

Section of Epidemiology and State Medicine.

President—Dr. E. W. GOODALL, O.B.E.

Typhus Fever in Poland, 1916 to 1919.¹

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IN the summer of 1919, in response to an appeal from the Ministry of Public Health of the Polish Republic, the War Victims' Relief Committee of the Society of Friends decided to send a small unit to Poland in order to work under the Ministry in the campaign against the epidemic of typhus which the Ministry was setting in motion, and I was asked to take charge of the unit. I reached Warsaw on July 26, and remained in Poland till September 27. I spent the nine weeks I was in that country partly in Warsaw, partly and mostly in Zawiercie, a town in the south of Congress Poland, and paid visits to places in the neighbourhood of the last-named town. Such knowledge of the prevalence of typhus as I gained was derived chiefly from information given me by various officials of the Public Health Service, and partly from personal inquiry. But although I received great assistance from every official with whom I came in contact, from the Minister himself downwards, I wish to make it quite clear that in the disordered state of administration into which Poland was thrown by the events of the war, accurate information was by no means easily obtained, even by the authorities themselves, still less, therefore, by a stranger and foreigner. Consequently the figures I shall bring forward are to be regarded as being approximate only. I believe, however, that even a general statement will be interesting to the members of this Section, for I doubt if the medical profession in the west of Europe has the smallest knowledge of the extent to which typhus and other epidemic diseases have been devastating the unfortunate country of Poland. Moreover, there

¹ At a meeting of the Section, held April 23, 1920.

is no large body of statistics of notified cases of typhus in existence so far as I am aware, as by the time the notification of infectious diseases was introduced in the United Kingdom typhus had ceased to be prevalent. The *Transactions* of the Epidemiological Society and of the Epidemiological Section of the Royal Society of Medicine contain no statistical accounts of typhus epidemics, with the exception of Colonel Hunter's paper of last December, which dealt chiefly with the outbreak in the Serbian army in 1915.

The figures I shall put before you have been obtained from the following sources: (1) "A Memorandum on the Sanitary Conditions of Poland," by Dr. Tomasz Janiszewski, Minister of Public Health, published in March, 1919; (2) "A Memorandum on the Plan of Campaign against the Epidemic of Typhus in Poland," also by Dr. Janiszewski, published in June, 1919; (3) No. 4, vol. i (October, 1919) of the *Bulletin of the League of Red Cross Societies*, containing the Report of the Interallied Commission in Poland, and (4) information given me by Dr. Trenkner and Dr. Ryder, the Medical Officers of Health respectively of Warsaw and Zawiercie, and by Dr. Rajchmann, of the Epidemiological Institute, Warsaw, to all of whom I am under deep obligations.

Typhus fever was endemic in Poland and certain of the neighbouring countries for many years before the war. By Poland I mean what is now known as Congress Poland, which corresponds to what was known as Russian Poland. The neighbouring countries referred to are South-eastern German Silesia, Austrian Silesia, Galicia, and, in Western Russia, Lithuania, Polesia, Volhynia, and the Ukraine; and the countries to the east were sources of a never-failing supply, as indeed they still are. In the memorandum by Dr. Janiszewski on the plan of campaign against typhus, it is stated that the mortality from typhus in Congress Poland amounted during the last years before the war to an average of six per 100,000, a maximum of twenty-four per 100,000 having been reached in 1892-3 and in 1909; and that the number of cases varied between 6,000 and 7,000 yearly. Congress Poland has an area of about 50,000 square miles; its population in 1914 was about 12,800,000. As the Russian government did little, if anything, towards attempting to eradicate the disease, it was not, apparently, diminishing to any great extent in Russian Poland. In Galicia, however, under the Austrian government, the disease was systematically declining. The area of Galicia is about 30,000 square miles, and its population in 1914 was about 8,000,000. Then came the war, and, for reasons which will

be mentioned later, typhus increased enormously. In consequence of the disordered state of the machinery of the civil administration of the country brought about by the war, no figures that can be regarded as being even approximately accurate are available up to the end of 1915, except for the city of Warsaw; but there can be no doubt that an unusual prevalence began in 1915, especially in connexion with the movements of the Russian armies. Thus it is stated that in that year already there were in that small part of Galicia which was not invaded by the Russians, upwards of 8,000 cases of typhus, with much larger numbers of other infectious diseases.

