Trends in Illness and Mortality

By Selwyn D. Collins, Ph. D.

Illness and mortality data for the United States and several foreign countries have been collected and summarized to show long-time trends. An analysis of these trends indicates particularly the effect of wars and their aftermath on the public health.

Sources of Data

Much information is available on trends of mortality among persons of specific ages and by detailed causes, but very little is available on trends of illness over any long period of time. It is true that many of the acute infectious diseases, such as diphtheria, scarlet fever, poliomyelitis, and smallpox, have been reportable to health departments for many years, but the incompleteness of the reports is generally recognized by health workers. Even more incomplete are the reports for the diseases for which there is nothing in the way of treatment or prophylaxis to be gained by reporting them.

Some information on trends of illness may be obtained from the records of organizations that include groups of individuals for whom medical care is provided. Institutions of various kinds and private schools come under this category, but the largest such organization is the United States Armed Forces. Since members of the armed forces receive complete medical care, a complete record of illness is usually made.

Other sources of continuous data on illness are the records of the various disability insurance associations in the United States and of compulsory sickness insurance in many countries of Europe. In most instances a doctor's diagnosis is available for each illness for which benefits are paid. Data from these sources, however, may be biased, since the regulations as to the types of illness covered and the minimum and maximum days of benefit allowable are changed periodically; this is particularly true of compulsory insurance administered by governments.

Sickness surveys of various kinds also provide data useful in determining trends of illness. In 1880 and again in 1890, a question on illness was included in the United States census schedule. Questions about persons in institutions of various kinds, and persons with various types of physical handicaps, mental defects, and diseases have been recorded and tabulated in considerable detail in some State censuses since 1890. In Ireland the decennial censuses from 1851 to 1891 all included questions on illness, as did the censuses of 1881 and 1891 in Australia. In addition there were special surveys in a few cities in the 1890's, and fairly numerous sickness surveys have been conducted since 1915 (*2*).

There are several difficulties, however, in obtaining trends from special surveys: (1) Successive illness surveys even when made by a single organization are seldom done in the

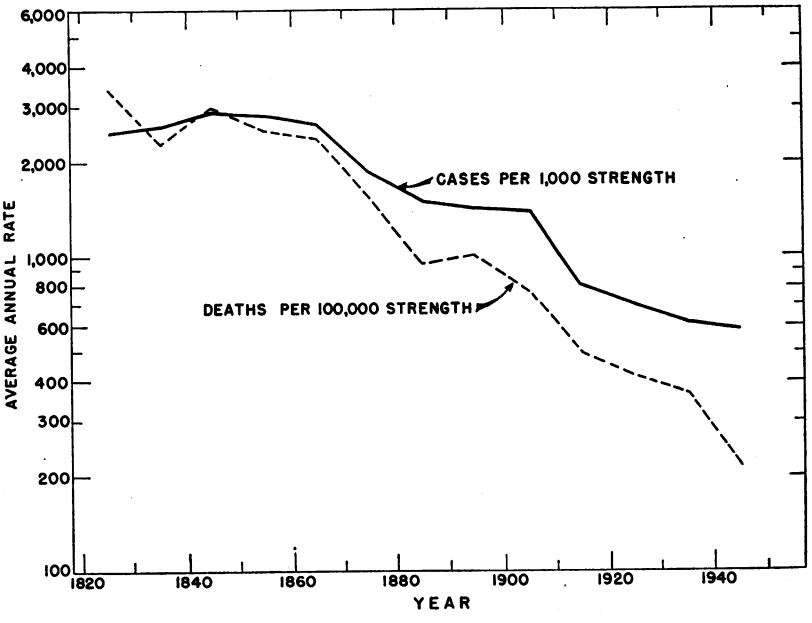

Figure 1. Trend of illness and mortality from all causes except battle casualties, U. S. Army, 1820–1949.

Average rates exclude 1833, 1834, and 1936 as not available, and 1847–48, 1862–66, 1918–19, and 1942–45 as war years or unreliable. Data in this and following charts for 1820–1940 are for enlisted men; 1941–49 data include officers.

