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TUBERCULOSIS IN EUROPE DURING AND AFTER THE SECOND WORLD WAR

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Among the suggestions made by Dr. Milroy for the lectures on State medicine and public health which he established over 60 years ago is the following :

"XVIII . . . that more diligent and continued attention may be paid than has yet been attempted in this country to the study of the accurate *Geography of Diseases*, (and to) the exact date of each epidemic prevalence . . . of the ordinary endemic maladies in different countries and localities, together with a brief notice of any exceptional feature . . . characteristic of each aggravated manifestation of the malady in question, so that some record of its varying natural history may be preserved for the benefit of future times. The want of thoroughly trustworthy information on this department of professional investigation has had much to do with causing the numerous errors and fluctuations of opinion which have hitherto retarded the real progress of sound knowledge on various questions. An accurate geography of many diseases is often essential to the complete determination of their true natural history."

It is a sobering thought that these words, written in days when the epidemiological study of infectious diseases was still in its infancy, are as true of tuberculosis to-day as they were then. The amount of work that has been done on tuberculosis, and particularly the amount that has been published in the past 50 years, defies calculation ; but the number of sound epidemiological studies of the disease can easily be enumerated, and our knowledge of its natural history is still rudimentary. In fact, though there has been a progressive and striking reduction in tuberculosis mortality since the time of Dr. Milroy, it is still the main killing disease at the most productive ages of man. Dr. Stocks (1944) has estimated on the basis of a combination of morbidity and mortality statistics that in 1938 there must have been at any one time in England and Wales about 100,000 persons with clinically active pulmonary tuberculosis and about 650,000 in a quiescent state ; and of this total about 60,000 were expected to die eventually of the disease. Its effect on the productive capacity of the population is demonstrated by the fact that the mortality from the disease in England and Wales in 1945 represented a loss of 565,000 person-years of future lifetime between the ages of 15 and 65 (Stocks, 1949).

The nineteen-thirties and the early years of the war saw discoveries of so great importance in the treatment of acute infections and in the prevention of such diseases as typhus that they reduced to relatively low proportions the toll usually taken by war in disease. It had become a commonplace to compare the numbers who died in past wars from casualties in battle with those dying from diseases such as

typhus, dysentery, and typhoid. But for the second world war this does not apply ; though there were some epidemics of these diseases they did not reach anything like their former gravity and distribution. Tuberculosis rates, however, rose in every European country seriously affected by the war, and there is now a growing realization in Europe that tuberculosis is our main public health problem. A study of the trends of the disease during the war years may be of some value in contemplating future action.

With these considerations information is presented here on wartime and post-war tuberculosis trends, and on the development of tuberculosis services in different European countries since the end of the war. Much of the information was collected during service with Unrra ; the disturbing scenes one saw then aroused and focused interest on some of the problems to be discussed here.

DEATH RATES AND PREVALENCE*

Tuberculosis Mortality

When one presents statistics of tuberculosis in Europe it is with a feeling that they are better than no information at all, but not much better. There are countries in which as many as 50% of the deaths are not medically certified, and where 15 to 20% are registered as being due to unknown causes. Even in France as many as 10% of deaths are registered as of cause unknown. Most regional statistics within the European countries are unreliable ; in most cases the deaths are registered at the place where they occur and are not referred to the residential population. The fear of tuberculosis in backward populations is responsible for much evasion of tuberculosis certification. In addition to all this, one must take into account the many factors operating during war and the German occupation, conditions to make statistics of any kind many times less reliable than before. The drafting of men into military service or into forced labour for the Nazis, the Jews deported, the numbers taken prisoner of war or thrown into concentration camps ; the people who died away from their homeland by violence on the battlefield, in air raids, or in gas chambers, or of untreated diseases in camp or elsewhere ; the migration of millions during and after the liberation, including the return to their homes of prisoners of war many of whom had a high incidence of pulmonary tuberculosis : these factors combine to modify all statistics

*The first of two Milroy Lectures (abridged) delivered at the Royal College of Physicians on February 15 and 17, 1949.

FIG. 1.—Tuberculosis mortality in Europe, 1921-5.

obtained. So all the figures to be given here bear this reservation: they are the statistics that were obtainable in the circumstances, the circumstances of war and post-war.