As regards 1916 and after, for the parts of Congress Poland which were occupied by the Germans and Austro-Hungarians respectively, and for Galicia, the official figures given by the Germans and Austrians are as follows :—

CONGRESS POLAND.						
<i>German Occupation.</i>						
Year		Cases		Deaths		Fatalities per cent.
1916	...	16,460	...	1,269	...	7·7
1917	...	29,618	...	2,328	...	7·8
1918	...	73,380	...	5,670	...	7·7
(To November 1)						
<i>Austro-Hungarian Occupation.</i>						
1916	...	11,294	...	1,328	...	11·7
1917	...	10,446	...	1,175	...	11·2
1918	...	15,645	...	(?)	...	—
(To November 1)						
GALICIA.						
1916	...	6,784	...	883	...	13·0
1917	...	3,776	...	273	...	7·2
1918	...	8,057	...	814	...	10·1
(To November 1)						
TOTAL NUMBER OF CASES FOR THE THREE YEARS IN CONGRESS POLAND AND GALICIA.						
1916	...	34,538	...	3,480	...	10·0
1917	...	47,840	...	3,776	...	8·6
1918	...	97,082	...	—	...	—
(To November 1)						

It has been estimated that for Galicia and Congress Poland there were, during the whole year 1918, about 122,000 cases of typhus. The figures for 1919 are more accurately known, having been obtained by the Ministry of Public Health; they are as follows, up to December 31 :—

		Cases		Deaths		Fatalities per cent.
Congress Poland	...	161,042	...	12,632	...	7·8
Galicia	...	70,158	...	7,250	...	10·3
		<hr/>		<hr/>		<hr/>
Total	...	231,200	...	19,882	...	8·5

Thus, for the period January 1, 1916 to December 31, 1919, there were at least 431,200 cases of typhus fever in Congress Poland and Galicia combined. The number is probably higher, for there can be little doubt that not a few cases escaped being recorded, in consequence of difficulties brought about by the conditions of war; probably also the figures given by the Austrians are under-estimated, as the Austrian administration was not so efficient as the German. The disease still continues to be prevalent; during January and February of the present year 12,098 cases have been notified in Congress Poland, and 34,476 in Galicia.

It will be seen from these figures that there has been a great and progressive increase of typhus during the war, and also and especially since the armistice. There can hardly be any doubt about this, even when all allowances are made, including those for errors of diagnosis.

From a list of affected counties which is given in one of the memoranda referred to above it appears that the epidemic was widely spread and prevailed at one time or another, with varying attack rate, all over Poland in 1918. Early in 1919 the whole country was more or less invaded, but the districts that suffered most were those in the east, south-east, and south-west (county of Bendzin, which contains the mining districts). Galicia and Volhynia were also severely affected.

The figures just given are mass figures and afford no indication as to the progress of the epidemic, nor of the seasonal and regional prevalence, but I have detailed figures for the periods of the epidemics in Warsaw and Zawiercie, thanks to Dr. Trenkner and Dr. Ryder.

WARSAW.

Typhus has always been prevalent to a slight extent in Warsaw, as in Poland generally, but of recent years there had been no epidemic till 1917, during the German occupation. In that year the number of cases rose from seventy-five per week during the first week of January, steadily though not evenly, to about 410 in the first week in June. There was then a fall to 225 during the first week of July, and after that a gradual rise with, however, interruptions, to 550 in the second week in January, 1918. In consequence of a strike amongst

the subordinate public health officials of the city from January 13 to 19, the notifications were very irregularly recorded during that and the two following weeks, and there can be little doubt that a large number of the 809 cases recorded during the week ending February 2, should have been recorded and really occurred earlier. Probably the acme of the epidemic was reached in the week ending February 23, when 775 cases were recorded. The number of cases then fell somewhat abruptly, with a moderate rise at the beginning of April, to less than fifty cases a week early in July and twenty-five a week in August. The weekly notifications remained at about twenty-five till the week ending November 21, when they rose to seventy. They then fell, but gradually rose again early in January, 1919, and again the maximum, 200 to 225, was attained in February. From the middle of April there was a gradual fall to less than twenty-five a week in July. During the whole of the first epidemic, from January, 1917, to July, 1918, there were between 24,000 and 25,000 cases.