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same manner and with the same questions; (2) even if the schedules and questions are uniform, the procuring of illness data by rather short interviews with the wife or head of the family is so difficult that careful training of the interviewer is an important factor in obtaining comparable data from different surveys; (3) since surveys are frequently made for special purposes, it is impracticable to use uniform schedules.

Armed Forces and Civilians

The longest series of data available on trends of both illness and death is for soldiers in the United States Army for the 130 years since 1820 (*6*). Figure 1 shows these data in average annual rates for 10-year periods. The war years, which usually show a high mortality from disease, have been omitted in the computation of the average rates. For easier comparison, the death rates are plotted as deaths per 100,000 soldiers, and the cases, as admissions to sick report per 1,000 soldiers. (Logarithmic scale is used.)

It is seen in figure 1 that illness rates decreased greatly over the 130-year period, but deaths declined even more rapidly, especially in the peacetime years of the last decade. It should be pointed out that these cases and deaths are from disease and accident only and not from battle injuries, and that they are for troops stationed in the United States. Moreover, the great majority of the soldiers are of the ages 20 to 30 years, which ages have low sickness and death rates.

Wartime Peaks

Figure 2 shows mortality and sickness data on a yearly basis for the armed forces, including data for the war years, but excluding data from both battle casualties and nonbattle accidents.

The mortality rates for disease only show striking changes; high peaks are seen for the Civil War, the Spanish-American War, and World War I. The predominant diseases causing the high case and death rates during the Civil War (*1*) and also the high 1898 peak of the

