43.9
Grams protein	85.4	70.1	61.0	49.3	53.7	58.1	50.6	48.4	58.0
of which animal	25.3	19.8	16.6	12.5	13.5	17.4	17.4	21.8	30.0
Grams carbohydrate	518.4	473.7	421.8	373.3	400.7	415.9	358.4	323.1	337.7
Total available	3866	3096	2596	2360	2666	2795	2513	2290	2362
Grams fat	110.1	67.7	52.8	45.5	55.4	60.8	59.7	52.1	50.7
Grams protein	95.0	79.4	70.0	58.0	63.0	67.4	59.7	57.2	66.8
of which animal	31.6	25.8	22.5	18.2	19.3	23.2	21.2	24.7	35.9
Grams carbohydrate	600.9	524.7	471.5	417.8	465.6	479.6	410.6	385.6	398.7

1) 2, 4, 7. See Vierwochensätze.

3) Pregnant and lactating women, post-partum patients and special professions receive 500 g whole milk, sick persons up to 750 g whole milk.

50. Ration Period from 31.5. - 27.6.1943
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread ¹⁾ = flour	675.0 506.2	532.1 399.1	417.8 313.4	332.1 249.1	382.1 286.5	382.1 286.5	257.6 182.1	181.9 136.6	167.8 125.9
Mehrwertmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats of which butter	84.0 17.9	45.5 17.9	34.2 17.9	31.4 17.9	40.2 24.5	39.7 26.3	39.7 26.3	28.6 26.3	19.7 19.7
Butter-fat ²⁾	4.5	4.5	4.5	4.5	4.5	4.5	4.5	-	-
Margarine	24.1	12.5	10.0	7.2	11.6	11.6	11.6	-	-
Slaughter fat	35.7	8.9	-	-	-	-	-	-	-
Whole milk (kg-1)	-	-	-	-	-				

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58. Ration Period from 10/1 - 6/2, 1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 11-18	Children			
						Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Bread 1) = flour	689.3 516.9	516.4 409.8	416.4 334.8	316.4 259.8	316.4 297.2	396.4 297.2	285.7 216.2	196.2 147.2	182.1 136.6
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat, - products	130.3	94.6	73.2	44.6	51.8	42.9	42.9	14.3	14.3
Total fats of which butter margarine oil slaughter fat	79.9 17.9 21.1 2.2 35.7	41.4 17.9 12.5 2.2 8.8	36.1 17.9 10.7 2.2 8.8	27.3 17.9 7.2 2.2 4.5	36.1 17.9 7.2 2.2 4.5	39.7 25.3 13.4 -	39.7 25.3 13.4 -	28.6 28.6 19.7 -	19.7 19.7 15.2 -
Whole milk (kg-1)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	-	-	-	-	-	-	-	-	-
Potatoes	500	500	500	500	500	500	500	500	500

Nutritional Content

Ration	3291	2595	2172	1849	2093	2190	1922	1713	1792
Total calories	3291	2595	2172	1849	2093	2190	1922	1713	1792
Grams fat	92.1	53.7	39.8	32.7	43.2	44.4	37.4	10.5	39.7
Grams protein	82.9	67.6	58.5	46.8	51.1	54.4	46.9	14.7	54.3
of which animal	26.2	20.7	17.2	13.4	14.4	17.0	14.4	21.6	30.1
Grams carbohydrate	507.8	433.1	381.2	389.7	335.2	370.4	312.9	277.6	292.2
Total available	3644	2874	2474	2138	2424	2563	2280	2047	2129
Total calories	3644	2874	2474	2138	2424	2563	2280	2047	2129
Grams fat	104.3	161.9	147.0	119.7	149.6	92.6	55.5	17.9	46.5
Grams protein	92.5	76.9	67.9	67.5	55.5	60.4	56.0	53.5	63.1
of which animal	32.5	26.7	23.5	19.1	20.2	22.8	23.2	27.2	32.7
Grams carbohydrate	560.3	484.1	430.9	337.2	420.1	434.1	375.1	339.1	353.2

1) 2, 3, 7, See Vierwochenratte.
3) pregnant and lactating women, post-partum patients and special professions receive 500 g whole milk, sick persons up to 750 g whole milk.

59. Ration Period from 7.2 - 5.3.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Bread = flour	689.3 516.9	516.4 409.8	416.4 334.8	316.4 259.8	316.4 297.2	396.4 297.2	285.7 216.2	196.2 147.2	182.1 136.6
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat products	130.3	94.6	73.2	44.6	51.8	42.9	42.9	14.3	14.3
Total fats 5) of which butter Butter fat Margarine Oil slaughter fat	79.9 17.9 21.1 2.2 40.2	41.4 17.9 13.4 2.2 13.3	36.1 17.9 13.4 2.2 13.4	27.3 17.9 13.4 2.2 4.5	36.1 17.9 13.4 2.2 4.5	39.7 25.3 13.4 -	39.7 25.3 13.4 -	28.6 28.6 19.7 -	19.7 19.7 15.2 -
Whole milk 3) (kg-1)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Potatoes 6)	500	500	500	500	500	500	500	500	500

Nutritional Content

Rations	3302	2567	2183	1860	2064	2204	1928	1729	1798
Total calories	3302	2567	2183	1860	2064	2204	1928	1729	1798
Grams fat	94.3	54.9	41.0	33.9	42.4	43.7	47.7	16.9	40.0
of which animal	26.5	21.0	17.8	13.7	14.7	17.6	17.6	21.9	30.4
Grams carbohydrate	507.3	433.0	381.1	329.6	355.1	370.4	312.9	277.5	292.1
Total available	3655	2885	2485	2149	2435	2569	2286	2073	2135
Total calories	3655	2885	2485	2149	2435	2569	2286	2073	2135
Grams fat	109.5	63.1	48.2	40.9	50.8	56.9	55.8	48.2	46.8
of which animal	32.8	27.0	23.7	19.4	20.5	23.4	23.4	27.5	36.0
Grams carbohydrate	560.2	484.0	430.8	377.1	420.0	434.1	375.1	339.0	353.1

Notes: 1, 2, 3, 4 and 7) See Vierwochenratte.
3) pregnant and lactating women, post-partum patients and special professions receive 500 g whole milk, sick persons up to 750 g whole milk.

60. Ration Period from 6.3 - 2.4.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Bread = flour	689.3 516.9	516.4 409.8	416.4 334.8	316.4 259.8	316.4 297.2	396.4 297.2	285.7 216.2	196.2 147.2	182.1 136.6
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	14.3	14.3	
Total fats of which Butter 5) Butter fat Margarine Oil slaughter fat	84.0 15.7 6.7 21.5 2.2 40.2	45.6 15.7 6.7 9.9 2.2 13.4	34.2 13.4 6.7 7.4 2.2 13.4	31.4 13.4 6.7 7.4 2.2 13.4	31.4 13.4 6.7 7.4 2.2 13.4	39.7 21.8 4.5 13.4 -	39.7 21.8 4.5 13.4 -	28.6 28.6 19.7 -	19.7 19.7 15.2 -
Whole Milk (kg-1) 3)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-
Cocoa mix powder	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8
Potatoes 6)	500	500	500	500	500	500	500	500	500

Nutritional Content

Rations	3333	2595	2212	1996	2091	2222	1944	1734	1909
Total calories	3333	2595	2212	1996	2091	2222	1944	1734	1909
Grams fat	95.8	56.6	43.0	35.9	44.3	49.5	48.7	14.8	41.1
of which animal	26.2	20.8	17.7	13.6	14.7	16.5	16.5	22.9	31.3
Total available	3686	2913	2514	2285	2462	2587	2302	2078	2146
Total calories	3686	2913	2514	2285	2462	2587	2302	2078	2146
Grams fat	107.0	64.8	50.2	42.9	52.7	57.7	56.8	19.1	47.9
of which animal	32.5	26.8	23.6	19.3	20.5	24.3	24.3	26.5	31.9

61. Ration Period from 3 - 30.4.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
Bread 1) = flour	589.3 516.9	516.4 409.8	416.4 334.8	316.4 259.8	316.4 297.2	396.4 297.2	285.7 216.2	196.2 147.2	182.1 136.6
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat, -products	121.4	85.7	64.3	35.7	42.9	42.9	14.3	14.3	
Total fats of which butter 5) Butter fat Margarine Oil slaughter fat	84.0 15.7 6.7 21.5 2.2 38.0	45.6 15.7 6.7 9.9 2.2 11.2	34.2 13.4 6.7 7.4 2.2 11.2	31.4 13.4 6.7 7.4 2.2 11.2	31.4 13.4 6.7 7.4 2.2 11.2	39.7 21.8 4.5 13.4 -	39.7 21.8 4.5 13.4 -	28.6 28.6 19.7 -	19.7 19.7 15.2 -
Whole milk (kg-1) 3)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-
Cocoa mix powder 7)	-	-	-	-	-	2.2	2.2	2.2	2.2
Eggs	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7
Potatoes 6)	500	500	500	500	500	500	500	500	500

Nutritional Content

Rations	3339	2599	2216	2001	2096	2228	1950	1740	1815
Total calories	3339	2599	2216	2001	2096	2228	1950	1740	1815
Grams fat	96.2	56.8	43.2	36.1	44.4	49.9	49.1	42.3	41.6
of which animal	26.6	21.1	18.0	13.9	15.0	18.9	18.9	23.3	31.7
Total available	3692	2917	2518	2290	2467	2593	2308	2084	2158
Total calories	3692	2917	2518	2290	2467	2593	2308	2084	2158
Grams fat	107.4	65.0	50.4	43.1	52.8	58.1	57.2	49.6	48.4
of which animal	35.9	27.1	23.						

62. Ration Period from 1. - 28.5.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children				
						10-14 yrs.				
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.	
	1	2	3	4	5	6	7	8	9	
Bread 1) = flour	689.5 516.9	516.4 409.8	446.4 334.8	346.4 259.8	396.4 ²⁾ 297.2	396.4 297.2	285.7 211.2	196.2 147.2	182.1 136.6	
Maschruttel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5	
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5	
Meat, -products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3	
Total fats of which Butter	84.0 17.9	45.6 17.9	34.2 17.9	31.3 17.9	40.1 24.5	39.7 24.1	39.7 24.1	28.6 15.2	19.7 15.2	
Margarine (oil h)	21.5 2.2	9.9 2.2	7.4 2.2	4.5 2.2	4.5 2.2	8.9 2.2	8.9 2.2	-	-	
Slaughter fat	35.7 6.7	8.9 6.7	-	-	8.9	6.7	6.7	4.5	4.5	
Whole milk (kg = 1 l)	-	-	-	-	-	250	250	500	750	
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	
Cocoa mix powder 5)	-	-	-	-	-	2.2	2.2	2.2	2.2	
Eggs	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	
Potatoes 6)	500	500	500	500	500	500	500	500	500	
Nutritional Content										
Rations	3324	2584	2198	1983	2074	2212	1934	1729	1804	
Total calories	93.4	54.1	40.4	33.3	41.9	47.2	46.4	14.1	14.0	
Grams fat	76.4	62.2	53.4	43.4	47.8	52.1	45.6	15.2	53.4	
Grams protein	26.6	21.1	18.0	13.9	15.4	19.1	19.1	23.4	31.7	
Total available	3674	2899	2500	2272	2445	2577	2292	2073	2111	
Grams fat	506.6	62.3	47.6	40.3	50.3	55.4	54.5	18.4	47.2	
Grams protein	86.0	51.7	62.6	52.4	57.1	61.4	54.7	54.0	62.2	
of which animal	33.7	27.4	24.2	19.9	21.2	24.9	24.9	29.0	37.4	
Non-Self Suppliers receive as an average:										
Ration	2040 Calories, 370 g Fat, 48.2 g Protein, of which 17.5 animal.									
Ration	2355 Calories, 46.3g Fat, 56.3 g Protein, of which 22.8 animal.									
Notes see Vierwochensätze.										

64. Ration Period from 25.6. - 23.7.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children				
						10-14 yrs.				
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.	
	1	2	3	4	5	6	7	8	9	
Bread 1) = flour	689.5 516.9	516.4 409.8	446.4 334.8	346.4 259.8	396.4 ²⁾ 297.2	396.4 297.2	285.7 211.2	196.2 147.2	182.1 136.6	
Maschruttel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5	
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5	
Meat-products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3	
Total fats of which Butter	84.0 17.9	45.6 17.9	34.2 17.9	31.3 17.9	40.1 24.5	39.7 24.1	39.7 24.1	28.6 15.2	19.7 15.2	
Margarine (oil h)	21.5 2.2	9.9 2.2	7.4 2.2	4.5 2.2	4.5 2.2	8.9 2.2	8.9 2.2	-	-	
Slaughter fat	35.7 6.7	8.9 6.7	-	-	8.9	6.7	6.7	4.5	4.5	
Whole Milk 3)	-	-	-	-	-	250	250	500	750	
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	
Cocoa mix powder 5)	-	-	-	-	-	2.2	2.2	2.2	2.2	
Eggs	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	8.9	
Potatoes 6)	500	500	500	500	500	500	500	500	500	
Nutritional Content										
Rations	3329	2589	2206	1990	2086	2221	1943	1734	1809	
Total calories	95.3	56.0	42.3	35.2	43.5	49.3	48.5	14.6	14.8	
Grams fat	76.1	62.2	53.4	43.4	47.4	51.9	45.4	15.1	53.3	
Grams protein	26.6	21.1	18.0	13.9	15.0	18.9	18.9	23.3	31.7	
Total available	2682	2907	2508	2279	2458	2586	2330	2078	2115	
Grams fat	106.5	61.2	49.5	42.2	51.9	57.5	56.6	18.9	47.6	
Grams protein	85.8	71.5	62.4	52.1	56.7	61.2	54.5	53.9	62.1	
of which animal	32.9	27.1	23.9	19.6	20.8	24.7	24.7	28.9	37.3	
Notes: see Vierwochensätze.										