The city of Warsaw had at the time of the epidemic a population of about 700,000 persons. I understood that this figure did not include any of the German troops, but represented the civil, Polish, population only. The epidemic started in the Jewish quarter of the city, and at first spread chiefly amongst the Jews. According to Dr. Trenkner the same thing happened at Łódź, of which city he was medical officer before he was appointed to Warsaw in 1917, and in many other places in Poland. Dr. Janiszewski confirms this statement. In the Warsaw epidemic, 73 per cent. of the cases occurred amongst the Jews, and 23 per cent. of these in one particular part of the Jewish quarter where the population was most dense. In the other quarters the number of cases was in proportion to the number of Jews amongst the inhabitants. The Jews form 30 per cent. of the population of Warsaw. Roughly, the number of cases in the different districts was in proportion to the density of population, and the density is highest in the parts of the city inhabited by Jews.

Since the epidemic of 1917-18 typhus has become more widely diffused through Warsaw, but the 1919 epidemic, if it can be called such, was comparatively slight. Lately (1919) the Christians have been attacked in larger numbers than the Jews. The attack-rate of the 1917-18 epidemic was between 3 per cent. and 4 per cent., and the fatality was about 9 per cent. It is a curious fact that the fatality amongst the Jews was half that of the Christians, 7 per cent. as against 14 per cent. Dr. Trenkner accounted for this difference by the greater

care and attention the Jews bestowed upon their sick. They also called in medical advice earlier than did the Christians, so that their patients came under treatment sooner.

As regards age-incidence I was supplied with the following figures relating to 5,747 consecutive cases occurring at the end of 1917:—

Age		Cases		Deaths		Fatalities per cent.
0—10	...	908	...	7	...	0·7
—20	...	2,407	...	29	...	1·2
—30	...	1,035	...	43	...	4·1
—40	...	717	...	71	...	10·0
—50	...	513	...	86	...	16·7
—60	...	112	...	59	...	52·6
—70	...	50	...	19	...	38·0
—80	...	5	...	3	...	60·0
Total		5,747		317		5·5

It is evident that these figures relate to a period of the epidemic when the fatality was below the mean. The low fatality in children will be noticed. Dr. Trenkner told me that, amongst the 908 patients under 10 years of age, there were fifty-four infants under 18 months, and not one of them died. He had reason for thinking that a considerable number of cases in children escaped notification because of their mildness.

As regards the age-incidence these figures correspond fairly closely with those of the London Fever Hospital as given by Murchison, and also of the hospitals of the Metropolitan Asylums Board, in the days when typhus was met with in London. They are the only extensive statistics bearing on this point to which I have had access. In respect of the fatality at different ages, however, the Warsaw figures differ from Murchison's, for in the London Fever Hospital cases the fatality under 10 was higher than that between 10 and 20. But the Asylums Board figures agree with those of Warsaw.

ZAWIERCIE.