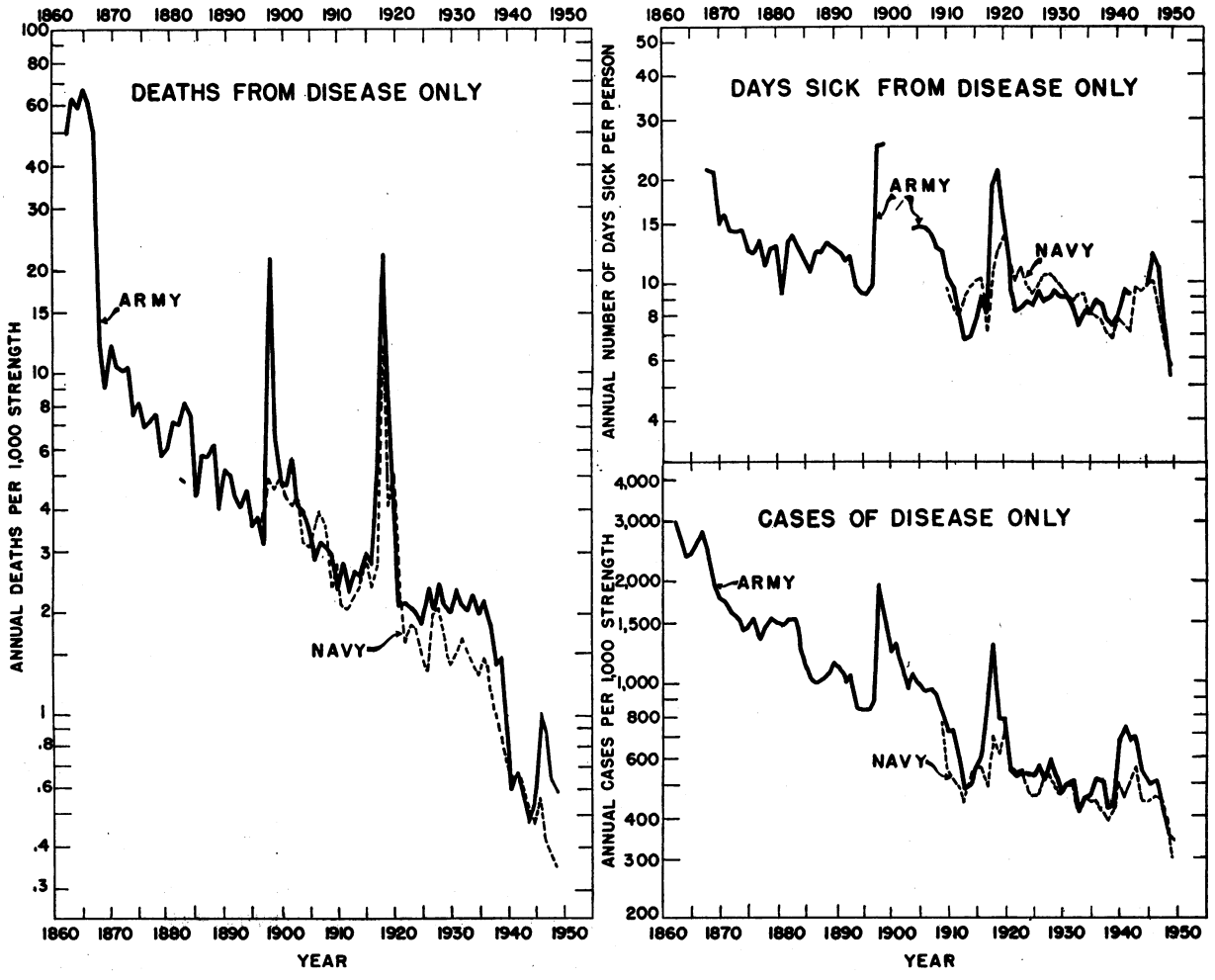

Figure 2. Trend of illness and mortality from disease only, U. S. Army, 1862–1949 (6); U. S. Navy and Marine Corps, 1897–1949 (7).

Spanish-American War were typhoid fever and the diarrheal diseases. The 1918 peak was almost entirely due to the great pandemic of influenza and pneumonia.

With the exception of two peaks, the death rates from disease in the Army declined rapidly after the Civil War until 1925. There was almost no decline, however, between 1925 and 1936; after that year there was a steep decline, which, with the exception of 1946 and 1947, continued until 1949, the last year for which data were available. The high rates of 1946 and 1947 may have been due in part to evacuees from overseas being brought to hospitals in the United States in 1945 and 1946.

The rates for the Navy and Marine Corps approximated those for the Army, although there was some decline in the period 1925 to 1936, but, as in the Army, a much steeper decline followed that year. Presumably a considerable part of this rapid decline in death rates in both services was due to the many improvements in therapeutics.

The lower right half of figure 2 shows cases of illness for armed forces personnel. There was a rather rapid decline in these rates from 1862 to 1896 when the build-up to the high peak of 1898 began; this decline continued at an even more rapid rate between the 1898 and 1918 peaks. It will be noted that the sickness peaks of 1898 and 1918 were both relatively lower than the mortality peaks. From 1921 to 1939 the decline in sickness rates was less steep than in the earlier period. There was a considerable rise in the rate for the years 1940 to 1943, followed by a drop which was particularly rapid from 1946 to 1949.

The upper right half of figure 2 represents the annual days of sickness per person in the Army and Navy. The 1898 and 1918 peaks were definitely present although each extended into the next year with rates as high as or higher than for the first of the two high years. In this measure of illness, in terms of days lost from duty, there is considerably less downward trend than in the rates for either cases or deaths.