63. Ration Period from 29.5.-25.6.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children				
						10-14 yrs.				
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.	
	1	2	3	4	5	6	7	8	9	
Bread 1) = flour	689.5 516.9	516.4 409.8	446.4 334.8	346.4 259.8	396.4 ²⁾ 297.2	396.4 297.2	285.7 211.2	196.2 147.2	182.1 136.6	
Maschruttel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5	
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5	
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3	
Total fats of which Butter	84.0 17.9	45.6 17.9	34.2 17.9	31.3 17.9	40.1 24.5	39.7 24.1	39.7 24.1	28.6 15.2	19.7 15.2	
Margarine (oil h)	21.5 2.2	9.9 2.2	7.4 2.2	4.5 2.2	4.5 2.2	8.9 2.2	8.9 2.2	-	-	
Slaughter fat	35.7 6.7	8.9 6.7	-	-	8.9	6.7	6.7	4.5	4.5	
Whole Milk 3)	-	-	-	-	-	250	250	500	750	
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	
Cocoa mix powder 5)	-	-	-	-	-	2.2	2.2	2.2	2.2	
Eggs	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	
Potatoes 6)	500	500	500	500	500	500	500	500	500	
Nutritional Content										
Rations	3266	2573	2203	1988	2084	2217	1939	1730	1807	
Total calories	88.2	54.1	41.9	35.0	45.3	51.9	45.4	15.1	16.1	
Grams fat	77.1	62.5	53.4	43.5	47.5	51.9	45.4	15.1	53.3	
Grams protein	27.6	21.1	18.0	14.0	15.1	18.9	18.9	23.3	31.7	
Total available	3519	2891	2505	2277	2455	2582	2297	2071	2114	
Grams fat	99.4	62.3	49.1	42.0	51.7	57.1	56.2	18.6	47.3	
Grams protein	86.3	71.8	62.4	52.2	56.8	61.2	54.5	53.9	62.1	
of which animal	33.9	27.5	24.0	19.7	20.9	24.7	24.7	28.1	37.3	
The Non Self Suppliers receive as an average:										
Ration	2053 Calories, 38.5 g Fat, 47.6 g Protein, of which 17.4 g animal.									
Ration	2397 Calories, 47.6 g Fat, 56.3 g Protein, of which 22.9 g animal.									
Notes see Vierwochensätze.										

65. Ration Period from 24/7 - 20/8, 1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18 yrs.	Children				
						10-14 yrs.				
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.	
	1	2	3	4	5	6	7	8	9	
Bread 1) = flour	689.5 516.9	516.4 409.8	446.4 334.8	346.4 259.8	396.4 ²⁾ 297.2	396.4 297.2	285.7 211.2	196.2 147.2	182.1 136.6	
Maschruttel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3	
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
Jam or sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5	
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5	
Meat, products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3	
Total fats of which Butter	84.0 17.9	45.6 17.9	34.2 17.9	31.3 17.9	40.1 24.5	39.7 24.1	39.7 24.1	28.6 15.2	19.7 15.2	
Margarine (oil h)	21.5 2.2	9.9 2.2	7.4 2.2	4.5 2.2	4.5 2.2	8.9 2.2	8.9 2.2	-	-	
Slaughter fat	35.7 6.7	8.9 6.7	-	-	8.9	6.7	6.7	4.5	4.5	
Whole milk 3)	-	-	-	-	-	250	250	500	750	
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	
Cocoa mix powder 5)	-	-	-	-	-	2.2	2.2	2.2	2.2	
Eggs	-	-	-	-	-	-	-	-	-	
Potatoes 6)	500	500	500	500	500	500	500	500	500	
Nutritional Content										
Ration	3395	2656	2273	2058	2152	2290	2012	1801	1876	
Total calories	95.2	55.1	41.4	34.3	42.5	48.7	47.9	14.8	14.0	
Grams fat	76.0	62.2	53.4	43.4	47.4	51.9	45.4	15.1	53.3	
Grams protein	26.5	21.1								

appendix C-4

66. Ration Period from 21/3 - 17/9, 1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread 1) = Flour	689.3 516.9	506.4 409.8	446.4 334.8	316.4 259.6	396.4 ²⁾ 297.2	396.4 297.2	285.7 214.2	196.2 147.2	182.1 136.6
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
Jam or Sugar	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	25.0 12.5	32.2 12.5	32.2 12.5	25.0 12.5	25.0 12.5
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - product	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats of which Butter	84.0 17.9	45.5 17.9	34.2 11.9	31.3 11.9	40.1 26.8	40.1 26.8	40.1 26.8	28.6 19.7	19.7 19.7
Margarine	26.8	14.3	11.8	8.9	8.9	13.4	13.4	-	-
Slaughter fat	34.4	8.9	-	-	-	-	-	-	-
Meat fat 4)	4.5	4.5	4.5	4.5	4.5	-	-	-	-
Whole Milk 3)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-
Eggs	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9	7.9
Potatoes 5)	500	500	500	500	500	500	500	500	500

Nutritional Content

	3326	2537	2204	1879	2084	2216	1938	1726	1801
Total Calories	3326	2537	2204	1879	2084	2216	1938	1726	1801
Grams fat	94.7	55.6	41.9	34.8	43.0	49.6	48.8	41.5	40.7
" protein	76.0	62.2	53.4	43.4	47.3	51.6	45.1	44.9	53.0
of which animal	26.5	21.1	18.0	13.9	14.9	18.8	18.8	23.3	34.7
Total Available	3679	2905	2506	2168	2405	2581	2226	2070	2138
Grams fat	105.9	63.3	48.1	31.4	37.8	57.8	56.9	48.6	47.8
" protein	85.7	731.5	62.4	52.1	56.6	60.9	54.2	53.6	61.9
of which animal	32.8	27.1	23.9	19.6	20.7	24.6	24.6	28.9	37.5

The Non Self Supplies receive as an average:

Ration: 2032 Calories, 40.4 g Fat, 47.3 g Protein, of which animal 17.3.
Total Available 2316 Calories, 47.7 g Fat, 55.9 g Protein, of which animal 23.0.

Notes: See Vierwochensätze.

67. Ration Period from 18.9. - 16.10.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread 1) = Flour	689.5 516.9	516.4 409.8	446.4 334.8	346.4 259.8	396.4 ²⁾ 297.2	396.4 297.2	285.7 214.2	196.2 147.2	182.1 136.6
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Jam or Sugar	26.8 13.4	26.8 13.4	26.8 13.4	26.8 13.4	26.8 13.4	34.0 13.4	34.0 13.4	26.8 13.4	26.8 13.4
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats of which Butter	84.0 17.9	45.6 17.9	34.2 11.9	31.3 11.9	40.1 26.8	40.1 26.8	40.1 26.8	28.6 19.7	19.7 19.7
Margarine	26.8	14.3	11.8	8.9	8.9	13.4	13.4	-	-
Slaughter fat	34.4	8.9	-	-	-	-	-	-	-
Meat fat 5)	4.5	4.5	4.5	4.5	4.5	-	-	-	-
Whole Milk 3)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-
Eggs	-	-	-	-	-	-	-	-	-
Potatoes 6)	500	500	500	500	500	500	500	500	500

Nutritional Content

	3301	2583	2187	1862	2068	2197	1919	1707	1782
Total Calories	3301	2583	2187	1862	2068	2197	1919	1707	1782
Grams fat	92.6	53.5	40.7	33.6	41.8	47.9	47.1	39.9	39.2
" protein	74.5	60.6	51.8	41.8	45.7	49.9	43.4	43.1	51.3
of which animal	25.0	19.5	16.4	12.3	13.3	17.2	17.2	21.6	30.0
Total Available	3654	2861	2489	2151	2339	2562	2277	2051	2119
Grams fat	103.8	61.7	47.9	40.6	50.2	56.1	55.2	47.2	46.0
" protein	84.2	69.9	60.8	50.5	55.0	59.2	52.5	51.9	60.1
of which animal	31.2	25.5	23.1	18.0	19.1	23.0	23.0	27.2	35.6

The Non Self Supplies receive as an average:
Ration: 1975 Calories, 38.9 g Fat, 45.7 g Protein, of which animal 15.7.
Total Available 2285 Calories, 48.2 g Fat, 54.3 g Protein, of which animal 21.4.

Notes: See Vierwochensätze.

68. Ration Period from 16.10. - 12.11.1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread 1) = Flour	646.5 484.9	517.9 358.4	446.4 334.8	317.9 238.4	396.4 297.2	396.4 297.2	285.7 214.2	182.1 136.6	167.9 125.9
Mehrmittel	21.4	21.4	21.4	21.4	21.4	21.4	21.4	28.6	39.3
Sugar	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Jam or Sugar	26.8 13.4	26.8 13.4	26.8 13.4	26.8 13.4	34.0 13.4	34.0 13.4	34.0 13.4	26.8 13.4	26.8 13.4
Artificial Honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats of which Butter	84.0 13.4	45.6 13.4	34.2 13.4	31.3 13.4	40.1 26.8	40.1 26.8	40.1 26.8	28.6 19.6	19.7 15.2
Margarine	26.8	14.3	11.8	8.9	8.9	8.9	8.9	-	-
Slaughter fat	34.4	8.9	-	-	-	-	-	-	-
Meat fat 2)	8.9	8.9	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Meat and fat 4)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Whole Milk 3)	-	-	-	-	-	250	250	500	750
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	5.4	5.4	5.4	5.4	5.4	5.4	5.4	-
Eggs	-	-	-	-	-	-	-	-	-
Potatoes 5)	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6

Nutritional Content

	3122	2424	2117	1721	2017	2111	1850	1601	1607
Total Calories	3122	2424	2117	1721	2017	2111	1850	1601	1607
Grams fat	89.9	50.8	38.3	30.9	39.4	45.4	44.7	37.4	38.0
" protein	72.0	59.0	51.8	40.1	45.9	49.8	41.5	42.4	49.2
of which animal	26.2	20.7	17.6	13.5	14.6	18.5	18.5	22.9	30.0
Total Available	3475	2742	2419	2010	2388	2479	2208	1915	2029
Grams fat	101.1	59.0	45.5	37.9	47.8	53.7	52.8	44.7	45.7
" protein	81.7	68.3	60.8	48.8	55.2	59.1	52.6	51.2	58.0
of which animal	32.5	26.7	23.5	19.2	20.4	24.3	24.3	28.5	35.6

The Non Self Supplies receive as an average:
Ration: 1861 Calories, 36.5 g Fat, 44.3 g Protein, of which animal 16.5.
Total Available 2159 Calories, 43.8 g Fat, 53.7 g Protein, of which animal 23.1.

Notes: See Vierwochensätze.

69 Ration Period from 13.11 - 10.12. 1944
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
	1	2	3	4	5	6	7	8	9
Bread 1) = Flour	646.5 484.9	517.9 358.4	446.4 334.8	317.9 238.4	396.4 297.2	396.4 297.2	285.7 214.2	182.1 136.6	167.9 125.9
Mehrmittel	19.6	19.6	19.6	19.6	19.6	19.6	19.6	25.8	37.5
Sugar	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Jam or Sugar	26.8 13.4	26.8 13.4	26.8 13.4	26.8 13.4	26.8 13.4	34.0 13.4	34.0 13.4	26.8 13.4	26.8 13.4
Artificial honey	-	-	-	-	-	4.5	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats of which Butter	84.0 13.4	45.6 13.4	34.2 13.4	31.3 13.4	40.1 26.8	40.1 26.8	40.1 26.8	28.6 19.6	19.7 15.2
Margarine	26.8	14.3	11.8	8.9	8.9	8.9	8.9	-	-
Slaughter fat	34.4	8.9	-	-	-	-	-	-	-
Meat fat 2)	8.9	8.9	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Meat and fat 4)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Whole Milk 3)	-	-	-	-	-	250	250	500	750
Cheese	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2
Meat instead of cheese	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee substitute	8.9	5.4	5.4	5.4	5.4	5.4	5.4	5.4	-
Eggs	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Potatoes	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6

Nutritional Content

	3133	2435	2128	1732	2023	2120
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70. Ration Period from 11.12.1944 - 7.1.1945
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
						1	2	3	4	5	6	7	8	9
Bread 1) = flour	616.5 484.9	517.9 358.4	416.4 334.8	317.9 238.4	396.4 297.2	396.4 287.2	285.7 214.2	182.1 136.6	167.9 125.9
Mehrmittel	19.6	19.6	19.6	19.6	19.6	19.6	19.6	26.8	37.5
Sugar	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Jam or Sugar	26.8	26.8	26.8	26.8	34.0	34.0	34.0	26.8	26.8
Artificial honey	-	-	-	-	-	-	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats	84.0	45.6	31.2	31.3	40.1	40.1	40.1	28.6	19.7
of which Butter	13.4	13.4	13.4	13.4	22.3	22.3	22.3	19.6	15.2
Margarine	26.8	11.3	11.8	8.9	8.9	8.9	8.9	-	-
Slaughter fat	30.4	4.4	-	-	-	-	-	-	-
Meat fat 2)	8.9	8.9	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Meat and fats 4)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	-
Whole Milk 3)	-	-	-	-	250	250	500	750	-
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee Substitute	8.9	5.4	5.4	5.4	5.4	5.4	5.4	5.4	-
Potatoes 5)	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6
Eggs	-	-	-	-	-	-	-	-	-

Nutritional Content

Rations	1	2	3	4	5	6	7	8	9
Total calories	3139	2441	2134	1738	2034	2131	1867	1638	1710
Grams fat	91.6	52.5	40.0	32.6	44.1	47.2	45.4	39.0	40.6
" protein	73.6	60.6	43.4	41.7	47.5	51.4	45.1	43.9	50.9
of which animal	27.9	22.4	19.3	15.2	16.3	20.2	20.2	24.6	31.9
Total Available	3492	2759	2436	2027	2405	2496	2225	1962	2017
Grams fat	102.8	60.7	47.2	39.6	49.5	55.4	54.5	46.3	47.4
" protein	83.3	69.9	62.4	50.4	56.8	60.7	56.2	52.7	59.7
of which animal	31.2	28.4	25.2	20.9	22.1	26.0	26.0	30.2	37.5

The Non Self Suppliers receive as an average:
Ration 1854 Calories, 38.3 g Fat, 45.3 g Protein, of which 18.5 g animal.
Total available 2183 Calories, 45.7 g Fat, 55.3 g Protein, of which 24.3 g animal.

Notes see Vierwochensätze.