Before looking at the trends of tuberculosis mortality during and after the second world war we can rapidly view the remarkable fall in the rates over the past 50 years. The tuberculosis death rates fell in several European countries from above 200 per 100,000 in 1885 to below 100 in 1935. The most striking fall was in Denmark; the rate there was one of the highest recorded in Europe in 1885, with a mortality of nearly 300, and in 1935 it was below 50. In most European countries, and particularly in Germany, Austria, and Belgium, there was a sharp rise between 1914 and 1918. A striking feature of the trends is that shortly after the end of that war the rate had declined to a level which it would normally have reached if the pre-war trends had continued uninterrupted.

The changes in the period between the two wars and during the recent war are demonstrated in the maps (Figs. 1-3). In Fig. 1 are charted the tuberculosis mortality rates in the countries of Europe in the period 1921 to 1925. It is obvious from this map that tuberculosis death rates in European countries were in the nineteen-twenties still very high according to present standards in all countries except Denmark; the mortality was highest in

Eastern Europe, France, Spain, Norway, and Ireland.

The second map (Fig. 2) demonstrates the striking change which had taken place by 1938. In England and Wales, Scotland, Belgium, Holland, Denmark, and Germany the tuberculosis mortality had fallen below 75 per 100,000, and in Norway, Sweden, Switzerland, and Italy it was below 100. In France, Spain, Portugal, and practically the whole of Eastern Europe the rates were still very high, though in Czechoslovakia and in Austria there had been some improvement. It is this particular picture that we must bear in mind in considering to what extent the tuberculosis situation was affected in the different countries by the conditions of war.

In Fig. 3 are charted the tuberculosis death rates for 1946. Statistics for some countries are as yet so incomplete that it has been necessary to leave them blank, but an outstanding feature is the relatively low rates in the whole of the mid-continent of Europe: in France and in Norway and Sweden the mortality was lower, than in 1938, in Germany and Scotland somewhat higher. We have figures as shown for Poland, Rumania, Hungary, and Bulgaria, and it is justifiable to assume that the tuberculosis mortality in the other Eastern European countries is as high as in these. Before the war the rates in these countries were among the highest in Europe.

FIG. 2.—Tuberculosis mortality in Europe, 1938.

FIG. 3.—Tuberculosis mortality in Europe, 1946.

Coming now to a study of what happened in each country during and after the war, we can consider three main groups of countries: one in which there was little or no wartime rise in tuberculosis mortality, a second group in which there was a rise in the early years of the war and then a continuous fall, and a third group in which there was a rise in the latter part of the war.

FIG. 4.—Tuberculosis mortality in European countries having little or no wartime rise, 1938-46.

I. Countries in Which there was Little or No Wartime Rise (Fig. 4)

In Denmark the rate was low in 1939 (rate 34) and slightly lower in 1945 (rate 33). It has the lowest tuberculosis mortality in Europe. At the beginning of the century the rate was as high as in most other countries. In the past 50 years there has been a very notable rise in living standards in this small country, and during the period between the two wars public social care was developed considerably. In this war Denmark fared better than most countries;

certain food supplies were limited, but there was never an acute shortage. In a number of other countries with particularly high tuberculosis rates before the war the rates remained high but there was no significant change, and Spain, Bulgaria, and Finland are typical of these. Switzerland had a medium rate, and, though there was an arrest in the decline of the pre-war years, there was no serious rise. Finally, in two countries, Norway and Sweden, there was a definite fall during the war years—in Sweden from 82 in 1938 to 51 in 1946, and in Norway from 88 to 65. There was a rise in 1943 and early 1944 in Oslo, attributed to a deterioration in the food supply.

II. Countries in Which the Rate Rose in the First Years and Fell in the Later Years of the War (Fig. 5)

The principal countries showing this trend are England and Wales, Belgium, Eire, and France.