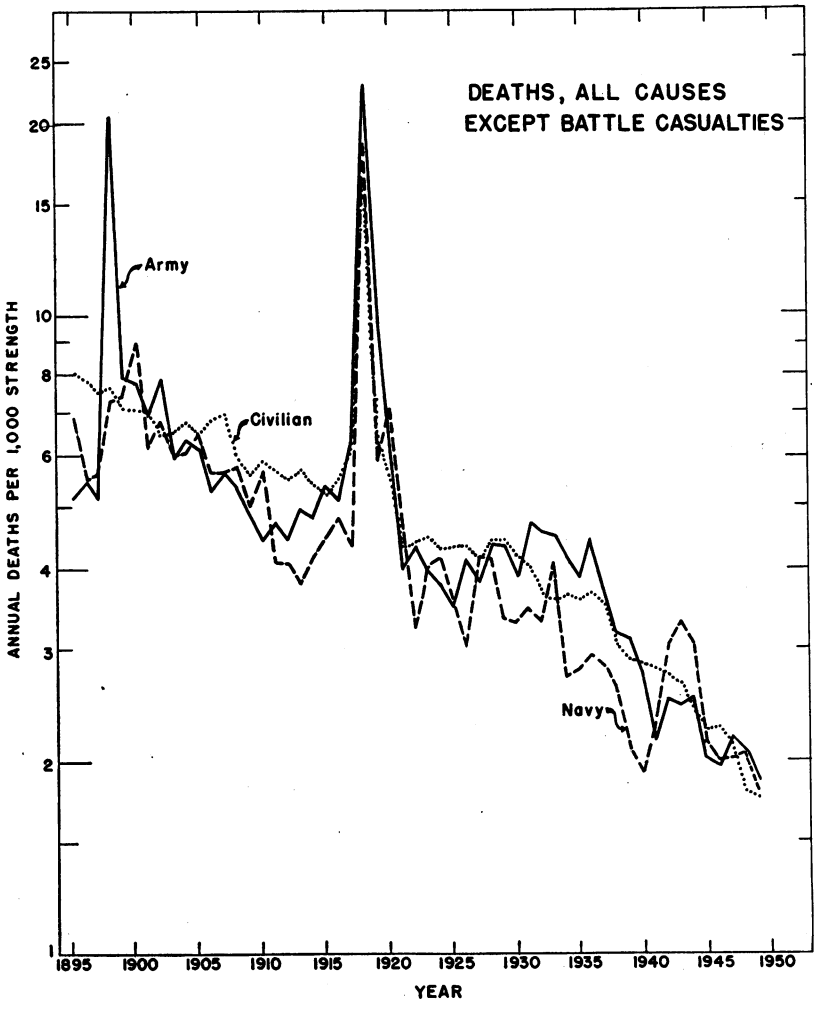

Figure 3. Trend of mortality from all causes except battle casualties, U. S. Army (6), U. S. Navy and Marine Corps (7), and civilian males of comparable ages, 1895–1949 (4, 5).

Comparison of Death Rates

Figure 3 affords a comparison of death rates for members of the armed forces with those for male civilians of approximately the same ages. To get a rate for a civilian group of comparable age with the military groups, simple averages of rates for males of the ages 15–24 and 25–34 were used. It is seen in the chart that the trend of mortality is roughly the same in the three groups, with the death rate among civilians in some periods tending to be somewhat higher than that among the armed forces personnel.

Illness Trends Among Industrial Employees

Data on the frequency of illness among industrial employees, as shown by absences from work, offer some measure of the trend of illness among civilians. The left half of figure 4 shows data for the approximately 3,000 employees of one large public utility establishment. From about 1920 to 1933 the rate of illness in this establishment tended toward a downward trend. There was little change in the rate from that date until 1940, when the rate for both males and females rose rapidly to a peak in 1946. After 1946 a definite drop occurred, but another small rise took place in 1950.