71. Ration Period from 8.1. - 4.2.1945
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
						1	2	3	4	5	6	7	8	9
Bread 1) = flour	616.5 484.9	517.9 358.4	416.4 334.8	317.9 238.4	396.4 297.2	396.4 287.2	285.7 214.2	182.1 136.6	167.9 125.9
Mehrmittel	19.6	19.6	19.6	19.6	19.6	19.6	19.6	26.8	37.5
Sugar	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2
Jam or Sugar	26.8	26.8	26.8	26.8	34.0	34.0	34.0	26.8	26.8
Artificial honey	-	-	-	-	-	-	4.5	4.5	4.5
Meat - products	121.4	85.7	64.3	35.7	42.9	42.9	42.9	14.3	14.3
Total fats	84.0	45.6	31.2	31.4	40.3	40.3	40.3	28.6	19.7
of which Butter	13.4	13.4	13.4	13.4	22.3	22.3	22.3	19.6	15.2
Margarine	22.3	9.8	7.3	4.5	4.5	4.5	4.5	-	-
Slaughter fat	34.9	8.9	4.5	4.5	4.5	4.5	4.5	-	-
Meat fat 2)	8.9	8.9	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Meat and fats 4)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	-
Whole Milk 3)	-	-	-	-	250	250	500	750	-
Cheese	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Quarg	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Coffee Substitute	8.9	5.4	5.4	5.4	5.4	5.4	5.4	5.4	-
Potatoes 5)	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6	428.6

Nutritional Content

Rations	1	2	3	4	5	6	7	8	9
Total calories	3124	2423	2116	1721	2012	2109	1850	1595	1689
Grams fat	90.6	51.3	38.9	31.6	40.1	46.2	45.4	37.3	34.9
Grams protein	72.0	58.9	51.7	40.1	46.0	49.9	43.5	42.3	49.2
of which animal	26.3	20.8	17.7	13.6	14.7	18.6	18.6	22.9	30.2
Total Available	3477	2711	2418	2010	2383	2474	2208	1939	2026
Grams fat	101.8	59.5	46.1	38.6	46.5	54.4	53.5	44.6	45.7
Grams protein	81.7	68.2	60.7	48.5	55.3	59.2	52.6	51.1	59.0
of which animal	32.6	26.8	23.6	19.3	20.5	24.4	24.4	28.5	35.8

The Non Self Suppliers receive as an average:
Ration 1836 Calories, 37.2 g Fat, 43.7 g Protein, of which 16.1 g animal.
Total available 2156 Calories, 44.3 g Fat, 52.6 Protein, of which 23.3 g animal.

Notes see Vierwochensätze.

72. Ration Period from 5.2. - 8.3. 1945 1)
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
						1	2	3	4	5	6	7	8	9
Bread = flour	574.7 431.2	460.4 305.3	396.9 297.6	282.6 211.9	352.4 264.4	352.4 264.4	253.9 190.4	161.9 121.8	149.3 112.0
Mehrmittel	17.4	17.4	17.4	17.4	17.4	17.4	17.4	23.9	33.3
Sugar	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8
Jam or Sugar	23.9	23.9	23.9	23.9	30.2	30.2	30.2	23.9	23.9
Artificial Honey	-	-	-	-	-	-	4.0	4.0	4.0
Meat - products	107.9	76.1	57.1	31.7	38.2	38.2	38.2	12.7	12.7
Total fats	80.8	45.8	35.5	32.9	40.8	40.8	40.8	30.4	19.0
of which butter	11.9	11.9	11.9	11.9	19.8	19.8	19.8	17.4	13.9
margarine	19.8	8.8	6.6	4.0	4.0	4.0	4.0	-	-
slaughter fat	31.9	8.0	4.0	4.0	4.0	4.0	4.0	-	-
meat fat	10.2	10.2	5.1	5.1	5.1	5.1	5.1	5.1	5.1
meat, fats	7.9	7.9	7.9	7.9	7.9	7.9	7.9	-	-
Whole milk	-	-	-	-	223	223	223	445	667
Cheese	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Quarg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Coffee substitute	7.2	4.0	4.0	4.0	4.0	4.0	4.0	4.0	-
Potatoes	-	-	-	-	-	-	-	-	-
Eggs	-	-	-	-	-	-	-	-	-

1) The 72nd and 73rd ration periods together were extended to cover 9 weeks, instead of the normal 8 weeks. Correction for this extension has been made in the figures above.

1) Figures are based on the publication of the Reich Ministry for Food and Agriculture:

"Lebensmittelmengen auf Kartengrundlage in der 72. Zuteilungsperiode vom 5.2. bis 4.3. 1945 lt. Erlass des RMF Bül. vom 20.12.44 - II B 1 - 72."

73. Ration Period from 8.3. - 8.4. 1945 1)
Daily Allowances in Grams

	Very Heavy Workers	Heavy Workers	Long and Night Workers	Normal Consumers	Adolescents 14-18	Children			
						10-14 yrs.	6-10 yrs.	3-6 yrs.	0-3 yrs.
						1	2	3	4	5	6	7	8	9
Bread = flour	512.9 407.2	428.6 321.5	365.1 273.8	250.8 188.1	320.6 240.5	320.6 240.5	238.2 178.7	146.0 109.5	149.3 112.0
Mehrmittel	8.7	8.7	8.7	8.7	8.7	8.7	8.7	17.4	26.1
Sugar	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8
Jam or Sugar	23.9	23.9	23.9	23.9	30.2	30.2	30.2	23.9	23.9
Artificial Honey	-	-	-	-	-	-	4.0	4.0	4.0
Meat - products	107.9	76.1	57.1	31.7	38.2	38.2	38.2	12.7	12.7
Total fats	70.7	36.6	26.5	23.8	31.7	31.7	31.7	21.4	13.4
Whole milk	-	-	-	-	223	223	223	445	667
Cheese	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Quarg	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Coffee Substitute	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0

1) The 72nd and 73rd ration periods together were extended to cover 9 weeks, instead of the normal 8 weeks. Correction for this extension has been made in the figures above.

1) Figures are based on lists prepared by officials of the Reich Ministry for Food and Agriculture at Walburg, Heessen, on 2 July 1945.

Frequently during the last few periods foods alternate to those originally announced were issued, e.g. meat in lieu of fat, cheese or Mehrmittel. This substitution of items is not considered in the above figures.

COMPILATION OF NUTRITIONAL VALUES

EXPLANATION OF TABLES

This compilation of nutritional values applies to foods of the customary type and quality of pre-war days (1939). It comprises three parts, namely the values for foods at the consumer level, foods at the wholesale level and the values of pure substances.

Part I shows the content of foods, as far as nutritive value is concerned, with occasional considerations as to the waste which exists in foods at the consumer level. These values apply to foods in such state and form as the consumer has at his disposal to fill his needs. The values contained in this part are therefore based on calculations relating to foods in the form in which they reach the kitchen of the consumer from the retailer or market place.

Part III contains the pure substance values of the raw product values contained in Part I and II. These are values given for each hundred grams of edible substance free of waste and loss. From these pure substance values the values for raw products contained in Part I and II have been calculated in such a way that the waste quotas (Table I) or the loss quotas (Table II) were always deducted from the pure substance values. The pure substance values were included primarily for use in scientific research. The practical significance of the pure substance values is confined to calculations on merchandise free of waste.

In order to calculate the calorie values of the individual nutritive substances, the following values were used:

1 gram protein	= 4.1 cal.	1 gram lemon (fruit) acid	= 3.4 cal.
1 gram fat	= 9.3 cal.	1 gram other organic acid	= 4.1 cal.
1 gram carbohydrates	= 4.1 cal.	1 gram extract taken from beer	= 4.1 cal.
		1 gram extract taken from wine	= 3.4 cal.

The content of alcohol has not been considered in the calculation of the calorie values, as according to an authoritative statement of the Kaiser Wilhelm Institute for Work Physiology in Dortmund, alcohol is no energy producer in respect to muscle work and it plays only a small part in metabolism in a state of rest.

The book by Koenig must still be considered as a main source for the analysis employed, since more up to date analyses can only be made on a limited scale. These were chiefly contributed by the nutrition physiology and chemical department of the Reich Health Office.

The values of the individual foodstuffs are taken in part in the form as given in the above mentioned sources, in part they are given as average values calculated from analyses contained in the sources. These average analyses are calculated as simple arithmetical means from the individual analyses at hand. As far as the values contained in the surveys are expressly designated as average values only group averages are concerned. These values given for a whole group of foods (for instance, cheeses) were calculated from values for individual types of merchandise (for instance, fat cheese, half fat cheese, etc.) as a rule as weighted average values. The calculations included consideration of the contribution of the individual type of foods in the total consumption of the respective groups of food, just prior to the war.

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Reichsministerium des Innern, Geschäftsführer
der Reichsarbeitsgemeinschaft für Volksernährung

Heft 11

Nährstoff- und Nährwertgehalt von Lebensmitteln

Bearbeitet im Statistischen Reichsamt
in Verbindung mit dem Reichsgesundheitsamt



1 9 4 3

VERLAG VON JOHANN AMBROSIOUS BARTH / LEIPZIG

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Teil I: Verbraucherstufe

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall %
	Eiweiß g	Fett g	Kohlehydrate g	Kalorien	
I. Tierische Nahrungs- und Genußmittel					
1. Fleisch und Fleischwaren					
a) Frisches Fleisch von Schlachttieren					
Fleisch i. D. ¹⁾ 1)					
Gesamtbewertung.....	13,5	16,6	0,2	211	22,7
Städtischer Verbrauch.....	14,3	15,0	0,2	199	20,4
Ländlicher Verbrauch.....	12,5	18,4	0,2	223	25,8
Schweinefleisch					
mit Knochen					
Fleisch vom fetten Tier ²⁾ :					
Klasse I (ohne Schinken) ⁴⁾	15,6	21,3	0,3	263	11,0
Klasse I Schinken ⁴⁾	10,1	13,7	0,2	170	42,5
Klasse II ⁴⁾	12,6	27,2	0,3	306	16,0
Klasse III ⁴⁾	10,9	20,7	0,2	238	32,0
Klasse IV ⁴⁾	5,7	18,6	0,1	196	55,0
i. D. ⁴⁾	11,0	20,1	0,2	233	31,4
i. D. ³⁾	11,3	20,6	0,2	238	29,8
Rindfleisch					
mit Knochen					
mager ⁴⁾	17,4	3,0	0,5	101	15,6
mittel fett ⁴⁾	16,7	6,6	0,3	131	16,0
fett ⁴⁾	14,4	15,4	0,2	203	20,4
i. D. ⁴⁾	16,3	7,9	0,3	142	17,0
i. D. ¹⁾	17,4	8,3	0,3	150	12,5
Fleisch vom fetten Tier⁴⁾ 1)					
Klasse I.....	19,1	12,5	0,4	196	4,5
Klasse II.....	15,5	16,6	0,3	219	16,5
Klasse III.....	12,5	20,3	0,2	241	24,1
Klasse IV.....	11,6	11,3	0,2	154	37,5
Hackfleisch.....	15,3	8,7	0,4	145	—

¹⁾ Hier wie im folgenden vgl. die Erläuterungen.
²⁾ Einschließlich des Nährwertes der eingewachsenen, auskochbaren Knochen ohne Inneren.
³⁾ Schweine-, Rind-, Kalb-, Schaf-, Pferde-, Ziegen-, Kaninchenfleisch und Geflügel im gewogenen Durchschnitt des Verbrauchs.
⁴⁾ Klasse I: Rücken, Kotelet, Schinken; Klasse III: Bauch;
 Klasse II: Kamm, Vorderhinken, Brust; Klasse IV: Kopf, Peine.
⁵⁾ Ohne den Nährwert der eingewachsenen, auskochbaren Knochen.
⁶⁾ Klasse I: Rinderbraten, Blume, Eckschwanzstück, Mittelschwanzstück; Klasse III: Fehrippe, Kamm, Querrippe, Brustkern;
 Klasse II: Unterschwanzstück, Bug, Mittelbrust; Klasse IV: Querrippe, Hensen, Dämmung-brust;

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall %
	Eiweiß g	Fett g	Kohlehydrate g	Kalorien	
Kalb(fleisch-) mit Knochen					
Klasse I ²⁾	17,8	6,9	0,4	139	10,5
Klasse II ²⁾	16,1	7,2	0,3	134	18,5
Klasse III ²⁾	14,3	7,6	0,3	131	26,5
Klasse IV ²⁾	9,8	2,7	0,2	66	50,0
i. D. ²⁾	16,1	6,9	0,2	131	18,7
i. D. ¹⁾	17,2	7,4	0,2	140	13,0
Rind- und Kalbfleisch mit Knochen					
i. D. ²⁾	16,3	7,7	0,3	140	17,3
i. D. ¹⁾	17,4	8,1	0,3	148	12,6
Schafffleisch					
Fleisch vom fetten Tier⁴⁾					
i. D. ²⁾	13,6	17,5	0,2	219	20,3
i. D. ¹⁾	14,1	18,2	0,2	228	17,4
Klasse I (Rücken) ²⁾	15,1	23,6	0,2	283	12,0
Klasse I (Keule) ³⁾	14,2	22,1	0,2	265	17,5
Klasse II ²⁾	11,7	27,1	0,2	301	19,0
Klasse III ²⁾	12,4	17,8	0,1	215	26,0
i. D. ²⁾	13,2	21,4	0,2	254	20,3
i. D. ¹⁾	13,6	22,1	0,2	262	17,4
Pferdefleisch					
Lende.....	21,2	1,2	0,9	100	—
mit Knochen ⁶⁾	20,4	2,3	0,9	109	5
Ziegenfleisch mit Knochen					
i. D. ²⁾	16,1	3,4	0,4	99	22,0
i. D. ¹⁾	17,6	3,7	0,4	108	15,0
Kaninchen					
mit Knochen, brautfertig.....	19,0	7,9	—	142	12,3
Ziegen- und Kaninchenfleisch mit Knochen, i. D. ³⁾	17,9	5,4	0,3	125	13,5
b) Inneren und Schlachtfette					
Inneren i. D. ⁶⁾	15,9	4,8	1,0	114	9,5
Herz, frisch, vom Rind oder Kalb.....	14,9	8,5	0,3	141	15,4
Leber, frisch, vom Rind oder Kalb.....	19,6	3,6	3,3	127	1,4
Leber, frisch, vom Schwein.....	19,2	5,2	2,5	137	1,4