In Belgium the rate rose from 69 to 98 in 1941 and fell subsequently to a level in 1946 just below that of 1938, and there was a further slight decline in 1947. There is enough in the chaos of the first two years of the war to explain the rise to a peak in 1941: the destruction and occupation of sanatoria, the discharge of patients to their homes, the breakdown of food distribution, the overcrowding and lack of hygiene. However, the central tuberculosis organization was re-established rapidly, after some opposition from the occupying authority, and by 1942 there were almost as many sanatorium beds available as before the war. Double rations were accorded by the dispensaries not only to patients with acute tuberculosis but also to those whose lesions had been active within the past five years. All things considered, there is enough to explain the rapid recovery after 1941, though it is important to note that the pre-war level had only just been reached in 1947.

In Eire there was a continuing rise until 1942-3; apparently Eire was the only neutral country in Europe to suffer from wartime conditions to this extent.

The death rates for France show an interesting phenomenon. The curve for the whole of France shows a rise in 1941 and a subsequent decline, at first gradual and then quite steep. The rate now is little more than half that for 1938. These trends were not the same throughout France. The curve for Paris shows the

FIG. 5.—Tuberculosis mortality in European countries in which the wartime rate rose and later fell, 1938-47.

general trend in an exaggerated form, with an acute rise from 155 in 1938 to 215 in 1941 and subsequently a very rapid fall to a level far below that of 1938 (72 in 1947). But other regions showed quite different tendencies. In Normandy, Brittany, and Eastern France there was an ample supply of animal food and milk, and in these regions, where there had always been a high mortality from tuberculosis, the rate declined throughout the war. In the South, on the contrary, in Bouches du Rhône, in Vaucluse, and in Var, the tuberculosis problem continued to be acute up to 1943, and this can be related to the very severe food shortages in these districts.

For France one must make reservations on the absolute value of mortality figures, but comparisons between years are valid. Apart from the striking feature of the differing reactions in various parts of France, the most outstanding is the very rapid decline of the death rate in France after the preliminary rise. This fall in the tuberculosis death rate is greater than for any other country in Europe. During the first years of the war the tuberculosis and the general death rates followed a similar course. But since 1943 the general death rate has remained higher than before the war; so the proportionate tuberculosis mortality in the department of Seine, for instance, went down from 13.5% in 1938 to 9.1% in 1945. For the whole of France it is now 6%, and this means in fact that it is approaching the level of relative importance that tuberculosis has in England as a public health problem. If we consider the pulmonary tuberculosis mortality separately we find an even more acute decline; the death rate from non-pulmonary tuberculosis was unchanged. It is important to note that this steep decline in the death rates from tuberculosis has been observed in most parts of the country; this is obvious in the most recent figures for separate large cities of France.

In England and Wales, as in Belgium and France, there was a rise in the first two years of the war, though less acute than in those countries. Obviously our experiences were less severe from many standpoints than those of the occupied countries, but in 1940 the air raids and the anticipated invasion, with evacuation of sanatoria from the danger areas and of hospitals to make room for air-raid casualties, combined to produce a situation highly favourable for the tubercle bacillus. The increase was 13% in the first two years. In this increase anxiety and overwork must have played an important part; there is evidence also that increased opportunities for infection were a major factor. The evacuation of hospitals and sanatoria, the black-out conditions, the overcrowding in homes because of air raids and billeting, the numbers of tuberculous patients drawn into industry, and the coming in contact with them of numbers of people who previously had led a relatively isolated life, must all have combined to increase infections greatly over the pre-war rates. There was in fact a marked increase among children under 5: between 1938 and 1941 deaths from respiratory tuberculosis went up 55% in boys and 105% in girls.

For meningitis in children up to 10 years there was an increase of 50%, and there is evidence that the majority of these infections were caused by the human bacillus. In mental hospitals in England and Wales, which already before the war showed an alarmingly high tuberculosis mortality—namely, 377—the rate increased by 140% to 901. Here the dominant factors must have been low nutrition and increased infection with overcrowding. Since 1941 the tuberculosis death rates in England and Wales have gradually declined, though they have not reached the level that would have been expected if pre-war trends had

continued uninterrupted. In children under 5 the death rate has remained above the level reached before the war.

III. Countries in Which the Death Rates Rose Through the War Years to a Peak at the End of the War

In Fig. 6 are shown the trends in several countries; the rates are those for large cities, as with the exception of Holland the overall national rates are not known. All show

FIG. 6.—Tuberculosis mortality in European cities, 1938-47.

the same type of curve with an acute drop at the end. All are countries which were most severely affected in the final years of the war.