Data for a group of roughly 200,000 industrial workers (right half

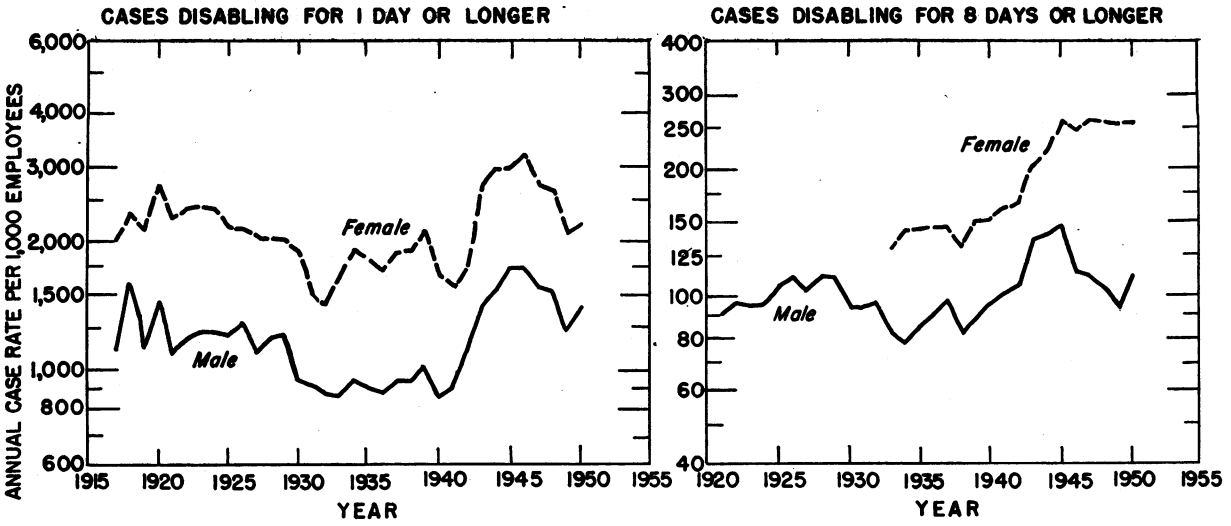

Figure 4. Trend of illness among selected groups of industrial employees, United States, 1920–50 (3).

of fig. 4) show the same downward trend from about 1928 to 1934. The downward trend was followed by a steep rise in the rate for males to a peak of 147 cases per 1,000 employees in 1945. In 1949 the rate dropped to 95 per 1,000, which was the approximate level of the rate for 1940; however, the 1950 rate showed another small rise. Among women employees there was a similar rise to a peak of 258 per 1,000 employees in 1945, at which approximate level the rate remained for the next 5 years.

The sharp rises in illness rates during the war years may have been a result of the inability to hire persons who were in the best physical condition, since the most healthy individuals were at that time in the armed forces. As the pressure for employees declined after the war, persons not in the best of health were probably the first to resign or to be dropped from employment. It is not clear why the rates of severe illness (8 days or longer) among women workers did not decline like those among men for both severe and mild cases and like those for mild cases among women.

Tuberculosis Mortality

Figure 5 shows the trend of tuberculosis death rates in many countries of the world from about 1910 to 1950, with data lacking from some countries at both ends of this period. A special attempt was made to determine the trend before World War I and also after World War II.

It will be noted that in nearly all of the countries where the intensity of the war was greatest (two top sections of chart), the tuberculosis mortality rates rose to a definite peak around 1918, the final year of World War I, and again around 1945, the climax of World War II. Following the World War I peaks the rates in most of these countries declined to a level that represents an approximate extension of the trend before the war. Similarly, after the peaks around 1945, the rates dropped rather sharply until by 1950 they were at or below the approximate level of a projection of the trend between the two wars.

The peaks for France and Belgium came in 1941, and the fairly small peak for Spain, in 1938. These dates are consistent with the trend of the war in those countries. England showed a smaller peak than the other warring countries, with the highest rate occurring in 1941.

In the countries that were at war but were geographically far removed from the areas of intensive fighting (lower right section of chart), the tuberculosis rates did not show any peaks that could be related to the war.

Although Scotland, Northern Ireland, Eire, and Finland (right middle section of the chart) were neither overrun by enemy forces nor particularly heavily bombed, the rates in these countries showed some increase in the years 1940–44.

In Portugal, Norway, Switzerland, Sweden, and Denmark, some of which were overrun but none of which were heavily bombed (lower left section of chart), there were evidences of retardation in the downward trends of tuberculosis mortality during the war years, but practically no peaks that could be attributed to war conditions.