¹⁾ Klasse I: Keule, Nierenbraten; Klasse III: Hals, Brust, Bauch;
 Klasse II: Rücken, Kamm, Bug; Klasse IV: Kopf, Fülle.
²⁾ Ohne den Nährwert der eingewachsenen, auskochbaren Knochen.
³⁾ Einschließlich des Nährwertes der eingewachsenen, auskochbaren Knochen.
⁴⁾ Klasse I: Rücken, Keule; Klasse III: Brust, Bauch, Hals, Kopf.
⁵⁾ Kein Nährwert auskochbarer Knochen.
⁶⁾ Durchschnitt der wichtigsten Arten.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß	Fett	Kohlehydrate	Kalorien		
d) Wild i. D. (ohne Wildgeflügel).....	18,6	1,7	0,4	94	—	14,4
Hirsch, Keule (mit Knochen).....	18,1	3,4	0,5	109	15,4	12,5
Reh (mit Knochen).....	17,7	1,6	0,3	89	5,0	16,0
Wildschwein, Keule (mit Knochen).....	18,9	2,1	0,4	99	9,8	12,5
Hase (mit Knochen).....	19,6	0,9	0,4	91	5,7	15,0
e) Geflügel i. D.	15,3	13,1	—	185	—	17,6
Gans, Mittel.....	11,0	34,5	—	366	—	22,2
Huhn, braisfertig.....	17,0	4,0	—	107	—	15,5
Ente, Hausf.	18,0	4,0	—	111	—	13,5
Taube, braisfertig.....	16,6	0,8	0,4	77	—	25,0
f) Wildgeflügel						
Fasan.....	12,9	1,1	0,2	64	—	42,1
Feldhuhn, Rebhuhn.....	14,3	0,8	0,3	67	—	41,2
Wildente.....	12,1	1,7	0,3	67	—	46,7

2. Fische und Fischwaren

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß	Fett	Kohlehydrate	Kalorien		
a) Fische, frisch, städtischer Verbrauch	8,7	1,3	—	48	—	51,5
See- und Süßwasserfische i. D.						
b) Seefische, frisch						
Ganze Fische, i. D. des städt. Verbrauchs.....	8,8	1,2	—	47	—	51,2
Aal (Flußaal).....	9,3	20,9	—	233	—	24,0
Heilbutt.....	15,1	0,2	—	64	—	26,2
Hering.....	8,3	3,5	—	67	—	53,5
Kabeljau.....	8,3	0,1	—	35	—	54,0
Knaurhahn.....	10,6	1,4	—	56	—	43,4
Leugfisch.....	16,6	0,2	—	70	—	7,7
Makrele.....	11,2	2,9	—	73	—	43,6
Petermann.....	11,4	1,4	—	60	—	34,2
Rotbarsch.....	10,9	0,5	—	49	—	41,0
Rotzunge.....	11,9	0,1	—	50	—	31,5
Schellfisch.....	9,5	0,2	—	41	—	48,5
Scholle.....	11,1	0,5	—	37,1	—	61
Seelachs.....	14,2	0,3	—	50	—	25,8
Thunfisch.....	14,6	0,3	—	63	—	43,6
Wittling.....	13,6	0,2	—	58	—	20,9
c) Süßwasserfische i. D.	7,3	2,4	—	52	—	57,1
Flußbarsch.....	7,0	0,3	—	31	—	63,0
Hech.....	10,2	0,3	—	45	—	45,0
Karpfen.....	7,5	4,4	—	72	—	55,0
Plötze, Rotaugen.....	7,6	0,5	—	36	—	55,0
Schleie.....	6,6	0,1	—	28	—	63,0
d) Fischdauern i. D.	14,3	10,5	0,5	158	—	31,5
Geräucherter Fisch i. D.	14,1	9,1	—	142	—	33,8
Aal.....	13,2	22,4	—	263	—	26,5
Büchling.....	13,7	9,9	—	148	—	37,0

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß	Fett	Kohlehydrate	Kalorien		
Niere, frisch, vom Rind oder Kalb.....	18,4	4,5	0,4	119	—	—
Lunge, frisch, vom Rind oder Kalb.....	12,9	2,1	0,5	74	15,4	—
Milz, frisch, vom Rind oder Kalb.....	16,9	4,0	1,0	111	5,0	—
Zunge, frisch, vom Rind oder Kalb.....	14,2	15,9	0,1	207	9,8	—
Hirn, frisch, vom Kalb.....	8,5	8,1	—	110	5,7	—
Jus (Bratenstaf, geliert).....	2,5	9,0	—	94	—	—
Knochenmark, frisch.....	3,2	89,9	—	849	—	—
Knochen.....	0,2	6,3	—	59	93,0	—
Schlachtfette						
Fettgewebe, frisch, vom Rind.....	1,2	89,0	—	833	—	—
Fettgewebe, frisch, vom Schwein.....	1,3	92,0	—	861	—	—
c) Fleisch- und Wurstwaren						
Schweinefleisch, geräuchert (Geselchtes) i. D. mit Knochen ¹⁾	20,8	27,8	—	344	9,2	—
Ochsenfleisch, geräuchert.....	20,9	27,9	—	345	8,7	—
Pferdefleisch, geräuchert.....	27,1	13,4	—	236	—	—
Schinken, geräuchert.....	31,8	6,5	0,9	195	—	—
Speck, geräuchert u. gesalzen.....	21,9	21,9	—	293	12,4	—
Speck, durchwachsen.....	14,0	72,8	—	714	—	—
Getriefferleisch.....	14,0	51,0	—	532	—	—
Mettwurst.....	15,8	7,7	0,3	138	19,8	—
Rindfleischwurst.....	19,4	42,8	—	478	2,0	—
Salami.....	20,1	32,2	—	382	2,0	—
Salami.....	27,2	47,4	—	552	2,0	—
Schinkenwurst.....	12,6	33,7	2,5	375	2,0	—
Zervelatwurst.....	21,8	46,0	0,1	518	2,0	—
Rohwurst i. D.	21,2	44,5	0,1	501	2,0	—
Leberwurst.....	6,9	19,5	0,3	211	2,0	—
Blutwurst.....	13,9	43,6	0,2	463	2,0	—
Frische Leberwurst.....	12,6	24,6	11,8	329	2,0	—
Frische Blutwurst.....	9,8	19,6	—	212	2,0	—
Frische Wurst i. D.	10,7	14,1	17,3	246	2,0	—
Kochwurst i. D.	8,8	24,2	2,0	269	2,0	—
Jagdwurst.....	15,2	25,8	—	302	2,0	—
Brühwurst i. D.	15,2	25,8	—	302	2,0	—
Wiener Würstchen.....	12,4	13,6	—	177	1,0	—
Frankfurter Würstchen.....	12,4	38,7	0,6	413	1,0	—
Würstchen i. D.	12,4	13,9	—	180	1,0	—
Sülzwurst.....	22,6	22,3	—	300	2,0	—
Wurst i. D.	14,0	27,8	0,9	320	1,8	—
Rindfleisch in Büchsen.....	19,2	12,4	1,2	199	—	—
Gulasch in Büchsen.....	19,2	11,0	2,7	192	—	—
Corned beef.....	22,3	6,5	—	152	6,2	—
Fleischkonserven i. D.	20,2	10,0	1,3	181	1,6	—
Fleisch und Fleischwaren i. D.	15,3	20,8	0,6	259	11,3	—
Fleischsalat.....	20,8	3,3	0,5	118	—	—

¹⁾ Ohne den Nährwert der eingewachsenen, auskochbaren Knochen.

²⁾ Einschließlich des Nährwertes der eingewachsenen, auskochbaren Knochen.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß g	Fett g	Kohlehydrate g	Kalorien		
Makrele	14,8	10,0	—	154	31,0	
Seelachs	18,9	1,0	—	87	14,8	
Spitzen	10,0	11,5	—	148	42,0	
Marinaden i. D.	15,4	11,3	0,8	172	23,9	
Bismarkhering	12,6	8,4	0,8	133	45,8	
Marinierter Hering ..	14,4	11,2	0,6	166	23,6	
Rollmöps	19,3	14,4	0,9	217	2,4	
Fischkonserven i. D. ..	14,5	10,0	0,7	155	33,0	
Hering in Gelee	10,2	8,7	0,4	124	44,0	
Aal in Gelee	9,4	9,0	0,3	123	47,9	
Ölsardinen	18,8	11,2	1,0	185	21,5	
Salbering	14,0	11,4	0,9	167	31,7	
Stockfisch	55,5	1,8	—	244	32,2	
Klippfisch	29,5	1,0	—	130	31,5	
Salzfisch, Laberdan ..	16,6	0,8	—	76	31,8	
e) Schattiere						
Krabben mit Schalen ..	7,5	0,6	1,1	41	52,4	
Misamuscheln mit Schalen	4,5	0,7	1,1	30	49,3	
f) Fischasale						
Heringssalat	6,6	5,3	17,6	149	—	
Fischsalat	13,8	1,3	0,7	72	—	
3. Eier und Eierzeugnisse						
a) Analysenwerte je 100 g						
Hühnerel	12,3	10,7	0,5	162	12,7	
Eiweiß (Eiklar)	12,8	0,3	0,7	58	—	
Eigelb (Eidotter)	16,1	31,7	0,3	362	—	
Trockenei (Voll)	43,2	40,9	2,0	566	—	
Trockeneiweiß	73,4	0,3	4,0	320	—	
Trockeneigel	35,1	53,2	1,0	643	—	
Entenei	11,1	13,0	0,3	168	12,9	
b) Analysenwerte je Stück						
Hühnerel der Klasse B = 57 g i. D. ¹⁾	7,0	6,1	0,3	87	12,7	
Entenei im durchschn. Gewicht von 69,8 g ...	6,6	7,8	0,2	100	12,9	
4. Milch und Milcherzeugnisse						
a) Milch u. dgl.						
Kahnmilch:						
Vollmilch, 3,1% Fettgehalt, durchschnittl.	3,4	3,1	4,8	62	—	
Heiße Trinkmilch	3,4	2,7	4,8	59	—	
Vollmilch, 2,7% Fettgehalt						

¹⁾ Nach den Ermittlungen der Reichsstelle für Eier besteht ein Ei der Klasse B im Durchschnitt aus 7,3 g Schale, 19,1 g Eidotter, 30,6 g Eiklar.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß g	Fett g	Kohlehydrate g	Kalorien		
Vollmilch, 2,8% Fettgehalt	3,4	2,8	4,8	60	—	
Vollmilch, 2,9% Fettgehalt	3,4	2,9	4,8	61	—	
Vollmilch, 3,0% Fettgehalt	3,4	3,0	4,8	62	—	
Vollmilch, 3,2% Fettgehalt	3,4	3,2	4,8	63	—	
Vollmilch, 3,3% Fettgehalt	3,4	3,3	4,8	64	—	
Vollmilch, 3,4% Fettgehalt	3,4	3,4	4,8	65	—	
Vollmilch, 3,5% Fettgehalt	3,4	3,5	4,8	66	—	
Vollmilch, 3,6% Fettgehalt	3,4	3,6	4,8	67	—	
Vollmilch, 3,7% Fettgehalt	3,4	3,7	4,8	68	—	
Vollmilch, 3,8% Fettgehalt	3,4	3,8	4,8	69	—	
Vollmilch, 3,9% Fettgehalt	3,4	3,9	4,8	70	—	
Entrahmte Frischmilch (Magermilch), 0,1% Fettgehalt	3,7	0,1	4,8	36	—	
Buttermilch, 0,5% Fettgehalt	3,7	0,5	3,7	35	—	
Trockenerzeugnisse:						
Vollmilchpulver	25,2	26,8	37,0	504	—	
Pulver aus entrahmter Milch (Magermilchpulver)	33,5	1,6	50,0	357	—	
Milch W	30,7	0,3	51,0	338	—	
Milch G	34,0	1,4	52,1	366	—	
Rahm, Sahne:						
Kaffeerahm	3,5	10,0	4,0	124	—	
Schlagrahm, 30% Fettgehalt	2,7	30,0	3,0	302	—	
Kondensierte Milch (Vollmilch ohne Zucker) ..	8,0	9,3	10,9	164	—	
Ziegenmilch	3,6	3,9	4,7	70	—	
b) Butter und Butterschmalz						
Butter i. D.	0,9	80,0	0,9	751	—	
Butterschmalz	0,1	99,8	0,1	929	—	
c) Käse und Quark						
Fettgehalt i. T. %						
Käse i. D.	29,3	20,3	2,5	319	4,6	
Doppelrahmkäse	19,3	37,3	1,4	432	1,5	
Rahmkäse	23,0	30,3	1,8	383	5,3	
Vollfettkäse ¹⁾	25,5	26,6	2,1	361	5,9	
Fettkäse ¹⁾	26,3	23,6	2,5	338	5,5	
Dreiviertel(fett)käse ¹⁾	31,8	17,5	2,6	304	5,6	
Halbfettkäse	36,2	9,9	3,0	253	4,2	
Vierfettkäse	36,5	4,2	3,2	202	4,8	
Magerkäse weniger als	37,1	2,6	3,8	192	4,8	
Quark, frisch						
aus abgerahmter Milch mit 0,8% Fettgehalt der Rohware	17,2	1,2	4,0	98	—	
aus entrahmter Frischmilch mit 0,1% Fettgehalt der Rohware	17,6	0,1	4,1	90	—	

¹⁾ Die Werte umfassen Hartkäse, halbfesten Schnittkäse und Streichkäse.