In Holland the rise was greater in Amsterdam than in the rest of the country—this is the more important as between the wars the rate in Amsterdam had declined to a lower figure. Between 1939 and 1945 it rose 208%, compared with the rise of 111% for the whole country. There is no doubt that the worst suffering in Holland was during the fighting in the final year. In Amsterdam many died of starvation. The deaths from all causes in the first half-year, which in 1939 numbered 3,736, totalled 9,701 in 1945. Deaths from infantile diarrhoea were 4 in 1939, 38 in 1944, and 255 in 1945.

In both Hungary and Austria there was a very acute rise at the end of the war. In Budapest the food situation

was not bad during the war, but there was chaos during the final year, and inflation with an acute food shortage. A very similar situation developed in Vienna. The highest mortality in Vienna was in the working-class boroughs; in one of the boroughs where there were the worst housing conditions the death rate was 322 in 1945. In both cities there was a sharp drop after 1945.

For Rome the peak of mortality was in 1944, and the death rate subsequently fell steeply. A study of the mortality in different parts of Italy reveals some interesting factors, reflecting here as in France the differences in conditions. The trends up to 1942 are very similar; by then there was an increase in tuberculosis deaths of 36–41% for respiratory tuberculosis, 21% for other tuberculosis. For cities of Southern Italy the mortality then went down gradually; we can recall that this part of the country was little affected by the fighting after the invasion. In Northern Italy there was a fall in 1943 and 1944 and another rise in 1945 corresponding with the campaign at the end of the war. But in Central Italy, where the most severe war conditions prevailed and for the longest period of time, the death rate rose steeply in 1943 and 1944 to a rate 130% above that of 1939. Subsequently there has been a drop, but in 1946 the rate (83 for the whole of Italy) was still above the pre-war figure: if the rate of decline in pre-war years had continued, mortality in 1946 would have been about 50.

In Germany also conditions were worst in the final years of the war; the aerial bombing, the disruption of public health activities, and the breakdown in food supplies must have contributed to produce the acute rise in 1945 after a moderate rise in the preceding war years. In all areas there has been a fall in mortality since 1945. The situation is much graver in Berlin than elsewhere. Among reasons given for the greater mortality in Berlin are: during the war, the effects of continual as opposed to sporadic raids, and since the war the food difficulties—much more serious than in the British and United States Zones—and particularly the fact that Berlin has been cut off from use of its sanatorium beds, most of which were outside the city. In this respect the Zones were relatively well placed; Berlin was left with a little over 5,500 beds, or 0.7 bed per death, compared with over 2 beds per death in the British Zone. The exceptional opportunities for hospital treatment of cases in the Zones may well be responsible for at least a part of the post-war decline in mortality. The tuberculosis mortality in the Western Zones of Germany is well below that of many other European countries, including Scotland and Ireland. The most recent figures for 1948 show a continuing fall in all areas, including Berlin, where the rate for the first half-year was 30% below that for the first half of 1947.

Poland is one of the countries which already before the war had a high death rate from tuberculosis. Figures for the whole country are not available, but we know that in the cities with one exception the rate was over 150 per 100,000. Despite wholesale destruction by the Germans, some records were preserved, and it has been possible to trace the course of the disease through the grim years of the occupation. Already by 1941 the mortality from tuberculosis in Warsaw had increased by nearly 200% over 1938, and in Lodz the increase was 80%. These are the worst recorded tuberculosis death rates that we found anywhere; there is sufficient in the conditions of the occupation to explain the magnitude of the rise. The rate persisted at a very high level, increasing further until the end of the war, since when there has been a rapid fall, and in all towns the rate is now well below the pre-war level. For com-

bined figures of six main towns the most recent rate—for the year from mid-1947 to mid-1948—is 28% below the 1938 figure. In Katowice, a flourishing mining and industrial centre, the rate is now 63 compared with 101 pre-war.

There is less information on the mortality trends in Yugoslavia, but in the city of Ljubljana, which before the war had a particularly active tuberculosis control department, the death rate rose from 70 in 1940 to 263 in 1944.