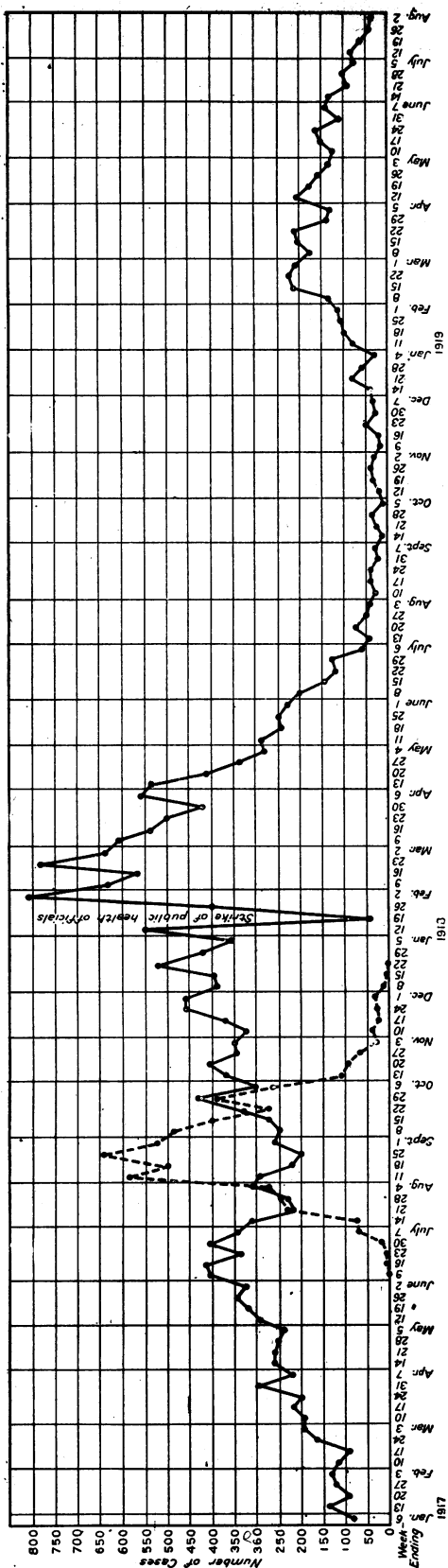
The daily figures for typhus from January, 1916, in this town have been given me, and I have charted the weekly total since that date. From these it appears that there was very little typhus during 1916 and 1917. There were slight rises in the number of cases in March, April, and October, 1916, and June, 1917. In 1918 there was a small

epidemic which, having started in November, 1917, attained its height in the following February and March, when there were nineteen cases for the week ending March 2, after which the numbers remained slightly raised, but with considerable weekly fluctuation, until August. The total number of cases from November, 1917, to August, 1918, were 198. Then followed a sharp epidemic which began in October, eleven cases for the week ending October 19. The rise in the number of cases continued with considerable weekly variations, and culminated in the week ending April 12, 1919, during which eighty cases were notified. The epidemic declined slightly more rapidly than it rose, though not evenly, to the end of July. During August and September the cases were being notified at the rate of one a day. The total number of cases from the beginning of October, 1918, to the end of July, 1919, was 1,340.

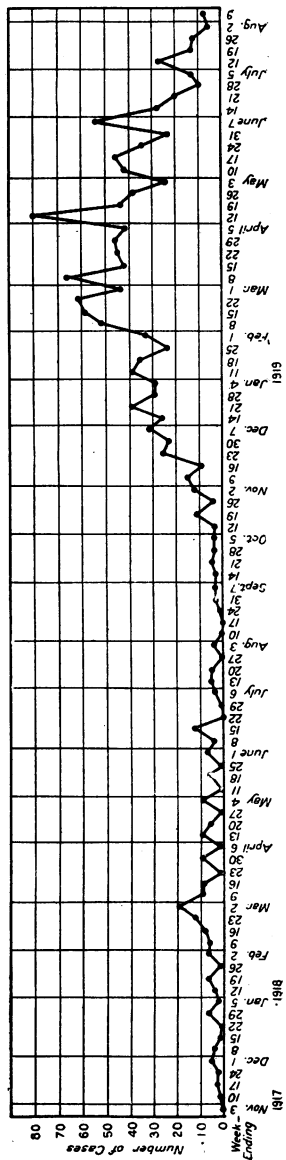
At the time of this epidemic the population of Zawiercie was about 44,600, so that the attack-rate was about 3 per cent. From official figures which were given to me it appears that the Jews formed 19 per cent. of the population. According to Dr. Ryder the Christians were attacked in a larger proportion than the Jews, as shown in the following table, which deals with about three-quarters of the epidemic and with the first six months of 1919 :—