II. Tierische und pflanzliche Fette / III. Pflanzliche Nahrungs- und Genussmittel

Teil I: Verbraucherstufe

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß	Fett	Kohlehydrate	Kalorien		

II. Tierische und pflanzliche Fette, gemischte Lebensmittel

1. Fette ¹⁾ und Öle						
Kunstseisefett	—	99,0	—	—	921	—
Lebertran	—	98,7	—	—	927	—
Margarine	0,5	80,0	0,4	—	748	—
Rindertalg, ausgelassen	0,5	99,2	—	—	925	—
Schweineschmalz	0,3	99,4	—	—	926	—
Speiseöl	—	99,5	—	—	925	—
Unvermishtes Pflanzenfett (Kokosfett, Palm-, Nuss- u. dgl.)	—	99,8	—	—	928	—
2. Suppenpräparate, Würzen und Hefe						
Hefe, frisch, gepreßt	16,2	1,3	5,5	—	101	—
Hefeextrakt i. D.	48,35	—	—	—	193	—
Nährhefe	52,0	3,0	25,7	—	346	—
Suppenwürfel, Suppenfäcin u. dgl. i. D.	13,7	8,2	54,5	—	356	—
Suppenwürze i. D.	30,5 ²⁾	—	—	—	122	—
Fruchtsuppen (Pulver)	2,3	0,3 ³⁾	80,2	—	341	—
Süße Suppen (Pulver)	10,9	1,6	74,1	—	363	—
Soßenwürfel, Soßenpulver	11,0	9,2	54,3	—	353	—

III. Pflanzliche Nahrungs- und Genussmittel

1. Getreide und Mühlenzeugnisse						
a) Ganzes Korn ⁴⁾						
Reis (Kochreis, poliert)	7,9	0,5	77,8	—	356	—
Gerstengruppen	11,8	2,7	74,5	—	379	—
Hafermehl (Floeken)	14,4	6,8	66,5	—	395	—
Buchweizen	10,2	1,9	71,7	—	353	—
Hirse (Rispenhirse)	10,5	4,3	68,2	—	363	—
c) Grieß, Grütze						
Weizengrieß Type 450 (Ausmahlung 0—57%)	9,4	1,0	74,6	—	354	—
Maisgrieß	8,8	1,1	78,0	—	366	—
Hafergrütze	13,4	5,9	67,0	—	385	—
Buchweizengrütze	10,6	1,5	70,1	—	345	—
d) Mehl						
Roggen- und Weizenmehl im volksw. D. einschließlich Backschrot	9,6	1,5	72,4	—	350	—
im volksw. D. ohne Backschrot	9,1	1,4	73,3	—	361	—

¹⁾ Butter und Butterschmalz s. „Milch und Milcherzeugnisse“; Rinderfett, Schweinefett, roh (Fettgewebe, frisch) s. „Schlachtfette“.
²⁾ Organische Substanz.
³⁾ Außerdem 2,4 g Frucht säure.
⁴⁾ Siehe Teil II und III.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß	Fett	Kohlehydrate	Kalorien		

im einzelnen

neue Sorten						
Roggenmehl Type 997 (Ausmahlung etwa 0—75%)	6,9	1,1	76,3	—	351	—
Roggenmehl Type 1150 (Ausmahlung etwa 0—80%)	7,7	1,3	74,5	—	349	—
Roggenmehl Type 1370 (Kornmehlmehl, Ausmahlung etwa 0—85%)	8,0	1,4	73,9	—	349	—
Roggenbackschrot, Roggenvollkornschrot Type 1800 (Ausmahlung etwa 0—94 bzw. 98%)	9,0	1,5	72,1	—	346	—
Roggenmehl i. D. einschließlich Backschrot	7,9	1,3	74,2	—	349	—
Roggenmehl i. D. ohne Backschrot	7,5	1,2	74,9	—	349	—
Weizenmehl Type 812 (Ausmahlung etwa 0—78%)	10,5	1,6	72,3	—	354	—
Weizenmehl Type 1050 (Ausmahlung etwa 0—83%)	10,9	1,7	71,1	—	352	—
Weizenbackschrot, Weizenvollkornschrot Type 1700 (Ausmahlung etwa 0—94 bzw. 98%)	12,6	1,9	68,2	—	349	—
Weizenmehl i. D. einschließlich Backschrot	11,3	1,7	70,5	—	351	—
Weizenmehl i. D. ohne Backschrot	10,7	1,7	71,7	—	354	—
alte Sorten						
Roggenmehl 1—30%, feinstes	5,9	0,6	75,7	—	340	—
Roggenmehl 30—60%, zweites	9,7	1,2	67,5	—	328	—
Roggenmehl 60—65%, drittes	12,8	2,2	60,9	—	323	—
Roggenmehl 65—70%, Nachmehl	14,6	2,4	68,7	—	323	—
Roggenmehl 70—95%, Kleie	15,5	3,2	29,4	—	214	—
Weizenmehl 1—30%, feinstes	11,6	0,9	71,5	—	349	—
Weizenmehl 30—70%, zweites	13,3	2,2	69,8	—	361	—
Weizenmehl 70—75%, drittes	17,1	3,5	61,2	—	354	—
Weizenmehl 75—80%, Nachmehl	17,9	4,0	50,3	—	316	—
Sonstiges Mehl						
Buchweizenmehl	8,3	2,1	74,6	—	359	—
Grünkornmehl, Dinkelmehl	8,9	1,8	76,3	—	366	—
Kartoffelstärkemehl, Kartoffelstärke, DPM (Deutsches Puddingmehl)	—	—	—	—	—	—
Kartoffelwalmehl	0,9	—	—	—	—	—
Maismehl	6,7	0,2	80,0	—	335	—
Maisstärkemehl	9,6	3,1	71,7	—	362	—
Reisstärkemehl	0,5	—	—	—	—	—
Reisstärke	0,8	—	86,2	—	353	—
Sojamehl, entfetet	52,2	1,2	29,9	—	348	—
Sojamehl, Vollsojamehl	42,5	19,9	24,3	—	459	—
Süßholzwurmel aus gelben, geschälten Süßholzwurmel	55,6	6,6	23,0	—	384	—
Weizenstärkemehl	1,1	0,2	84,1	—	351	—

Beh. 11 zur Zeitschrift „Die Ernährung“

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß g	Fett g	Kohlehydrate			
			g	g		
e) Nahrungsmittel und ähnliche industrielle Erzeugnisse						
Nährmittel i. D. ¹⁾	9,2	1,9	74,9	362	—	—
Kindernährmittel i. D.	17,1	5,6	69,9	409	—	—
Kindernährmittel auf Getreidebasis i. D.	17,4	4,5	75,2	413	—	—
Kindernährmittel auf Milchbasis i. D.	14,7	15,5	39,8	368	—	—
Puddingpulver i. D.	5,1	1,7	80,4	366	—	—
f) Getreidekaffee i. D.	6,5	1,4	30,1	163	37,6	—
100 cem Kaffeeaufguß	0,15	.	2,51	11	—	—

2. Brot und Backwaren

a) Brot, i. D.	7,2	1,0	50,5	246	—	—
Roggenbrot aus R-Mehl Type 997	5,8	0,8	53,3	251	—	—
Roggenbrot aus R-Mehl Type 1150	6,4	1,0	52,2	250	—	—
Roggenbrot aus R-Mehl Type 1370 (Kornmischbrot)	6,6	1,0	51,7	248	—	—
Roggenbrotbrot und Roggenvollkornbrot aus Roggenbackmehl bzw. Roggenvollkornbrot Type 1800	7,4	1,1	50,4	247	—	—
und 20% W-Mehl Type 812	6,3	0,9	52,9	251	—	—
Weizenbrot aus W-Mehl Type 812	8,2	1,2	48,6	244	—	—
Weizenbrot aus W-Mehl Type 1050	8,5	1,2	47,8	242	—	—
Weizenbrotbrot bzw. Weizenvollkornbrot aus Weizenbackmehl bzw. Weizenvollkornbrot Type 1700	9,7	1,4	45,7	240	—	—
Weizenmischbrot aus 50% W-Mehl Type 812 und 50% R-Mehl Type 997	6,9	1,0	60,1	243	—	—
Knäckebröt	11,4	1,8	78,6	386	—	—

b) Backwaren

Weizenkiegelbäck (ohne Milch) aus W-Mehl Type 812	9,6	1,4	66,3	291	—	—
Weizenkiegelbäck (ohne Milch) aus W-Mehl Type 1050	9,9	1,4	57,2	288	—	—
Weizenviehback, gewöhnlich	9,9	5,2	78,2	410	—	—
Butterkekse (10,4 kg Weizenmehl, 1,2 kg Butter, 1,6 kg Zucker, 3,2 Liter Vollmilch)	9,1	9,3	70,2	412	—	—
Stollen (Milch, Mehl, Eier, Zucker, Butter, Rosinen)	8,3	19,0	47,1	404	—	—
Lebkuchen, Nürnberger	9,0	4,3	80,4	407	—	—
Apfelkuchen (300 g Mehl, 130 g Zucker, 130 g Butter, 1 Ei, 60 g Mandeln, 640 g Apfel)	4,5	12,1	36,6	282	—	—
Honigkuchen	5,3	0,8	75,3	330	—	—

¹⁾ Gewogener Durchschnitt aus Grieß, Graupen und Grütze, Haferflocken, Grünkern-, Maisstärkemehl, Kartoffelsago, Teigwaren und Reis.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	%
	Eiweiß g	Fett g	Kohlehydrate			
			g	g		
3. Teigwaren						
Makkaroni, Nudeln, Suppeninlagen	9,6	1,0	75,9	360	—	—
Eier-Makkaroni, Eier-Nudeln usw. mit 4 Eidottern auf 1 kg Weizengrieß	10,6	2,9	73,0	370	—	—
Eier-Makkaroni, Eier-Nudeln usw. mit 2,5 Eidottern auf 1 kg Weizengrieß (seit Dezember 1935 übliche Eierteigware)	10,2	2,2	74,1	366	—	—

4. Zucker und Zuckerwaren, Honig

a) Zucker und Sirup						
Rübenzucker, Kochzucker	—	—	99,8	409	—	—
Speisesirup ¹⁾	9,5	—	64,5	303	—	—
b) Hartzuckerwaren (Bonbons) i. D.	0,6	0,1	94,3	390	—	—
Fruchtbonbons	0,3	0,1	96,9	399	—	—
Karamellen, ungefüllt	—	—	94,3	387	—	—
Bonbons, bessere	1,6	0,2	91,9	386	—	—
Bonbons, gewöhnliche	0,7	0,2	93,9	390	—	—
c) Honig						
Bienenhonig	0,4	—	81,0	334	—	—
Kunsthonig, Invertzucker sirup	0,2	—	73,5	302	—	—

5. Kartoffeln

Kartoffeln						
mit Schalen: gekocht geschält	1,8	0,2	18,6	86	11,0	—
ungekocht geschält	1,5	0,2	15,7	72	25,0	—
Durchschnitt (städtischer Verbrauch) ²⁾	1,6	0,2	17,1	79	18,0	—
Durchschnitt (Gesamtbevölkerung)	1,5	0,2	16,3	75	21,9	—
ohne Schalen	2,0	0,2	20,9	96	—	—
Trockenkartoffeln	7,6	0,3	77,1	350	—	—

6. Hülsenfrüchte, getrocknet

Hülsenfrüchte, reif getrocknet, i. D. ³⁾	24,7	1,9	52,2	333	—	—
Linsen	24,0	1,9	52,8	341	—	—
Erbsen, gelbe, ungeschält	23,4	1,9	52,7	330	—	—
Erbsen, gelbe, geschält	26,0	2,0	57,0	359	—	—
Ackerbohnen (Puff-, Futter-, Sau-, Pferdebohnen), ungeschält	25,7	1,7	47,3	315	—	—
Gartenbohnen (weiße Bohnen, Veits-, Speck-, Buschbohnen), ungeschält	23,7	2,0	56,1	346	—	—
Kichererbsen	22,6	5,1	66,1	370	—	—
Kichererbsen, geröstet	24,8	6,1	58,0	366	—	—

¹⁾ Siehe auch Kunsthonig.

²⁾ Ländlicher Verbrauch = Kartoffeln mit Schalen, ungekocht geschält.

³⁾ Nach deutscher Verbrauchsgewohnheit.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	/o
	Eiweiß g	Fett g	Frucht-saure g	Kohlehydrate g			Kalorien
9. Kakao und Kakaoverzeugnisse						
Kakaopulver.....	18,0	14,0	—	51,0	413	—
Speisechokolade.....	6,9	26,0	—	62,0	525	—
Pralinen i. D.....	5,1	16,2	—	69,7	457	—
Desertpralinen.....	3,6	12,4	—	74,8	437	—
Schokoladepralinen.....	6,6	20,0	—	64,7	478	—

Nahrungs- und Genußmittel	Spezif. Gewicht	Der genießbare Teil von 100 g Rohware enthält				Ex-trakt ³⁾ g	Kalorien
		Eiweiß g	Kohlehydrate ¹⁾ g	Al-kohol ²⁾ g	g		
10. Alkoholische Getränke							
a) Bier		0,4	—	3,8	4,5	20	
Stammwürzegehalt 12,0%.....							
b) Traubenwein							
Weiß- und Rotwein, deutscher, i. D.....	0,9965	—	0,1	7,6	2,3	8	
Weißwein, deutscher, i. D.....	0,9965	—	0,1	7,5	2,3	8	
Weißwein, Altreich, i. D.....	0,9964	—	0,1	7,6	2,3	8	
Baden.....	0,9964	—	0,1	6,8	2,0	7	
Elsaß.....	0,9961	—	0,1	6,5	1,9	7	
Franken.....	0,9972	—	0,1	7,0	2,2	8	
Hessen.....	0,9958	—	0,1	7,9	2,2	8	
Lothringen.....	0,9968	—	0,1	6,5	2,1	8	
Mosel und Saar.....	0,9963	—	0,2	7,4	2,3	9	
Nah.....	0,9953	—	0,2	8,2	2,3	9	
Niederdonau.....	0,9950	—	—	7,9	2,2	7	
Pfalz.....	0,9946	—	0,1	8,6	2,3	8	
Rheinbessen.....	0,9960	—	0,1	7,4	2,2	8	
Rhein- und Mangau.....	0,9977	—	0,2	8,1	2,9	11	
Steiermark.....	0,9994	—	—	8,4	3,1	11	
Württemberg.....	0,9983	—	—	6,6	2,0	7	