Infant Mortality

The infant mortality rate is usually considered an index of economic and sanitary status which responds rather readily to environmental conditions. Figure 6 presents data that show particularly the influence of war conditions.

Noting first the two top sections of the chart, it is seen that there was in nearly every one of these countries a peak rate of infant mortality for some year during World War II. In a few countries, such as Austria, there was more or less of a build-up to that peak, but in other countries, there was little increase in the rate until the most intensive year of the war. For example, in the Netherlands there was a minor peak in 1941, but it was small compared with the high peak of 1945. Similarly, in

France there was a peak in 1940, but the peak in 1945 was higher. In both countries the rate declined rapidly in the 5 years following the peak, to a point not far from the projected interwar trend. In England and Wales there was a small rise in 1940 and 1941, but after that time the interwar downward trend continued at a slightly accelerated rate through 1950.

In the countries that were too far from the main theaters of war to be heavily bombed (lower right chart), no wartime peaks in the infant mortality rates occurred.

The middle right section of the chart includes data for countries that were near the European theater of war, but were not overrun or heavily bombed. Finland had its high peak in infant mortality in 1940 and a smaller peak in 1944. The moderate peaks in Scotland came in 1941 and 1943.

Neutral countries which were in or near the European theater of war, and some of which were overrun by enemy forces, experienced some moderate peaks in infant mortality. These peaks, however, occurred in the early part of World War II, and in none of these countries is there evidence of any exceptionally high peaks such as occurred in the Netherlands, France, Hungary, and Austria.