Among the millions who died in concentration camps tuberculosis was only one of many causes contributing to death; but it was found in a very high proportion when the conditions in the camps were revealed at the liberation: 40% of necropsies at Dachau showed advanced tuberculosis. Of 64 cases of starvation studied in Belsen Hospital 27 had definite tuberculosis. At Buchenwald, Dachau, Nordhausen, and other camps, hundreds of tuberculous patients were taken out when the camps were liberated, many of them so ill that they died within a few days.

Tuberculosis trends in Scotland merit particular study, as this is the one country which, after having been seriously affected by the war, has shown no improvement in rates since the end of the war: there has even been a rise to a rate higher than the peak during wartime. Fig. 7 shows the death rates from respiratory tuberculosis between 1932 and 1946. The curve for the whole country shows the slow decline between 1932 and 1939 and the rise in the first year of the war; this level was maintained to 1945, since when there has been a further rise to a rate higher than in 1932. The combined rate for the large burghs shows a marked rise, and maintenance at a level well above 1932. The rate for the counties (excluding large burghs) showed a steeper decline in the pre-war years, a less marked but sustained increase during the war years, and in 1946 a rate still below the 1932 rate. The main part of the rise in Scotland is due to the rates in the cities, and it is interesting

FIG. 7.—Death rates from respiratory tuberculosis, Scotland, 1932–46.

to look at a few of these specifically. Fig. 8 shows the death rates from respiratory tuberculosis from 1920 to 1947. In Aberdeen there was a fairly consistent fall through out the nineteen-twenties and nineteen-thirties, a rise during the

FIG. 8.—Death rates from respiratory tuberculosis, Scottish towns, 1920–47.

war, and a fall since then to a level below that for 1939; this is similar to what is happening in England. In Edinburgh there was a slower decline in the pre-war years, a fall at the end of the war, then a rise. It is Glasgow which presents the main problem: with its population of one million—i.e., one-fifth that of the whole of Scotland—it plays a large part in determining the overall trends. The first striking fact is that the decline in tuberculosis rates was arrested during the nineteen-thirties. Secondly, the wartime rise was steep and has been maintained at a level as high as the 1921 rate. There is at present a commission studying the causes of these trends, and one can only underline the differences between the trends in Scotland and those in the rest of the continent of Europe.

Age and Sex Analysis of Death Rates

An interesting phenomenon in the wartime rise in tuberculosis has been the predominance of the rise in men, except in Scotland (Fig. 9). In some countries, in fact,

FIG. 9.—Respiratory tuberculosis death rates (male and female); showing predominance of the rise in men in Belgium and Denmark, compared with the trend in Glasgow.

the rise was confined to males. Even in Denmark, where the overall rate from pulmonary tuberculosis had remained stationary at the low rate of 29 throughout the war, analysis shows that this rate was composed of a rate in males rising from 28 to 33, and in females falling from 30 to 25. Similar trends were observed in Holland. In Belgium, where as in most other countries the rate in males was already higher before the war, the phenomenon is more striking. In 1941, at the peak of mortality, the increase over the 1938 rate was 49% in males and 36% in females. The subsequent decline was much slower in males: in 1944 the female rate had returned to the pre-war level, and by 1947 was 20% below; the male rate in 1944 was still 32% above the pre-war level, and did not reach it till 1947. There is much less difference between the sexes in the rates for non-pulmonary tuberculosis. In Italy there was a similar rise; whereas in 1939 the male death rate was 2% higher than in females, in 1946 it was 27% higher.

In France there was very little rise in the female rate in the years 1939–41, and a considerable drop subsequently at all ages. In males there was a very great increase at all ages, and a subsequent drop much below the 1935 rates. It is particularly marked in the 30–50 age group. The overall rise in the first two years of the war was 16% in females and 57% in males. A noteworthy feature of the remarkable fall in tuberculosis mortality in France is that it occurred in all age groups except young children and old people.

In Berlin, where as we have seen there was an alarming increase in tuberculosis, the increase was greater in men than in women, and occurred at all adult age groups. In Hamburg, if one compares the 1946 rate with that for 1939,

in females there was no increase, whereas in males the rate was nearly 50% higher in 1946 than in 1939.