1) Bei Wein und Brantwein geben die Zahlen den Zuckergehalt an.
 2) Der Alkoholgehalt ist bei der Berechnung der Kalorien nicht berücksichtigt. Siehe die Erläuterungen S. 2.
 3) Bei Wein zuckerfreier Extrakt.
 4) Im Extrakt enthalten.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungsmittel	Der genießbare Teil von 100 g Rohware enthält				Berücks. Abfall	/o
	Eiweiß g	Fett g	Frucht-saure g	Kohlehydrate g			Kalorien
b) Südfrüchte, ganze Früchte, i. D. ¹⁾						
Ananas.....	0,7	—	1,6	10,8	53	31,8
Apfelsinen.....	0,3	—	0,4	8,8	39	37,0
Orangen.....	0,6	—	0,96	9,0	43	29,0
Bananen.....	0,9	—	0,26	15,5	68	12,0
Feigen.....	1,4	—	—	17,5	77	—
Grape fruit (Pampelmuse).....	0,6	—	4,0	3,4	30	27,0
Johannisbrot.....	5,3	—	1,0	63,9	293	7,4
Mandarinen.....	0,5	—	0,9	5,4	27	36,8
Zitronen.....	0,6	—	5,9	2,3	32	35,7
c) Hartschalenobst						
Nüsse und Mandeln i. D., handelsübliche Ware.....	9,7	30,6	—	6,1	349	47,2
Nüsse mit Schalen, lufttrocken, i. D.....	7,4	26,1	—	4,7	292	56,1
Edelkastanien, mit Schalen, lufttrocken.....	9,0	6,0	—	57,7	328	17,0
Haseelnüsse mit Schalen (lufttrocken).....	8,7	31,3	—	3,6	341	50,0
Haseelnüsse ohne Schalen, trockene Handelsware.....	17,4	62,6	—	7,2	682	—
Mandeln, süß, ohne Schalen, trockene Handelsware.....	21,4	52,2	—	13,2	637	—
Mandeln mit Schalen (lufttrocken).....	12,0	29,9	—	7,4	358	43,8
Paranüsse mit Schalen (lufttrocken).....	7,8	33,9	—	1,9	355	50,0
Walnüsse mit Schalen (lufttrocken).....	6,7	23,5	—	5,2	267	60,0
d) Obstdauerware						
Getrocknetes Obst i. D. ¹⁾	1,9	0,9	1,6	60,3	269	5,6
Äpfel mit Kernen.....	1,4	0,8	3,51	55,4	252	—
Birnen mit Kernen.....	2,2	0,7	1,0	58,9	260	—
Aprikosen mit Kernen.....	3,6	0,4	2,4	51,7	239	4,0
Aprikosen ohne Kerne.....	3,8	0,4	2,5	53,9	249	—
Pflaumen mit Kernen.....	1,9	0,5	1,72	51,4	230	13,8
Rosinen, Sultaninen, Malagatrauben.....	1,6	1,2	1,52	66,2	295	—
Korinth.....	2,8	1,3	1,14	77,3	344	—
Feigen.....	3,3	1,3	1,05	58,8	270	—
Datteln mit Kernen.....	1,9	—	0,6	72,4	307	1,3
Obstkonserven i. D.....	0,5	0,33	—	20,9	91	—
Apfelkompott.....	0,4	—	—	23,2	97	—
Birnen in Zucker.....	0,3	0,18	—	18,4	78	—
Zwetschgen in Zucker.....	0,5	0,52	—	23,3	102	—
Kirschen in Zucker.....	0,6	0,45	—	17,6	79	—
Mirabellen in Zucker.....	0,5	0,59	—	22,0	98	—
Obstkraut						
Apfelkraut, rheinisch.....	0,8	—	1,86	67,0	286	—
Marmelade i. D.....	0,7	—	1,09	65,2	274	—
Apfelmarmelade.....	0,4	—	0,71	57,5	240	—
Erbeermarmelade.....	0,6	—	0,75	68,2	285	—
Himbeermarmelade.....	1,1	—	1,26	68,5	290	—
Johannisbeermarmelade.....	0,5	—	1,61	65,3	275	—
Pflaumen-Zwetschgenmarmelade.....	0,8	—	1,14	66,6	280	—

1) Durchschnitt der wichtigsten Arten.

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungs- und Genußmittel	Spezif. Gewicht	Der genießbare Teil von 100 g Rohware enthält				Kalorien
		Eiweiß g	Kohlehydrate ¹⁾ g	Alkohol ²⁾ g	Extrakt ³⁾ g	
Rotwein, deutscher, i. D.	0,9966	—	0,1	8,1	2,5	9
Rotwein, Altreich, i. D.	0,9965	—	0,1	8,5	2,6	9
Ahr.....	0,9967	—	0,2	9,5	2,9	11
Baden.....	0,9968	—	0,1	7,6	2,5	9
Elsaß.....	0,9973	—	0,1	7,2	2,4	9
Lothringen.....	0,9972	—	0,1	6,3	2,1	8
Niederdonau.....	0,9958	—	—	8,7	2,6	9
Rheinbessen.....	0,9957	—	0,2	8,8	2,6	10
Rheingau.....	0,9960	—	0,1	9,3	2,8	10
Württemberg.....	0,9983	—	0,05	7,1	2,2	8
Rotwein, ausländischer						
Bordeaux.....	0,9958	—	0,2	8,2	2,4	9
Bulgarien.....	0,9943	—	0,1	9,1	2,4	9
Italien.....	0,9952	—	0,1	9,8	2,7	10
Südtirol.....	0,9934	—	0,15	9,1	2,2	8
Süßwein						
Malaga.....	1,0749	—	17,0	11,7	20,6	140
Marsala.....	1,0047	—	3,2	15,1	6,4	35
Portwein, rot.....	1,0217	—	7,6	15,5	9,5	63
Sherry.....	0,9932	—	2,4	16,2	4,1	24
Wermutwein, italienisch.....	1,0159	—	10,1	12,1	12,8	85
e) Obstwein						
Apfelwein, Altreich.....	1,0019	—	0,2	5,1	2,5	9
Apfelwein, Steiermark.....	1,0054	—	0,9	4,4	3,2	15
Johannisbeerwein, süß.....	1,0115	—	7,3	11,0	9,4	62
d) Schaumwein						
Deutscher u. französ. i. D.	1,0146	—	5,9	9,8	7,8	51
e) Brantwein						
Rum.....	—	—	—	31,4 ⁵⁾	—	—
Trinkbranntwein, gewöhnlicher (Kartoffel, Korn).....	—	—	—	26,4 ⁴⁾	—	—
Weinbrand (Kognak).....	—	—	—	31,4 ⁵⁾	—	—
Weingeist 100 Vol.-%.....	—	—	—	100,0	—	—

1) Siehe Fußnote 1 S. 17.
 2) Siehe Fußnote 2 S. 17.
 3) Siehe Fußnote 3 S. 17.
 4) 32 Vol.-%
 5) 38 Vol.-%

Teil I: Verbraucherstufe (Fortsetzung)

Nahrungs- und Genußmittel	Spezif. Gewicht	Der genießbare Teil von 100 g Rohware enthält					Kalorien
		Eiweiß g	Fruchtsäure g	Kohlehydrate ¹⁾ g	Alkohol ²⁾ g	Extrakt ³⁾ g	
II. Alkoholfreie Getränke							
a) Fruchtsäfte, Frucht-sirup	—	0,15	0,69	68,9	—	—	285
Himbeersaft (Himbeersirup)	—	0,36	6,70	2,98	—	—	36
Zitronensaft.....	—	—	—	—	—	—	—
b) Süßmoste							
Apfelsaft, unvergoren, ohne Zuckerzusatz.....	—	0,3	1,0	15,0	—	—	66
Traubensaft, unvergoren, ohne Zuckerzusatz.....	—	0,7	1,0	19,9	—	—	88
c) Sonstige							
Brausepulver.....	—	—	15,9 ⁴⁾	67,7 ²⁾	—	1,1 ⁶⁾	342
Fleischbrühe.....	—	0,8	—	0,6	—	1,0 ⁷⁾	15

1) Siehe Fußnote 1 S. 17.
 2) Siehe Fußnote 2 S. 17.
 3) Siehe Fußnote 3 S. 17.
 4) Zitronensäure.
 5) Saccharose.
 6) Ätherisches Öl.
 7) Fett.

Teil III: Reinsubstanztabelle

Teil III: Reinsubstanztabelle

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohlehydrate g	Kalorien
I. Tierische Nahrungs- und Genußmittel				
1. Fleisch und Fleischwaren				
a) Frisches Fleisch von Schlachtieren (ohne Inneren)				
Fleisch i. D.¹⁾				
Gesamterörkerung.....	17,5	21,5	0,3	273
Städtischer Verbrauch	18,0	18,8	0,3	250
Ländlicher Verbrauch	16,8	24,8	0,3	301
Schweinefleisch, ohne Knochen vom, fetten Tier²⁾				
Klasse I	17,5	23,9	0,3	295
Klasse II	15,0	32,4	0,3	364
Klasse III	16,0	30,5	0,3	350
Klasse IV	12,6	41,2	0,2	438
i. D.	16,0	29,3	0,3	339
Rindfleisch				
mager.....	20,6	3,5	0,6	120
mittelfett	19,9	7,8	0,4	156
fett.....	18,1	19,4	0,3	255
i. D.	19,7	9,6	0,4	172
Fleisch vom fetten Tier³⁾				
Klasse I	19,5	13,1	0,5	204
Klasse II	18,0	19,7	0,4	253
Klasse III	16,5	26,7	0,3	317
Klasse IV	18,5	18,1	0,4	246
Hackfleisch	15,3	8,7	0,4	145

¹⁾ Schweine-, Rind-, Kalb-, Schaf-, Pferde-, Ziegen-, Kaminchenfleisch und Geflügel im gewogenen Durchschnitt des Verbrauchs.
²⁾ Klasse I: Rücken, Kotelett, Schinken; Klasse III: Bauch;
 Klasse II: Kamm, Vorderhinken, Brust; Klasse IV: Kopf, Beine.
³⁾ Klasse I: Rinderbraten, Blume, Eck- Klasse III: Fehrlippe, Kamm, Querrippe, schwanzstück, Mittelschwanzstück.
 Klasse II: Unterschwanzstück, Bug, Klasse IV: Querrippenstück, Hossen, Dönnung Mittelbrust;

I. Tierische Nahrungs- und Genußmittel

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohlehydrate g	Kalorien
Kalb(fleisch¹⁾)				
Klasse I	19,9	7,7	0,4	165
Klasse II	19,8	8,8	0,4	165
Klasse III	19,3	10,4	0,4	178
Klasse IV	19,6	5,4	0,4	182
i. D.	19,7	8,5	0,4	181
Rind- und Kalbfleisch i. D.				
ohne Knochen	19,7	9,4	0,4	170
Schafffleisch²⁾				
Klasse I	17,2	26,8	0,3	321
Klasse II	14,4	33,5	0,2	372
Klasse III	18,4	24,0	0,2	291
i. D.	16,5	26,7	0,2	317
Pferdefleisch				
ohne Knochen	21,5	2,5	0,9	115
Lende.....	21,2	1,2	0,9	100
Ziegenfleisch, ohne Knochen	20,7	4,3	0,5	127
Kaminchenfleisch, ohne Knochen	21,0	8,0	—	161
Ziegen- und Kaminchenfleisch, ohne Knochen, i. D.	20,7	6,2	0,3	144
b) Inneren, Schlachtfette und Schlachtabgänge				
Inneren i. D. ³⁾	17,6	5,3	1,1	126
Herz, frisch, vom Rind oder Kalb	17,6	10,0	0,4	167
Leber, frisch, vom Rind oder Kalb	19,9	3,7	3,3	180
Leber, frisch, vom Schwein	19,5	5,3	2,5	139
Niere, frisch, vom Rind oder Kalb	18,4	4,5	0,4	119
Lunge, frisch, vom Rind oder Kalb	16,2	2,5	0,6	88
Milz, frisch, vom Rind oder Kalb	17,8	4,2	1,1	117
Zunge, frisch, vom Rind oder Kalb	15,8	17,7	0,1	230
Hirn, frisch, vom Kalb	9,0	8,6	—	117
Jus (Bratenfat, geliert)	2,5	9,0	—	94
Knochenmark, frisch.....	3,2	89,9	—	849
Schlachtfette				
Fettgewebe, frisch, vom Rind	1,2	89,0	—	833
Fettgewebe, frisch, vom Schwein	1,3	92,0	—	861
Schlachtabgänge				
Blut vom Schwein	18,4	0,1	0,1	77
Blut vom Rind.....	18,7	0,1	0,1	78
Blut vom Kalb.....	14,6	0,1	0,3	62
Schweineschwarte.....	35,3	3,8	—	180

¹⁾ Klasse I: Hals, Brust, Bauch;
 Klasse IV: Kopf, Fuße.
²⁾ Klasse I: Rücken, Kamm, Bug;
 Klasse III: Brust, Bauch, Hals, Kopf.
³⁾ Klasse II: Bug;
⁴⁾ Durchschnitt der wichtigsten Arten.