	Males	Females	Total	Deaths	Per cent.	CHRISTIANS		JEWS	
						Cases	Per cent.	Cases	Per cent.
January ...	71	68	139	15	10·7	129	92·8	10	7·2
February ...	100	113	213	16	7·5	163	76·5	50	23·5
March ...	100	111	211	18	8·5	198	93·5	13	6·2
April ...	97	111	208	29	13·9	195	93·7	13	6·3
May ...	60	89	149	19	12·8	129	86·5	20	13·5
June ...	46	66	112	23	20·5	100	89·3	12	10·7
Totals ...	474	558	1,032	120	11·6	914	88·6	118	11·4

The Jews were said to be less cleanly than the Christians, and from what I saw of them I should say that this was true. But there were reasons for thinking that there was more concealment of cases amongst the Jews; the authorities had had some trouble in getting certain of the Jewish medical attendants to notify.



Typhus and dysentery in Warsaw : weekly notifications. Continuous line = typhus ; dotted line = dysentery.



Typhus in Zawiercie : weekly notifications.

There are one or two points in these epidemics to which I wish to draw attention. So far as I know, there are few, if any, published figures of the number of cases week by week of a typhus epidemic. Our knowledge of the prevalence of the disease is derived partly from the returns of fatal cases and partly from records of admissions to hospitals. Hence I venture to think the figures of the Warsaw and Zawiercie epidemics are of interest. From his observations at the London Fever Hospital during the twenty-three years 1848-70, Murchison came to the conclusion that typhus epidemics occurred chiefly in cold weather, and therefore most frequently in winter and spring. The seasonal prevalence both of the Warsaw and Zawiercie epidemics were the winter and spring, and I have been given to understand that during the war, at any rate, those have been the seasons for the typhus prevalence in Poland and Galicia. It will be noticed that both the typhus epidemics in Zawiercie culminated in the early spring and persisted though less severely during the summer. In the 1917-18 epidemic of Warsaw the height of the epidemic was reached in February, rather earlier than in the case of the second Zawiercie epidemic. It did not persist into the summer to such an extent as did that Zawiercie epidemic, and declined steadily during April, May and June. This decline is attributed by the local authorities to the vigorous campaign against the disease which was set on foot in April and carried on for three months, and to which I shall refer later. It is to be observed however, that the Zawiercie epidemic of 1919 declined rather more abruptly than the Warsaw epidemic, and no such special measures were undertaken to combat the epidemic as was the case in Warsaw. It is also to be noticed that the Warsaw epidemic began in the spring of 1917 and continued fairly steadily through the subsequent months of the year. The Zawiercie epidemic of 1919, attributed by the local authorities to the laxity in observing sanitary regulations, which set in on the departure of the Germans, was preceded by a smaller one the previous year, while the Germans were in full possession, and, indeed, showed signs of commencing even before the Germans left.

There is now absolutely no doubt that typhus is spread almost entirely by means of the body or clothes louse. There are some authorities who believe that it can be spread also by the head louse, but if that be the case, it is difficult to account for the diminution of the disease in Great Britain, for I am sorry to say that in London the proportion of lousy heads amongst certain classes of the population is still rather high. Amongst patients of all ages admitted to the North-

western Hospital, Hampstead, at the present time the percentage of lousy heads is about 59. Twenty years ago at the Eastern Hospital, Homerton, it was 60; so that there has been no improvement in that matter of cleanliness. Detailed observations as to the connexion between the prevalence of typhus, meteorological conditions and the degree of lousiness of the population, are much wanted, if we are to explain correctly several questions which arise in respect of typhus. For example, what connexion is there, if any, between the age-incidence of typhus and the age-incidence of louse infestation?