There seems to be a tendency toward fewer peaks in the countries

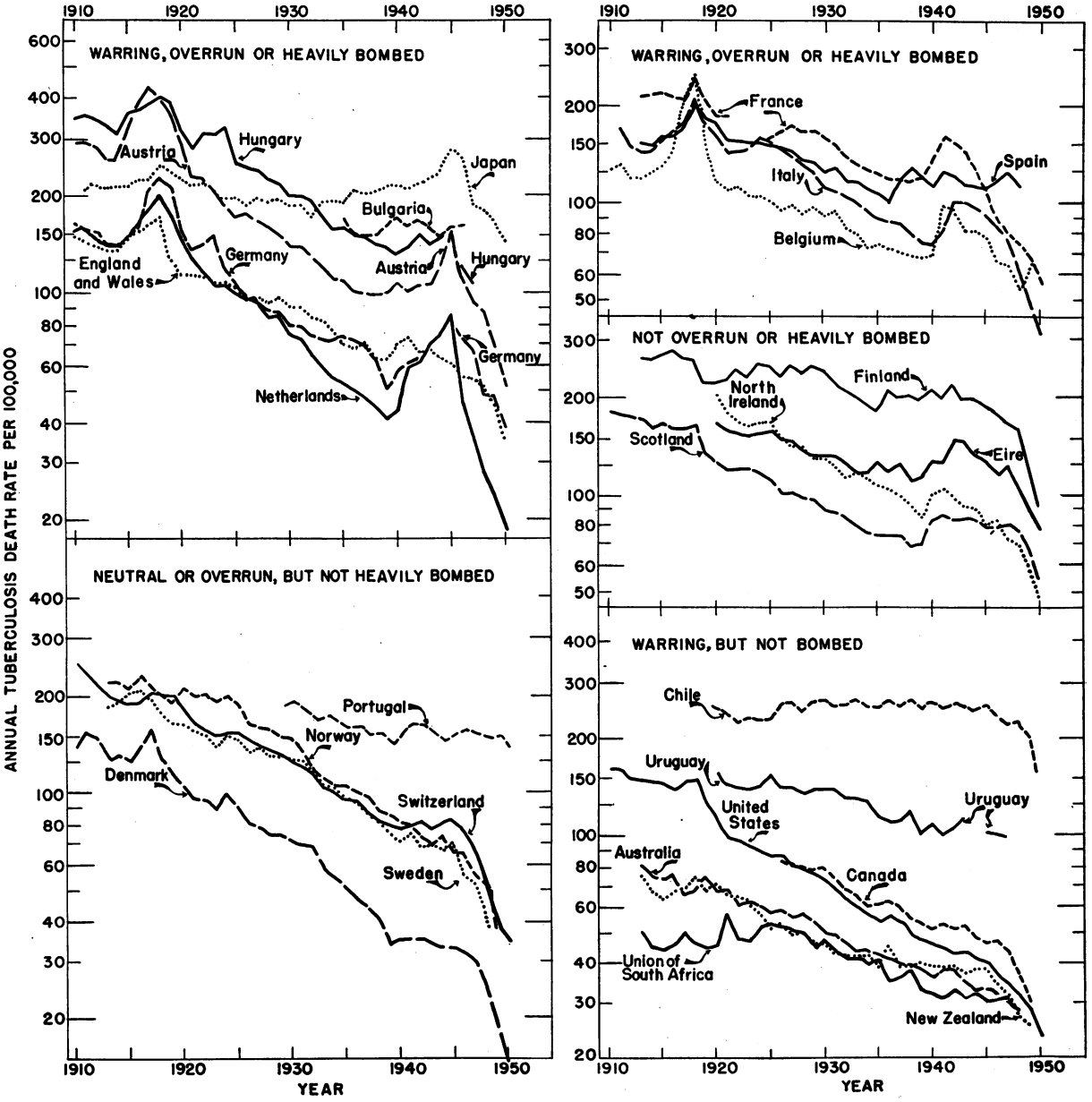

Figure 5. Trend of tuberculosis mortality, 1910–50 (8–10).