In Scotland, on the contrary, there has been a greater increase in females than in males (in 1946–7 the respiratory tuberculosis death rate was 19% higher in males, 32% higher in females, than at the outbreak of war). In fact, the exceptional rise of rate in women is the main feature of the persisting high rate in Scotland when compared with the rest of Europe. An analysis of the data in age groups shows that in females the increase was predominantly in young women. In men the increase was wholly in the older age groups.

Many possible causes have been suggested for the excessive rise of mortality in males in countries other than Scotland. Certainly in part it may be due to the selection by the Services of healthy non-tuberculous members of the young adult population. But where rates are calculated on the whole population this does not apply; and, moreover, we have seen that the older age groups showed a greater rise than those affected by military service. Deterioration in working conditions and participation in outside work in civil defence duties in this country or in resistance movements in other countries may have played a part. In this respect, however, it is interesting to note that in the mental hospitals in England and Wales the increase was greater in males than in females and that it has persisted in males at a level 60% above 1939, whereas in females it is now back at the 1939 level. There, either added exposure to infection or undernutrition, or both, must be responsible. It has been suggested elsewhere that reaction to malnutrition is more severe in males than in females, but definite proof of this is lacking.

It is interesting to look in rather more detail at the age-group trends in each of the sexes. In Fig. 10 for England

FIG. 10.—Tuberculosis mortality in England and Wales at various ages (male and female, and including non-civilians), in 1931–5, 1938, and 1947. Respiratory tuberculosis only.

and Wales, where the rates are adjusted to include non-civilians, one sees first that in females a peak at ages 20–24 is maintained, and that there is a fall in all age groups, whereas in males the rates are lower in 1947 than in 1939 at all ages except young children and the over-fifties. This is part of a phenomenon which is being increasingly noted in other countries—namely, the maintenance of the acutely peaked curve in females with a maximum at ages 15–24, though with falling rates, and in males the rounded curve with high rates at all adult ages but a peak gradually shifting towards the older age groups. This phenomenon of the

shift of the peak to the older age groups in males has given rise to various hypotheses. A most interesting one is based on a statistical analysis of tuberculosis mortality in successive generations: the mortality in different age groups plotted on a generation basis shows little change in the type of curve through successive decades (Springett, personal communication).

Tuberculosis Morbidity

I have taken the tuberculosis death rate as the main index of tuberculosis trends. At present it is the most reliable index. Statistics regarding new cases diagnosed in dispensaries each year, or new notifications, or total cases known to the dispensaries at any one time are not lacking. But in the conditions of war these are practically valueless for comparative purposes, either for comparison between successive years in the same country or between different countries. Fig. 11 is characteristic. It shows for Belgium

FIG. 11.—Morbidity and mortality statistics, Belgium, 1938-47.

when rationing was very severe, the dispensaries were beset with people more or less asking to be diagnosed as tuberculous—and in the conditions of the occupation there was little reason why doctors should refuse. In France, too, the notification rate continued to rise at a time when the death rate was falling: in 1945 the total of new cases on the register was 45% above the 1938 figure, but the death rate was 20% below, and subsequently it continued to fall steeply.

The problem of assessment of tuberculosis prevalence by the morbidity rates has arisen again in the past two years in Germany. Alarming reports were issued pointing to a very acute rise in the numbers of notifications. It was said that, though the death rate was declining slightly, another rise would certainly occur. However, the death rate has continued to fall.

Thus even in the few countries in Europe where notification of tuberculosis is compulsory there may be very serious causes of error. The morbidity statistics may be of value in a country where tuberculosis is notifiable, where there is a well-defined and constant basis of notification, where the economic situation is not such as to influence the diagnosis, and at a time when new methods of examination are not being introduced. It is possible that much information may be derived from them in the future.