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohle- hydrate g	Kalorien
c) Fleisch und Wurstwaren				
Schweinefleisch, geräuchert (Gesaltes) i. D. ...	22,9	30,6	—	378
Ochsenfleisch, geräuchert	27,1	13,4	—	236
Pferdefleisch, geräuchert	31,8	6,5	0,9	195
Schinken, geräuchert	25,0	25,0	—	335
Speck, geräuchert und gesalzen	9,0	72,8	—	714
Speck, durchwachsen	14,0	51,0	—	532
Metwurst	19,8	43,7	—	488
Rindfleischwurst	20,5	32,9	—	390
Salami	27,8	48,4	—	564
Schinkenwurst	12,9	34,4	2,5	283
Zervelatwurst	22,2	46,9	0,1	528
Robwurst i. D.	21,6	45,4	0,1	511
Leberwurst	7,0	19,9	0,3	215
Blutwurst	14,2	44,5	0,2	473
Frische Leberwurst	12,9	25,1	12,0	336
Frische Blutwurst	10,0	10,0	20,0	216
Frische Wurst i. D.	10,9	14,4	17,7	251
Kochwurst i. D.	9,0	24,7	2,0	275
Jagdwurst	15,5	26,3	—	308
Brühwurst i. D.	15,5	26,3	—	308
Wiener Würstchen	12,5	13,7	—	179
Frankfurter Würstchen	12,5	39,1	0,6	417
Würstchen i. D.	12,5	14,0	—	181
Sülzwurst	22,6	22,3	—	300
Wurst i. D.	14,3	28,3	0,9	326
Rindfleisch in Büchsen	19,2	12,4	1,2	199
Gulasch in Büchsen	19,2	11,0	2,7	192
Corned beef	23,8	6,9	—	162
Fleischkonserven i. D.	20,7	10,1	1,3	184
Fleisch und Fleischwaren i. D.	17,2	23,5	0,6	292
Fleischaal	20,8	3,3	0,5	118
d) Wild i. D. (ohne Wildgeflügel)				
Hirsch, Keule	21,7	2,0	0,5	110
Reh	20,7	3,9	0,6	124
Wildschwein, Keule	21,6	2,4	0,5	103
Hase	23,1	1,1	0,5	107
e) Geflügel i. D.				
Gans, Mittel	18,6	15,9	—	224
Huhn, bratfertig	14,1	44,3	—	470
Ente, Hausier	20,8	4,6	—	126
Taube, bratfertig	22,1	1,1	0,5	103
f) Wildgeflügel				
Fasan	22,3	1,9	0,4	111
Feldhuhn, Rebhuhn	24,3	1,4	0,5	115
Wildente	22,7	3,1	0,5	124

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohle- hydrate g	Kalorien
2. Fische und Fischwaren				
a) Fische, frisch, städtischer Verbrauch				
See- und Süßwasserfische i. D.	18,0	2,7	—	99
b) Seefische, frisch				
Ganze Fische, i. D. des städtischen Verbrauchs	18,0	2,5	—	97
Aal (Flußaal)	12,2	27,5	—	306
Heilbutt	20,4	0,3	—	86
Hering	17,9	7,6	—	144
Kabeljau	18,1	0,2	—	76
Knurrhahn	18,8	2,4	—	99
Leugfisch	18,0	0,2	—	76
Makrele	19,8	5,2	—	130
Petermann	17,3	2,1	—	93
Rotbarsch	18,5	0,9	—	80
Rotzunge	17,4	0,2	—	73
Schellfisch	18,4	0,4	—	79
Scholle	17,7	0,8	—	80
Seelachs	19,1	0,4	—	82
Thunfisch	25,8	0,6	—	111
Wittling	17,2	0,2	—	72
c) Süßwasserfische i. D.				
Flußbarsch	17,1	5,7	—	123
Hecht	18,9	0,8	—	85
Karpfen	18,4	0,5	—	80
Plätze, Rotauge	16,7	9,8	—	160
Schleie	16,9	1,1	—	80
d) Fischdauwaren i. D.				
Geräucherter Fisch i. D.	20,9	15,3	0,8	231
Aal	21,3	13,7	—	215
Bückling	18,0	30,5	0,3	359
Makrele	21,7	15,7	—	235
Seelachs	21,4	14,5	—	223
Sprotten	22,2	1,2	—	102
Marinaden i. D.	17,2	19,8	—	255
Bismarckhering	20,2	14,8	1,1	225
Marinierter Hering	23,2	15,5	1,5	245
Rollmöps	18,8	14,7	0,8	217
Fischkonserven i. D.	19,8	14,8	0,9	223
Hering in Gelee	21,6	14,9	1,0	231
Aal in Gelee	18,2	15,5	0,7	222
Ölsardinen	18,0	17,2	0,5	236
Salzhering (Pökelhering)	23,9	14,3	1,3	236
Stockfisch	20,5	16,7	1,3	245
Klappfisch	81,9	2,7	—	361
Salzfisch, Laberdan	43,1	1,5	—	191
	24,4	1,1	—	110

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten				Kalorien
	Eiweiß g	Fett g	Kohlhydrate g		
e) Schältere					
Krabben mit Schalen	15,8	1,3	2,3		86
Miesmuscheln mit Schalen	8,9	1,4	2,2		59
f) Fischsalate					
Heringssalat	6,6	5,3	17,6		149
Fischsalat	13,8	1,3	0,7		72
3. Eier und Eierzeugnisse					
a) Analysenwerte je 100 g					
Hühnerrei	14,1	12,3	0,6		175
Eiweiß (Eiklar)	12,8	0,3	0,7		58
Eigelb (Eidotter)	16,1	31,7	0,3		362
Trockenei (Volles)	43,2	40,9	2,0		566
Trockeneiweiß	73,4	0,3	4,0		320
Trockeneigelb	35,1	53,2	1,0		643
Eitenei	12,8	15,0	0,3		193
b) Analysenwerte je Stück					
Hühnerrei der Klasse B = 57 g i. D. ¹⁾	8,0	7,0	0,3		99
Eitenei im durchschn. Gewicht von 59,8 g.....	7,6	9,0	0,2		116
4. Milch und Milcherzeugnisse					
a) Milch u. dgl.					
Kuhmilch:					
Vollmilch, 2,7% Fettgehalt	3,4	2,7	4,8		59
Vollmilch, 2,8% Fettgehalt	3,4	2,8	4,8		60
Vollmilch, 2,9% Fettgehalt	3,4	2,9	4,8		61
Vollmilch, 3,0% Fettgehalt	3,4	3,0	4,8		62
Vollmilch, 3,1% Fettgehalt ²⁾	3,4	3,1	4,8		62
Vollmilch, 3,2% Fettgehalt	3,4	3,2	4,8		63
Vollmilch, 3,3% Fettgehalt	3,4	3,3	4,8		64
Vollmilch, 3,4% Fettgehalt	3,4	3,4	4,8		65
Vollmilch, 3,5% Fettgehalt	3,4	3,5	4,8		66
Vollmilch, 3,6% Fettgehalt	3,4	3,6	4,8		67
Vollmilch, 3,7% Fettgehalt	3,4	3,7	4,8		68
Vollmilch, 3,8% Fettgehalt	3,4	3,8	4,8		69
Vollmilch, 3,9% Fettgehalt	3,4	3,9	4,8		70
Entrahmtes Frischmilch (Magermilch) 0,1% Fettgehalt	3,7	0,1	4,8		36
Buttermilch, 0,5% Fettgehalt	3,7	0,5	3,7		35
Trockenerzeugnisse:					
Vollmilchpulver	25,2	26,8	37,0		504
Pulver aus entrahmter Milch (Magermilchpulver)	33,5	1,6	50,0		357
Milch W	30,7	0,3	51,0		338
Milch G	34,0	1,4	52,1		366

¹⁾ Nach den Ermittlungen der Reichsstelle für Eier besteht ein Ei der Klasse B im Durchschnitt aus 7,3 g Schale, 19,1 g Eidotter, 30,6 g Eiklar.
²⁾ Durchschnittlicher Fettgehalt der von den Molkeereien gelieferten Trinkmilch.
³⁾ Durchschnittlicher Fettgehalt der an die Molkeereien gelieferten Milch.

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten				Kalorien
	Eiweiß g	Fett g	Kohlhydrate g		
Rahm, Sahne:					
Kaffeerahm	3,5	10,0	4,0		124
Schlagrahm, 30% Fettgehalt	2,7	30,0	3,0		302
Kondensierte Milch (Vollmilch ohne Zucker)	8,0	9,3	10,9		164
Ziegenmilch	3,6	3,9	4,7		70
b) Butter und Butterschmalz					
Butter i. D.	0,9	80,0	0,9		751
Butterschmalz	0,1	99,8	0,1		929
c) Käse und Quark					
Fettgehalt i. T. o/o					
Käse i. D.	30,7	21,1	2,6		333
Doppelrahmkäse	19,6	37,8	1,4		438
Rahmkäse	24,3	32,0	1,9		405
Vollfettkäse ¹⁾	27,2	28,3	2,2		384
Fettkäse ¹⁾	27,8	25,0	2,6		357
Dreiviertelfettkäse ¹⁾	30	18,6	2,6		323
Halbfettkäse	37,8	10,3	3,1		263
Viertelfettkäse	38,4	4,4	3,4		212
Magerkäse weniger als	39,0	2,7	4,0		201
Quark, frisch					
aus abgerahmter Milch mit 0,8% Fettgehalt der Rohware	17,2	1,2	4,0		98
aus entrahmter Frischmilch mit 0,1% Fettgehalt der Rohware	17,6	0,1	4,1		90
II. Tierische und pflanzliche Fette, gemischte Lebensmittel					
1. Fette und Öle ⁴⁾					
Kunstspeisefett		99,0			921
Lebertran		99,7			927
Margarine	0,5	80,0	0,4		748
Rindertalg, ausgelassen	0,5	99,2			925
Schweineschmalz	0,3	99,4			926
Speisöl		99,5			925
Unvermishtes Pflanzenfett (Kokosfett, Palmöl, Nuss u. dgl.)		99,8			928
2. Suppenpräparate, Würzen und Hefe					
Hefe, frisch, gepreßt	16,2	1,3	5,5		101
Hefeextrakt i. D.	48,3 ⁴⁾				193
Nährhefe	52,0	3,0	25,7		346
Suppenwürfel, Suppentafeln u. dgl. i. D.	13,7	8,2	54,5		356
Suppenwürfel i. D.	30,5 ⁴⁾				122
Fruchtaufgaben (Pulver)	2,3	0,3 ³⁾	80,2		349
Süße Suppen (Pulver)	10,9	1,6	74,1		363
Soßenwürfel, Soßenpulver	11,0	9,2	54,3		353

¹⁾ Die Werte umfassen Hartkäse, halbfesten Schnittkäse und Streichkäse. ²⁾ Organische Substanz. ³⁾ Außerdem 2,4 g Fruchtzucker. ⁴⁾ Butter und Butterschmalz siehe „Milch und Milcherzeugnisse“; Rindertalg, Schweinefett, roh (Fettgewebe, frisch) siehe „Schlactfette“

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohl- hydrate g	Kalorien
III. Pflanzliche Nahrungs- und Genufmittel				
1. Getreide und Mühleerzeugnisse				
a) Ganzes Korn				
Roggen	11,2	1,6	69,1	344
Weizen	12,0	1,8	68,7	348
Hafer	10,3	5,3	59,7	336
Gerste	9,7	2,0	68,5	339
Mais	9,4	4,1	69,4	361
Buchweizen	11,4	2,7	58,8	313
Hirse (Rispenhirse)	10,6	3,9	61,1	330
b) Geschältes Korn				
Reis (Kochreis, poliert)	7,9	0,5	77,8	356
Gerstengraupen	11,8	2,7	74,5	379
Hafermehl (Floeken)	14,4	6,8	66,5	395
Buchweizen	10,2	1,9	71,7	353
Hirse (Rispenhirse)	10,5	4,3	68,2	363
c) Grieß, Grütze				
Weizengrieß Type 450 (Ausmahlung 0—57 ^o / ₁₀₀)	9,4	1,0	74,6	354
Maiszugrieß	8,8	1,1	78,0	366
Hafergrütze	13,4	5,9	67,0	385
Buchweizengrütze	10,6	1,5	70,1	345
d) Mehl				
Roggen- und Weizenmehl im volkw. D. einschl. Backschrot	9,6	1,5	72,4	350
im einzeinh. D. ohne Backschrot	9,1	1,4	73,3	351
neue Sorten				
Roggenmehl Type 997 (Ausmahl. etwa 0—75 ^o / ₁₀₀)	6,9	1,1	76,3	351
Roggenmehl Type 1150 (Ausmahl. etwa 0—80 ^o / ₁₀₀)	7,7	1,3	74,5	349
Roggenmehl Type 1370 (Kornmüllmehl, Ausmah- lung etwa 0—85 ^o / ₁₀₀)	8,0	1,4	73,9	349
Roggenbackschrot, Roggenvollkornschrot Type 1800 (Ausmahlung etwa 0—94 bzw. 98 ^o / ₁₀₀)	9,0	1,5	72,1	346
Roggenmehl i. D. einschl. Backschrot	7,9	1,3	74,2	349
Roggenmehl i. D. ohne Backschrot	7,5	1,2	74,9	349
Weizenmehl Type 812 (Ausmahl. etwa 0—78 ^o / ₁₀₀)	10,5	1,6	72,3	354
Weizenmehl Type 1050 (Ausmahl. etwa 0—83 ^o / ₁₀₀)	10,9	1,7	71,1	352
Weizenbackschrot, Weizenvollkornschrot Type 1700 (Ausmahlung etwa 0—94 bzw. 98 ^o / ₁₀₀)	12,6	1,9	68,2	349
Weizenmehl i. D. einschl. Backschrot	11,3	1,7	70,5	351
Weizenmehl i. D. ohne Backschrot	10,7	1,7	71,7	354
alte Sorten				
Roggenmehl 1—30 ^o / ₁₀₀ feinstes	5,9	0,6	75,7	340
Roggenmehl 30—60 ^o / ₁₀₀ zweites	9,7	1,2	67,5	328
Roggenmehl 60—65 ^o / ₁₀₀ drittes	12,8	2,2	60,9	323
Roggenmehl 65—70 ^o / ₁₀₀ Nachmehl	14,6	2,4	58,7	333
Roggenmehl 70—95 ^o / ₁₀₀ Kleie	15,5	3,2	29,4	214

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohl- hydrate g	Kalorien
100 ccm Kaffeeaufguß				
e) Nahrungsmittel u. ä. industrielle Erzeug- nisse				
Nährmittel i. D. ¹⁾	9,2	1,9	74,9	362
Kindernährmittel i. D.	17,1	5,6	69,9	409
Kindernährmittel auf Getreidebasis	17,4	4,5	73,2	413
Kindernährmittel auf Milchbasis	14,7	15,5	39,8	368
Puddingpulver i. D.	5,1	1,7	80,4	366
f) Getreidekaffee i. D.	10,4	2,3	48,3	262
100 ccm Kaffeeaufguß	0,15		2,51	11
2. Brot und Backwaren				
a) Brot i. D.	7,2	1,0	50,5	246
Roggenbrot aus R-Mehl Type 997	5,8	0,8	53,3	251
Roggenbrot aus R-Mehl Type 1150	6,4	1,0	52,2	250
Roggenbrot aus R-Mehl Type 1370 (Kornmüllbrot) Roggenbrot und Roggenvollkornbrot aus Roggenbackschrot bzw. Roggenvollkornschrot Type 1800	6,5	1,0	51,7	248
Roggenmischbrot aus 80 ^o / ₁₀₀ R-Mehl Type 997 und 20 ^o / ₁₀₀ W-Mehl Type 812	7,4	1,1	50,4	247
Weizenbrot aus W-Mehl Type 812	6,3	0,9	52,9	251
Weizenbrot aus W-Mehl Type 1050	8,2	1,2	48,6	244
Weizenbrot aus W-Mehl Type 1050 Weizenbrot bzw. Weizenvollkornbrot aus Weizenbackschrot bzw. Weizenvollkornschrot Type 1700	8,5	1,2	47,8	242
9,7	1,4	45,7	240	

¹⁾ Gewogener Durchschnitt aus Grieß, Graupen und Grütze, Haferfloeken, Grünkern-, Maisstärkemehl, Kartoffelsago, Teigwaren und Reis.

