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The Epidemiology of Diphtheria
During the last forty years.

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THE
EPIDEMIOLOGY OF DIPHTHERIA
DURING THE LAST FORTY YEARS

by

W. T. RUSSELL.



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PREFACE

This report deals statistically with the incidence and mortality of diphtheria in Britain during the last forty years, and it includes a study of the results of the protective inoculation of children, with particular reference to experience in the United States and Canada, where inoculation has been extensively practised. The interests of the findings in relation to the campaign for the immunisation of children in Britain against diphtheria has been held to justify their publication at the present time.

In the first chapter of the monograph "Diphtheria" issued by the Council in 1923, the late Professor William Bulloch gave a masterly summary of the epidemiological history of the disease. So far as Europe is concerned, diphtheria first came into view as a serious epidemic disease in the Iberian Peninsula late in the 16th and early in the 17th century. Since then it has spread widely, although, in view of the difficulty of clinical and epidemiological differentiation of diphtheria from the anginal forms of scarlet fever in written descriptions, it is impossible to be certain of the biological nature of "throat" epidemics in the 18th century. A new epidemiological epoch opened in the third decennium of the 19th century when, thanks to the classical investigations of Bretonneau, clinical and epidemiological differentiations became clearer. About the middle of the 19th century a new pandemic period began; France was first involved and this country, in which scarlet fever had already attained a terrible importance, was included in the pandemic extension of diphtheria about 80 years ago. We have, then, a suggestion—it cannot be put higher—that our epidemiological invasion lines run from the south of Europe. The suggestion is worth bearing in mind now that North Africa has become a main theatre of war.

In the decennium 1861-70, 39,454 deaths in England and Wales were attributed to diphtheria and nearly 208,000 to scarlet fever, an epidemic disease which, in our generation has been but a minor cause of mortality. The history of diphtheria as a cause of mortality during the last 60 years is shown in the following table.

England and Wales

<i>Period</i>		<i>Deaths at age</i> 0-15 years	<i>Population at age</i> 0-15 years
1881-1890	41,269	9,820,413
1891-1900	76,919	10,353,849
1901-1910	58,756	10,781,340
1911-1920	48,551	10,930,200
1921-1930	30,916	10,015,322
1931-1938	22,605	9,266,700

Although there is evidence of improvement, the progress is disappointing in view of the fact that, of the infectious diseases of childhood, diphtheria is the one of which exact biological knowledge is most complete and was earliest obtained. When the fathers of this generation of medical practitioners were young men, fifty years ago, laboratory research had already established the fundamental biological facts of the aetiology of diphtheria and a powerful method of treatment was available in diphtheria antitoxin, which has much reduced the fatality of the disease. Almost a generation ago, it became possible to measure precisely the liability of children to fall victims to diphtheria, and both laboratory and field experiments showed that artificial active immunisation much increased the resistance of persons exposed to the infection. Yet, in this country, diphtheria has continued to be a major cause of mortality. There is indeed reason to think that in certain sections of the population, the danger of infection has increased.

The researches of many workers have shown that, in the natural course of events, immunity or partial immunity is produced either by passing through a clinical attack of the disease or, more frequently, by a covert or sub-clinical, attack, due presumably to infection by micro-organisms too few in number or of too little infectivity and virulence to excite manifest or serious disease. Since diphtheria is commonly transmitted through the discharge of infective matter by coughing or spitting—or through the unhygienic use in common of spoons, pencils, etc.—it would be expected that, in over-crowded homes or schools, infection and resultant immunity would be earlier developed among the children of the less fortunate classes of society. That this was so, has been frequently demonstrated. Nevertheless, with the decline of the birth rate and an improved general standard of living the class differentiation has, as Mr. Russell shows, been much reduced, so that what may be called the natural resistance of certain sections of the community at school and later ages has weakened. There is also the possibility, mentioned in an earlier paragraph, that the epidemic strains may be reinforced by importation.

In some countries, notably the United States of America, the expediency of raising the general resistance of the child population to diphtheria, by widespread active immunisation, was realised years ago. These field experiments have been of a sufficient extent and duration to justify statistical appraisal, and the evidence here published amounts to proof that in those American and Canadian cities in which mass immunisation of children against diphtheria has been practised on a really large scale, thousands of lives have been saved which would have been sacrificed had not the procedure been adopted. In Britain, on the other hand, morbidity and mortality from diphtheria remain high. Prior to 1940, active immunisation of the child population was carried out only by a proportionately small number of local authorities. The practice was limited almost entirely to school children and to young children attending welfare centres. Since 1940, when the Government decided to issue an approved prophylactic free to all local authorities and urged the adoption of active immunisation as a public health measure, good progress has been made. By the end of 1942, 46·5 per cent. of the child population under 15 in England and Wales had been immunised, and in quite a number of areas almost the whole of the child population has been brought within the scheme. It cannot be stated with certainty that the world-wide adoption of mass immunisation, as in New York City and Toronto, would have had the same measure of success in all countries, for the history of epidemiology proves that factors not controllable by human intelligence may favourably, as in the case of scarlet fever, or unfavourably, as in the case of influenza, affect the progress of epidemic or pandemic diseases. None the less, the conclusions to be drawn from the whole body of evidence, to which this report makes a valuable addition, are impressively in favour of active immunisation against diphtheria as a life-saving measure which should be adopted in this country also on the widest possible scale.

MEDICAL RESEARCH COUNCIL,

c/o London School of Hygiene and Tropical Medicine,
Keppel Street, London, W.C.1.

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THE EPIDEMIOLOGY OF DIPHTHERIA DURING THE LAST FORTY YEARS

BY

W. T. RUSSELL, D.Sc.

(Member of the Statistical Staff, Medical Research Council; working at the London School of Hygiene and Tropical Medicine).

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