Results of mass radiography could conceivably provide more valid information concerning the prevalence of tuberculosis. No comparison can be made with pre-war prevalence, but comparison should be possible between different European countries, since, when properly employed, results should indicate what proportion of a community at any single time have lesions of pulmonary tuberculosis significant enough to require observation or treatment. The

method is being extensively used now for the early detection of tuberculosis, and it is tempting, despite variations in diagnostic interpretation, to compare in detail the results obtained in different countries. There are some gross differences that one cannot ignore—between on the one hand the Scandinavian countries, France, Germany, and this country, with an incidence of about 3 to 5 per 1,000 of active tuberculosis requiring treatment, and, on the other hand, countries like Greece and Poland, with an incidence of corresponding lesions in 10 to 50 per 1,000 of the populations examined. Mass-radiography examination of Frenchmen returning from Germany in 1945 revealed pulmonary lesions in 1.5% of prisoners of war, 2.5% of men coming from labour camps, and 4.4% of men from concentration camps. There can be no doubt from present-day surveys that there is a very high prevalence of tuberculosis in Eastern European countries. At the present stage of development of this method, however, it is probably not justifiable to make more detailed comparisons.

Statistical Analysis. Conclusions

Looking back over this collection of statistics, there are at least three outstanding features about which there can be little doubt, despite the reservations regarding the absolute validity of some figures. One is that the wartime rise was closely related to the severity of war conditions; the second that the rise predominated in men; and the third that in nearly all European countries there has been an important fall in tuberculosis mortality since the end of the war.

The study of trends in different countries has shown that the increase in tuberculosis was related to deterioration in conditions so closely, in time and in gravity, as to constitute a remarkable index of the wartime tribulations of those countries. That tuberculosis prevalence is closely related to living conditions and nutrition is no new conception and has been shown in several studies of under-privileged communities. The incidence of tuberculosis discovered by mass radiography in Polish university students is on the same level as the incidence of lesions discovered in homeless destitutes of New York City (Edwards, 1940).

In some ways the disaster was not as great as in previous wars; this applies particularly to the countries where public health services had developed to a high degree between the two wars. In former years the health and social services in peacetime were barely adequate to maintain a perilous state of equilibrium, and the disaster of war would so upset the balance as to produce chaos. This time, in countries such as our own, after the first crisis with the evacuation of hospitals the health and social services were rapidly re-established, and measures designed to protect the people's health were extended well beyond those of peacetime. It is to the credit of those responsible for planning the health and food services of the country during and after the war that the wartime attack on health was relatively well resisted. On the other hand, where the social and health services were relatively undeveloped before the war, where already before the war there were very high tuberculosis rates—and this applies to many of the Eastern European countries—the wartime reaction was nothing less than catastrophic, and was made even more so by the conditions of the German occupation.

There has been much conjecture regarding the nature of the wartime rise. The additional deaths could be of patients who under normal conditions would have lived a little longer; they could be of those patients who would normally have overcome their disease and survived. In both events the main factor responsible would be the

deterioration of living conditions and of nutrition aggravating the prognosis of established disease. Or, thirdly, the deaths could be of persons who were being infected for the first time in greater numbers than normally because of increased exposure. No doubt in most countries there was a combination of all three factors.

In this respect the post-war fall, and in particular the rate of fall, is worth studying. Were the wartime rise due solely to the premature death of patients suffering from the disease we would expect a steep rise followed by a deeper fall, and it is possible that this may occur where conditions are severe enough to precipitate the death of patients with a bad prognosis, but not to provoke any great extension of the disease. This may partly explain the remarkable fall in France, but other factors must intervene also.* In nearly all other countries, where the pre-war decline was resumed at the same level or a higher level than would have been observed normally, it is obvious from the plotted rates for both world wars that there were many thousands of deaths from tuberculosis which would not have occurred but for the war. To what extent these were due in the main to aggravation of disease from which the patient normally would have recovered, and to what extent to new infections, must remain an open question.

We are far from a complete understanding of the nature of the wartime and post-war trends in tuberculosis. The uncertainty of our conclusions regarding widely differing trends, in for instance France, England, and Scotland, underlines the need for sounder and more detailed epidemiological study of tuberculosis in the future. Such study is at any time indispensable to a rational programme for eradication of the disease; it is particularly so at a time when our resources are limited, and action must be directed towards those groups of the community revealed in this way as being most susceptible to the disease. It will certainly be indispensable in the future when improvement in social services reaches the limit of reduction of tuberculosis by such means and we are left with the need for a real understanding of the disease if any further progress is to be made.

[The second lecture, with a list of references, will appear in our next issue.]