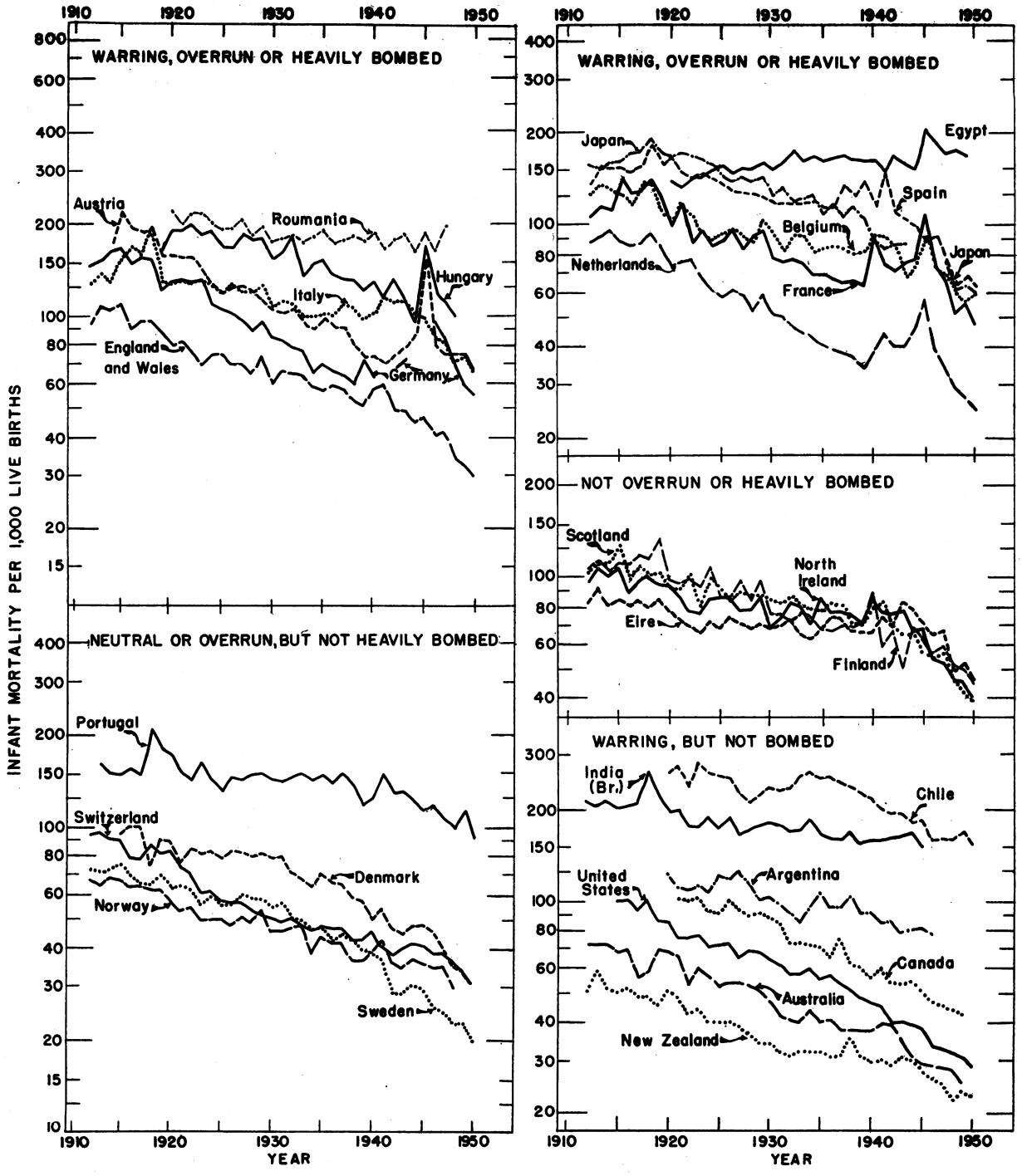

Figure 6. Trend of infant mortality, 1910–50 (8, 11).

where infant mortality is normally very high, such as Roumania, India, and Egypt.

Compared with the trend in tuberculosis mortality, infant mortality had a tendency toward a shorter build-up to the high wartime peaks and tended to decline in slightly shorter periods to near the prewar level. The build-up in the infant mortality rates was sometimes manifest only in a leveling off of the prewar trend, but the build-up in tuberculosis tended to be a definite rise in rates for several years preceding the peak.

Tuberculosis is an infectious disease and the patients are usually

sick for several years. In contrast, the sick baby does not count in infant mortality unless he dies within the first 12 months of his life. Since the severe conditions resulting from intensive warfare lasted several years, however, it would be expected that successive cohorts of infants experiencing the same severe conditions would each contribute something to higher death rates. However, nutrition is an important element in infant mortality, and food in many countries must have become more scarce as the intensity of the war was stepped up to its final culmination in 1945, when the highest infant mortality peaks occurred. Another factor of possible importance in saving infants may have been that an increased proportion of them were nursed rather than put on artificial feeding; even without an increase in nursing it may be that in the countries involved mothers normally nursed a high proportion of infants and thus kept infant mortality on a low level until the most severe years of the war.

Summary

Available data on trends of morbidity and mortality have been reviewed. Since 1820, both sickness and death rates in the armed forces have declined, but during wartime peak rates occurred. Data on the trend of illness among male and female industrial workers showed an increase in rates during World War II.

In the absence of data on morbidity from tuberculosis, the trend of mortality was shown. During both world wars there were high peaks in the tuberculosis mortality rates for most countries at war or overrun by invading armies. Tuberculosis death rates built up in a 3- or 4-year period to high peaks which occurred at the climax of the war but which were followed by sharp declines to rates that represented the approximate levels of extensions of the trend between the two world wars.

Infant mortality showed similar trends except that the rises to peaks tended to occur in shorter periods. In general, war conditions seemed to affect infant mortality somewhat less than tuberculosis mortality.

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Graduates in Sanitary Engineering

The number of graduates from undergraduate courses in sanitary engineering in the United States increased steadily from 1946 to 1950, but declined slightly in 1951. In 1946 there were 36 graduates; in 1947, 120; in 1948, 168; in 1949, 247; in 1950, 287; and in 1951, 244. The number graduated in 1951, however, is well above the average of 172 for the preceding 5-year period, according to the Division of Engineering Resources, Public Health Service.