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohle- hydrate g	Kalorien
6. Hülsenfrüchte				
Hülsenfrüchte, reif, getrocknet, i. D.	24,7	1,9	52,2	333
Linzen	26,0	1,9	52,8	341
Erbsen, gelbe, ungeschält	23,4	1,9	52,7	330
Erbsen, gelbe, geschält	26,0	2,0	57,0	359
Ackerbohnen (Puff, Futter-, Sau-, Pferdebohnen) ungeschält	23,7	1,7	47,3	315
Gartenbohnen (weiße Bohnen, Veits-, Speck-, Buschbohnen), ungeschält	23,7	2,0	55,1	346
Kichererbsen	22,6	5,1	56,1	370
Kichererbsen, geröstet	24,8	6,1	58,0	396
7. Gemüse				
a) Gemüse, frisch, i. D. (einschl. Pilze)	1,7	0,3	5,0	30
Artischocken	2,0	0,1	7,5	40
Blumenkohl, Karfiol	2,4	0,3	4,5	31
Champignons	4,9	0,2	3,6	37
Chicorée	1,9	0,2	8,5	45
Chinakohl	1,5	0,3	0,9	13
Eierfrucht (Aubergine)	1,3	0,2	4,8	27
Endiviensalat	2,0	0,1	2,3	19
Erbsen (Schoten)	6,5	0,5	12,5	83
Eskariol	1,4	0,1	2,5	17
Fenchel	2,6	0,2	11,2	58
Flaschenkürbis	1,0	0,4	2,2	17
Gelbe Rübe, große Mohrrübe	1,2	0,3	9,1	45
Grüne Bohnen	2,6	0,2	6,4	39
Grünkohl, Köhl, Wintert Kohl	4,9	0,9	10,2	70
Gurken, mittelgroß, ungeschält (1 Stück = 170 bis 190 g)	0,8	0,3	1,4	12
Karotte, kleine (frühe) Mohrrübe	1,0	0,2	8,1	39
Kohlrabi (Oberkohlrabi)	2,5	0,1	5,8	35
Kohlrübe (Brassica napus)	1,4	0,1	7,5	37
Kopfsalat	1,5	0,3	2,0	17
Kürbis	1,1	0,1	6,5	32
Lauchporree	2,4	0,4	5,5	36
ganze Pflanze	2,8	0,3	6,5	41
Knollen	2,1	0,4	4,6	31
Blätter	1,2	0,3	3,9	24
Mairübe	9,4	4,1	69,4	361
Mais (Kolbenmais)	0,8	0,1	0,9	30
Melonen	3,4	0,4	4,5	36
Morchel (Speise-)	15,7	12,5	34,3	321
Paprika (ganze Frucht)	3,7	0,7	7,4	52
Petersilie	2,6	0,4	3,8	30
Pfifferling, Eierschwamm	1,1	0,2	0,9	10
Portulak, Bunzelkraut	6,7	0,4	4,2	48
Puffbohnen, Pferdebohnen	1,3	0,2	3,8	23
Radieschen	1,9	0,1	8,4	43
Rettsich	0,5	0,09	3,1	16
Rhabarber				

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Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohle- hydrate g	Kalorien
Weizenmischbrot aus 50% W.-Mehl Type 812 und 50% R.-Mehl Type 997	6,9	1,0	50,1	243
b) Backwaren				
Weizenkeimbäck (ohne Milch) aus W.-Mehl Type 812	9,6	1,4	58,3	291
Weizenkeimbäck (ohne Milch) aus W.-Mehl Type 1050	9,9	1,4	57,2	288
Käsekobrot	11,4	1,8	78,6	386
Weizenwieback, gewöhnlich	9,9	5,2	78,2	410
Butterkoks (10,4 kg Weizenmehl, 1,2 kg Butter, 1,6 kg Zucker, 3,2 Liter Vollmilch)	9,1	9,3	70,2	412
Stollen (Milch, Mehl, Eier, Zucker, Butter, Rosinen)	8,3	19,0	47,1	407
Lebkuchen, Nürnberger	9,0	4,3	80,4	404
Apfelkuchen (300 g Mehl, 130 g Zucker, 130 g Butter, 1 Ei, 50 g Mandeln, 640 g Apfel)	4,5	12,1	36,6	282
Honigkuchen	5,3	0,8	73,3	330
3. Teigwaren				
Makkaroni, Nudeln, Suppeneinlagen	9,6	1,0	75,9	360
Eier-Makkaroni, Eier-Nudeln usw. mit 4 Ei- dottern auf 1 kg Weizenmehl	10,6	2,9	73,0	370
Eier-Makkaroni, Eier-Nudeln usw. mit 2,5 Ei- dottern auf 1 kg Weizenmehl (seit Dezember 1935 übliche Eierteigware)	10,2	2,2	74,1	366
4. Zucker und Zuckerwaren, Honig				
a) Zucker und Sirup				
Rübenzucker, Kochzucker	—	—	99,8	409
Speisesirup ¹⁾	9,5	—	64,5	303
b) Hartzuckerwaren (Bonbons) i. D.	0,6	0,1	94,3	390
Fruchtbonbons	0,3	0,1	96,9	399
Karamellen, ungefüllt	—	—	94,3	387
Bonbons, bessere	1,6	0,2	91,9	385
Bonbons, gewöhnliche	0,7	0,2	93,9	390
c) Honig				
Bienenhonig	0,4	—	81,0	334
Kunsthonig, Invertzuckersirup	0,2	—	73,5	302
5. Kartoffeln				
Kartoffeln, ohne Schalen, i. D.	2,0	0,2	20,9	96
Trockenkartoffeln	7,6	0,3	77,1	350

¹⁾ Siehe auch Kunsthonig.

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Frucht- säure g	Kohle- hydrate g
Aprikosen.....	3,8	0,4	2,5	53,9
Pflaumen.....	2,2	0,6	2,00	59,6
Rosinen, Sulfaminen, Malagatrauben.....	1,6	1,2	1,52	66,2
Korinthen.....	2,8	1,3	1,14	77,3
Feigen.....	3,3	1,3	1,05	58,8
Datteln mit Kernen, getrocknet.....	1,9	—	0,6	73,4
Obstkonserven i. D.....	0,5	0,33	—	20,9
Apfelkompott.....	0,4	—	—	23,2
Birnen in Zucker.....	0,3	0,18	—	18,4
Zwetschgen in Zucker.....	0,5	0,52	—	23,3
Kirschen in Zucker.....	0,6	0,45	—	17,6
Mirabellen in Zucker.....	0,5	0,59	—	22,0
Obstkraut				
Apfelkraut, rheinisch.....	0,8	—	1,86	67,0
Marmelade i. D.....	0,7	—	1,09	65,2
Apfelmarmelade.....	0,4	—	0,71	57,5
Erdbeermarmelade.....	0,6	—	0,75	68,2
Himbeermarmelade.....	1,1	—	1,26	68,5
Johannisbeermarmelade.....	0,5	—	1,61	65,3
Pflaumen-Zwetschgenmarmelade.....	0,8	—	1,14	66,6

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Kohle- hydrate g	Wasser + Asche + Rohfaser + Theobromin
Kakaomasse.....	11,0	55,0	25,0	660
Kakapulver.....	18,0	14,0	51,0	413
Speisechokolade.....	6,9	26,0	62,0	525
Pralinen i. D.....	5,1	16,2	69,7	457
Dessertpralinen.....	3,6	12,4	74,8	437
Schokoladepralinen.....	6,6	20,0	64,7	478

9. Kakao und Kakaoverzeugnisse

Nahrungsmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Fett g	Frucht- säure g	Kohle- hydrate g
Aprikosen.....	3,8	0,4	2,5	53,9
Pflaumen.....	2,2	0,6	2,00	59,6
Rosinen, Sulfaminen, Malagatrauben.....	1,6	1,2	1,52	66,2
Korinthen.....	2,8	1,3	1,14	77,3
Feigen.....	3,3	1,3	1,05	58,8
Datteln mit Kernen, getrocknet.....	1,9	—	0,6	73,4
Obstkonserven i. D.....	0,5	0,33	—	20,9
Apfelkompott.....	0,4	—	—	23,2
Birnen in Zucker.....	0,3	0,18	—	18,4
Zwetschgen in Zucker.....	0,5	0,52	—	23,3
Kirschen in Zucker.....	0,6	0,45	—	17,6
Mirabellen in Zucker.....	0,5	0,59	—	22,0
Obstkraut				
Apfelkraut, rheinisch.....	0,8	—	1,86	67,0
Marmelade i. D.....	0,7	—	1,09	65,2
Apfelmarmelade.....	0,4	—	0,71	57,5
Erdbeermarmelade.....	0,6	—	0,75	68,2
Himbeermarmelade.....	1,1	—	1,26	68,5
Johannisbeermarmelade.....	0,5	—	1,61	65,3
Pflaumen-Zwetschgenmarmelade.....	0,8	—	1,14	66,6

1) Theobromin.

Teil III: Reinsubstanztabelle (Fortsetzung)

Nahrungs- und Genußmittel	100 g genießbare Substanz enthalten				
	Spezif. Gewicht	Eiweiß g	Kohle- ¹⁾ hydrate g	Alko- hol ²⁾ g	Ex- trakt ³⁾ g

10. Alkoholische Getränke

a) Bier	—	0,4	— ⁴⁾	3,8	4,5
Stammwürzegehalt 12,0%/o.....					
b) Traubenwein					
Weiß- und Rotwein, deutscher, i. D.....	0,9965	—	0,1	7,6	2,3
Weißwein, deutscher, i. D.....	0,9965	—	0,1	7,6	2,3
Weißwein, Altrreich, i. D.....	0,9964	—	0,1	6,8	2,0
Baden.....	0,9961	—	0,1	6,5	1,9
Elsaß.....	0,9972	—	0,1	7,0	2,2
Franken.....	0,9958	—	0,1	7,9	2,2
Hessen.....	0,9968	—	0,1	6,5	2,1
Lothringen.....	0,9963	—	0,2	7,4	2,3
Mosel und Saar.....	0,9963	—	0,2	8,2	2,3
Nabe.....	0,9950	—	—	7,9	2,2
Niederdonau.....	0,9946	—	0,1	8,6	2,3
Pfalz.....	0,9960	—	0,1	7,4	2,2
Rhein- und Mangau.....	0,9977	—	0,2	8,1	2,9
Steiermark.....	0,9994	—	—	8,4	3,1
Württemberg.....	0,9983	—	—	6,6	2,0
Rotwein, deutscher, i. D.....	0,9966	—	0,1	8,1	2,5
Rotwein, Altrreich, i. D.....	0,9965	—	0,1	8,5	2,6
Altr.....	0,9957	—	0,2	9,5	2,9
Baden.....	0,9968	—	0,1	7,6	2,5
Elsaß.....	0,9973	—	0,1	7,2	2,4
Lothringen.....	0,9972	—	0,1	6,3	2,1
Niederdonau.....	0,9958	—	—	8,7	2,6
Rhein- und Mangau.....	0,9957	—	—	8,8	2,6
Rheingau.....	0,9960	—	0,1	9,3	2,8
Württemberg.....	0,9983	—	0,05	7,1	2,2
Rotwein, ausländischer					
Bordeaux.....	0,9958	—	0,2	8,2	2,4
Bulgarien.....	0,9943	—	0,1	9,1	2,4
Italien.....	0,9952	—	0,1	9,8	2,7
Südtirol.....	0,9934	—	0,15	9,1	2,2
Süßwein:					
Malaga.....	1,0749	—	17,0	11,7	20,6
Marsala.....	1,0047	—	3,2	15,1	6,4
Portwein, rot.....	1,0217	—	7,6	15,5	6,3
Sherry.....	0,9932	—	2,4	16,2	4,1
Wermutwein, italienisch.....	1,0159	—	10,1	12,1	12,8
c) Obstwein					
Apfelwein, Altrreich.....	1,0019	—	0,2	5,1	2,5
Apfelwein, Steiermark.....	1,0054	—	0,9	4,4	3,2
Johannisbeerwein, süß.....	1,0115	—	7,3	11,0	9,4

1) Bei Wein und Brantwein geben die Zahlen den Zuckergehalt an.

2) Der Alkoholgehalt ist bei der Berechnung der Kalorien nicht berücksichtigt. Siehe die Erläuterungen S. 2.

3) Bei Wein und Brantwein zuckerfreier Extrakt.

4) Siehe Extrakt.

Teil III: Reinsubstanz tabelle

Teil III: Reinsubstanz tabelle (Fortsetzung)

Nahrungs- und Genußmittel	100 g genießbare Substanz enthalten				
	Spezif. Gewicht	Kohle- ¹⁾ hydrate g	Alko- hol ²⁾ g	Ex- trakt ³⁾ g	Kalorien
d) Schaumwein Deutscher und französischer i. D.	1,0146	5,9	9,8	7,8	51
e) Brantwein					
Rum	—	—	31,4 ⁴⁾	—	—
Trinkbrantwein, gewöhnlicher (Kartoffel, Korn)	—	—	26,4 ⁴⁾	—	—
Weinbrand (Kognak)	—	—	31,4 ⁴⁾	—	—
Weingeist 100 Vol.-%	—	—	100,0	—	—

Nahrungs- und Genußmittel	100 g genießbare Substanz enthalten			
	Eiweiß g	Frucht- säure g	Kohle- hydrate g	Kalorien

11. Alkoholfreie Getränke

a) Fruchtsäfte, Fruchtsirup				
Himbeersaft (Himbeersirup)	0,15	0,69	68,9	285
Zitronensaft	0,36	6,70	2,98	36
b) Süßmoste				
Apfelsaft, unvergoren, ohne Zuckerzusatz	0,3	1,0	15,0	66
Traubensaft, unvergoren, ohne Zuckerzusatz	0,7	1,0	19,9	88

¹⁾ Siehe Fußnote 1 S. 47.

²⁾ Siehe Fußnote 2 S. 47.

³⁾ Siehe Fußnote 3 S. 47.

⁴⁾ 32 Vol.-%.

⁵⁾ 38 Vol.-%.