The case mortality both for Congress Poland and Galicia, and in the Warsaw and Zawiercie epidemics, was not high when we consider the conditions under which the population were living. In consequence of typhus not having been prevalent to any large extent in the United Kingdom since the introduction of the notification of infectious diseases, there are no figures relating to large numbers of cases except for patients in hospital; and as regards such patients there can be no doubt that a large proportion of the worst cases were taken to hospital, so that hospital statistics do not represent the truth as regards case mortality. Murchison, in discussing this question, came to the conclusion that the case mortality of typhus was probably not more than 10 per cent. In the gross figures for Poland and Galicia, given above, it will be noticed that the case mortality varied from 7·2 to 13·0 per cent. It will be noticed also in the Zawiercie figures for the first six months of 1919 the monthly case mortality varied very considerably, from 7·5 to 20·5 per cent.

CAUSES OF THE PREVALENCE OF TYPHUS.

It is not difficult to account for the wide prevalence of typhus in Poland since the beginning of the war on general grounds. Constant warfare, the movements of troops, the influx of refugees from the districts which were the actual scenes of fighting, the return of prisoners of war, especially since the armistice, in both directions across the country, the lack of soap and clothing and of medical and surgical necessities in the country districts and in many of the towns the difficulty of obtaining sufficient water, would be factors conducing to the prevalence and dissemination of lice, that is to say of typhus, in a country where the disease had been endemic before the war. Medical men and nurses have been very scarce, and there has been a deficiency of food for the poorer classes, especially in the East and South-east.

The figures I gave at the commencement of this paper showed that typhus had been especially prevalent since the armistice. There is no doubt that when the Germans and Austrians established themselves in Poland in 1915, they both, and especially the former, used their utmost endeavours to keep infectious diseases under control, not from any love they bore to the Poles, but with the object of keeping their armies free from sickness. There can also be little doubt that to a certain extent, especially in the country and smaller towns, they succeeded. In spite however of their efforts there was the large epidemic in Warsaw in 1917-18. Dr. Trenkner attributed the epidemic chiefly to the action of the Jews. Much smuggling, especially of food, went on from outside into the city, the smugglers, who were chiefly Jews, hid and slept together in little groups in sheds and barns. Members of the groups became infected with typhus and carried the disease into the city. Dr. Trenkner on various occasions traced fresh cases to group infection in this way. Overcrowding and want of cleanliness did the rest. In Zawiercie the action by the Germans seems to have had more effect, and there was not any great prevalence of disease there before they left. In that part of Poland which I visited—viz., the county of Bendzin, typhus had become especially rampant since the armistice, as was exemplified in the Zawiercie epidemic. Directly the Germans left there was an unrestrained movement of population to and fro between the town and surrounding country; released and escaped prisoners of war began to return, especially from the East; and refugees flocked to the West from the devastated Eastern districts. Thus between November 1, 1918, and January 1, 1920, 652,604 prisoners of war returned westwards from Russia, and 627,088 emigrants came back from the same country to Poland. All these people were registered at the various points in Eastern Poland through which they passed. The number of the refugees from the devastated regions was estimated at 200,000. Besides these, 553,845 Russian prisoners of war were registered as having returned eastwards from Germany and Austria. The Germans had been severely thorough in their sanitary measures. They set up de-lousing stations and forced the inhabitants to be de-loused at the point of the bayonet. When they left compulsion ceased and personal cleanliness diminished.

In Warsaw, after the Germans left, there was a slight increase in the number of cases of typhus, but the rise was not very noticeable until January, and the epidemic reached its height in February and March. Considering, however, the greater freedom of movement

amongst the people and the influx of repatriated prisoners of war and refugees from the devastated regions, it is rather to be wondered at that a more severe epidemic did not arise. By the following July the population of Warsaw had increased by another 100,000 persons, and the city was very much overcrowded; besides that, the scarcity of certain necessities, and especially soap, clothes, and linen, became rather great. This scarcity exists to a larger extent in small towns in the country than it does in the greater cities, though it is bad enough in some of these. Even in some of the best hospitals in Warsaw the want of linen was noticeable even to the most casual observer, and in the smaller towns and villages the scarcity was appalling. Some faint idea of the dearth of soap may be obtained from knowledge of the fact that quite a small piece of the commonest kind of soap cost 4 marks, and for tablets of better quality anything up to 20 marks a tablet was demanded. At that time the value of the mark was about 190 to the English pound. Since that time the mark has still further depreciated in value and has now reached 650 to the pound. The price of war articles has gone up greatly, and I have been recently informed on authority I know I can rely upon, that the articles I have mentioned are still more scarce than they were last year.