*One possible factor is the fall in consumption of alcohol since the introduction of rationing of wines and spirits in France during the war. This was followed by a marked fall in morbidity and mortality from diseases attributable to alcoholism, a fall not paralleled in any disease other than tuberculosis.

A residential college—the Midwife Teachers Training College—has been opened for midwives training for the Midwife Teachers Diploma awarded by the Central Midwives Board. The college is at High Coombe, Kingston Hill, Surrey, and will accommodate 16 students at a time for courses lasting six months. The first course is expected to begin in January, 1950. Intending candidates, who must satisfy the requirements laid down by the Rules (Section C) framed by the Central Midwives Board under the Midwives Acts, should apply for places to Mr. G. Thomas, Secretary, Midwife Teachers Training College Council, 72, Great Peter Street, London, S.W.1. Selected applicants will be required to give the council of the college a written undertaking that if they qualify they will serve as midwife teachers within the National Health Service for at least two years. The Minister of Health hopes that hospital boards and committees will encourage midwives likely to make good teachers to take advantage of these facilities. Suitable intending students should not be dissuaded from taking the course on the grounds that the hospital in which they are employed has no prospective vacancies for midwife teachers, since the scheme is intended to benefit the midwifery services as a whole.

RISK OF NEUROLOGICAL COMPLICATIONS IN PERNICIOUS ANAEMIA TREATED WITH FOLIC ACID

BY

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The identification and synthesis of pteroyl- γ -glutamic acid (folic acid*) by Angier *et al.* (1945, 1946) led to the early recognition of its quite unexpected and remarkable effects in the treatment of pernicious anaemia (Moore *et al.*, 1945) and of nutritional macrocytic anaemia (Spies *et al.*, 1945).

The results in pernicious anaemia were very striking at first, as many workers reported, including ourselves (Wilkinson, Israëls, and Fletcher, 1946). It soon became evident, however, that even when the blood counts were restored to normal levels relapses were occurring, and signs of involvement of the peripheral nerves, such as paraesthesiae and numbness in the limbs, and of the spinal cord tracts, like ataxia and loss of vibration sense, might not be improved or might become worse.

Even more important, however, was the fact that some patients who had not previously shown signs of nervous system disturbances developed such signs, often very acutely, after being treated with folic acid for variable periods. Since 1946 several groups of workers have become aware of this disquieting fact, and in consequence the widespread enthusiasm for folic acid, at least for the treatment of pernicious anaemia, has been rapidly waning.

TABLE I.—Summary of Cases Reported as Developing Neurological Changes

Authors	No. of Patients Treated	No. Developing Neurological Symptoms and Signs	Neurological Symptoms Made Worse
Schwartz, Armstrong (1947) ..	69	4	—
Heinle, Welch (1947) ..	47	3	—
Heinle <i>et al.</i> (1947) ..	..	..	..
Spies <i>et al.</i> (1948) ..	..	..	..
Spies, Stone (1947) ..	38	28	7 (out of 19)
Vilter, Vilter, Spies (1947) ..	..	..	..
Vilter, Vilter, Hawkins (1947) ..	..	..	..
Ross, Belding, Paegel (1948) ..	22	9	4
Israëls, Wilkinson (1949) ..	20	13	3
Wilkinson (1948, 1949) ..	..	..	..
Keil (1947) ..	19	1	—
Davidson, Girdwood (1947) ..	16	1	—
Hall, Watkins (1947) ..	14	"A significant proportion"	—
Hall, Watkins, Hargraves (1946) ..	..	..	..
Wagley (1948) ..	10	8	—
Castle, Berk (quoted Wagley, 1948) ..	10	1	—
Bethell, Sturgis (1948) ..	6	1	—
Bethell <i>et al.</i> (1946) ..	..	..	..
Jacobson <i>et al.</i> (1948) ..	—	2	—

In Table I we have included all the available references to the development of subacute combined degeneration of the spinal cord in patients with pernicious anaemia, or the worsening of neurological symptoms already present, after treatment with pteroyl- γ -glutamic acid.

From a careful study of the various reports it was obvious that many of them referred to the same groups of cases, since some authors have published their results and cases in several journals, often without cross-references, and in some reports no details are given at all, other than

*In this paper folic acid is used synonymously with and refers to the synthetic pteroyl- γ -glutamic acid.