Another very potent factor has been overcrowding, especially since the armistice, and especially in winter time. In other countries and in former years typhus has always been a disease of the winter, doubtless because in that season people of the poorest classes herd together more densely, and change their clothing and wash less frequently, than at other times of the year. These causes would be especially present in such a country as Poland when the winter is as a rule severe, and in smaller towns and country places water is obtained with difficulty. During and since the war fuel, especially coal, has also been scarce, so that warm water cannot be provided in large quantities. I have alluded to the greater freedom of movement among the people since the armistice. At the same time the train service has been limited and therefore the trains are almost always crowded to excess. Under these circumstances it is not difficult to understand how easily lice are conveyed from one person to another and one place to another.

I happened to be in Poland at the end of the summer and the beginning of the autumn, and that is the season of least prevalence of typhus. The diminished prevalence at that season is due to the fact that there is less overcrowding than in the winter, because the people are scattered in the country for the work of the harvest,

also water is more easily obtained and bathing more pleasant than in the winter. Although in Warsaw and other places the Jews suffered more severely than the Christians, it is doubtful, in my opinion, that they so suffered because they were Jews: the more probable reason is because they were more densely crowded together, for, as has been mentioned, the Jews were less attacked in Zawiercie than the Christians, and as far as I could see from inspection of houses in different quarters of the town, amongst the poorer classes, there was as much overcrowding amongst Christians as Jews.

Adverse, however, as the circumstances have been in Poland, during and since the war, it must not be supposed that the authorities have not attempted to deal with the epidemic. As far back as April, 1918, that is to say, six months before the Germans quitted Warsaw, Dr. Trenkner made a great effort to cleanse the houses and their inhabitants in the worst and most crowded parts of the city, a proceeding to which the Germans offered no objections, as of course such a measure was conducive to keeping their army free from infection. But the task was a very difficult one as the people were by no means anxious to help the authorities. If the inhabitants of a certain square for instance got wind that their houses were going to be visited by the sanitary squad, they cleared out and locked their rooms up. However, this obstacle was overcome by making unexpected visits very early in the morning, taking the passports away from the inhabitants, who were sent off to the de-lousing station, with the instruction that they would not receive their passports back again until they produced the certificate that they had been de-loused. Meanwhile, their homes were disinfected and cleaned. A movable disinfector was taken round for the purpose. This campaign was carried on very vigorously for three months, and to it must, I think, be attributed, at any rate partly, the smallness of the epidemic which occurred not long after the Germans vacated the city. It should be added that both before and after this special campaign a considerable amount of preventive sanitary work was carried on.

As regards Poland generally the Ministry of Public Health had planned a most comprehensive scheme to fight the epidemic. The proposals were, in the first place, that every effort should be made to prevent fresh infection entering the country from beyond the Eastern and South-eastern frontiers, that is from regions where typhus is more rampant than in Poland itself, by setting up a cordon of housing barracks, epidemic hospitals and de-lousing stations on the principal railway lines; and, secondly, that the foci already existing

in the country should be dealt with somewhat in the same manner as in Warsaw.

In order to carry out these measures the country was divided into districts, and the necessary staff laid down for each district. Estimates were also made of the machinery and material that would be required. Besides these measures a great effort was to be made to deal with the general insanitary condition of the country, which is especially bad in Congress Poland. Unfortunately, however, the Ministry was met by a great dearth of both personnel and material, and an appeal was made to the Governments of the Allies, and to private organizations, for help. I am afraid, however, the response to this appeal was at that time but feeble. In order to get any preventive work done with a view to stopping an epidemic in the winter, the measures indicated should be commenced not later than the beginning of the summer. I understand that neither Warsaw nor Zawiercie have suffered from an epidemic during the past winter, but that the disease has been extremely prevalent in Eastern and South-eastern Poland and very severe in Eastern Galicia.

Although this paper deals only with typhus, it should be mentioned that large numbers of other communicable and epidemic diseases had occurred and were continuing to occur in some parts of the country—namely, relapsing fever, dysentery, cholera, enteric fever, small-pox, and malaria. Tuberculosis in its various forms is also rife. There was a severe epidemic of dysentery in Warsaw from the beginning of July to the middle of October, 1917, just when the typhus epidemic was on the rise, and there were 2,434 fatal cases. There was also a virulent epidemic of influenza in Poland at the end of 1918 and beginning of 1919.

Clinically, the disease, typhus, presented the same appearances as I have observed in cases in London some years ago; but complications were infrequent: pulmonary complications and parotid buboes were the most common.

DISCUSSION.

Lieutenant-Colonel W. BYAM: I think we must be particularly careful before we accept epidemiological evidence that the head louse cannot convey typhus. Both the head louse and the body louse are now considered to belong to one species, *Pediculus humanus*, being simply varieties (*capitis* and *corporis*), and from the evidence we possess it is extremely probable that they are equally

capable of transmitting infection. That both varieties do not transmit disease with equal facility is possible, but the explanation should, in my opinion, be sought in the methods by which the insects are disseminated. The body louse spreads as the result of close contact between the infested person and his neighbour, especially in warm surroundings, for stray lice but rarely find a fresh host. Only the larvæ and adult insects are transferred in this way, though considerable numbers may pass from man to man on any suitable occasion. On the other hand, the head louse may often be transmitted as an egg while still adhering to a detached hair, the hair being conveyed by means of brushes, combs and articles of head gear, or by being picked up, as when a clean head rests against the back of an upholstered seat recently vacated by one who is lousy. It is seldom that lousy heads come directly in contact, or that adult insects are transferred. As a result, the percentage of lice which are infected becomes a factor of importance. In the case of typhus, exact knowledge of the percentage of lice which are infected is not available, but the greater the number of lice transferred the greater is the risk of infection being transmitted. If body lice are transferred in greater numbers than head lice the more marked will be their power of transmitting disease, even though the eventual degree of infestation may be the same in both cases. From our knowledge of the allied disease, trench fever, we know that infection is not transmitted hereditarily in the louse and, from the evidence at present available, it is more than likely that the same holds good for typhus. Should this be true and the dissemination of head lice be mainly by the transference of eggs, it would follow that head lice would play little part in the spread of either typhus or trench fever. The second aspect of typhus on which I would like to speak is its prophylaxis as aimed at by disinfection. By the kind permission of Lieutenant-Colonel P. S. Lelean, C.B., Professor of Hygiene at the Royal Army Medical College, I am able to show you some pictures¹ of a disinfector designed by him which will be largely employed in the Army for field work in future. The advantages of this apparatus are its efficiency, portability, cheapness, and the ease with which it can be worked. And for these reasons I think it should be of extreme value in the campaign against typhus which Dr. Buchanan has told us is about to be undertaken by the League of Nations. The pictures, I think, are self-explanatory, but I may add that each of the sacks you see is capable of dealing with the kits of ten soldiers every half hour; and that, with the exception of the sack, the boiler and the chimney, the apparatus is built of mud and, therefore, does not require to be transported. The efficiency of disinfection depends on the fact that the steam is introduced from *above*, thereby displacing all the air from the clothing before the steam can escape below from the mouth of the sack.

Sir WILLIAM MACPHERSON: May I suggest that the future as regards epidemics of typhus in Poland may not be so dismal as it appears from the

¹ See Byam and Archibald's "Practice of Medicine in the Tropics," Oxford, 1920.

extensive prevalence of these epidemics during 1916 and 1919, of which Dr. Goodall has given us so clear an account? For this reason: If, as I understand, an attack of typhus confers immunity, the time must come when the non-immune material will be exhausted, and I would be inclined to anticipate a much less incidence of typhus fever on that account in the future among the slum population of the towns which Dr. Goodall described. In other words, in the future we should have in these slums an immune population, and, therefore, a less incidence of typhus. Perhaps Dr. Goodall would let us have his views on this point.