

clearing the district of mosquitoes malaria has been eradicated.

In England the ordinary house-fly carries the germs of tuberculosis, ophthalmia, and many other diseases, including that of diarrhoea, which, in 1910, killed in London alone no less than 1,811 children under two years of age. It is well to kill flies, but the real remedy is to destroy their breeding places by the frequent removal of refuse, and by other simple means, which are already well known and only need to be carried into effect.

## CHAPTER IV

### CRUDE AND STANDARDISED DEATH RATES—THE PROGRESS OF SANITARY REFORMS

THERE are two forms in which death rates may be expressed, viz. :—

(a) Crude death rate.

(b) Standardised death rate.

If the total number of deaths occurring within a defined period of time in a certain community is taken and divided by the total number living at the central point of the period, the result will be the crude rate for that period. It is customary to express the death rates in reference to one year, and, therefore, if the period for which the deaths have been taken is any other period, the result must be adjusted accordingly. The rate thus obtained is the rate per unit, and, if multiplied by 100, 1,000, or 1,000,000 is known as the rate per cent., rate per thousand, or rate per million, as the case may be.

The crude rate of mortality was used when discussing the natural increase in populations.

If it is desired to institute a comparison of the death rates in each of several communities, we must take into account the factors of sex and age distribution of the population. In order to see the necessity for this, suppose one community to be formed from occupants of almshouses aged 75 and upwards, while another community comprises men between the ages of 20 and 25. The crude

death rates, we will suppose, to be 120 and 10 per thousand respectively. It might be argued, if we were unacquainted with the age constitution of those communities, that the former must be most unhealthily situated to produce so high a death rate, and that the latter must be unusually healthy. The facts are exactly the reverse; the apparently low death rate of 10 per 1,000 is more than twice what it should be, and the apparently high rate of 120 per 1,000 is very low. A more exact measure for comparison must be found, therefore, than the crude death rate, and this is obtained by calculating what is known as the standardised death rate.

The connecting link between the crude death rate and the standardised death rate is known as the index death rate. The index death rate can only be obtained with exactitude at each census, when the numbers living in each age-group are known.

In order to obtain the index death rate for any district it is first necessary to ascertain the number of deaths that would occur in the district if it were experiencing the same rate of mortality at each age as the whole of the country. The rates of mortality for the whole country are known for the same groups of ages as those in which the population of the district is tabulated, and consequently it is merely a matter of multiplication to obtain the expected deaths of any district according to the standard rate. The number of deaths thus obtained is known as the "expected deaths."

By dividing the total expected deaths for any given district by the total population of that district we obtain the index death rate for that district.

The ratio between the index death rate of the whole country and the index death rate of a particular district is termed the "standardising factor," and, by multiplying

the standardising factor into the crude death rate, we obtain the standardised death rate. That is to say, by means of the standardising factor, we are able to weight the crude death rate for the district so as to allow for the incidence of the age and sex distribution of the population.

Thus, if the age and sex distribution of a particular district is exactly the same as that of the whole population, the standardising factor is unity. If there is a larger proportion of lives in the community which are normally subject to very heavy rates of mortality, *e.g.*, the old or very young lives, then the standardising factor will be less than unity, while, if the opposite conditions prevail, the factor will be greater than unity. The standardised death rates, therefore, do not represent any actual rates of mortality, but are hypothetical rates, which enable true comparisons to be instituted between the rates of various districts.

By way of illustration, it may be useful to show how to obtain the standardising factor for Liverpool. The index death rate for the whole country is 15.192 per 1,000. The index death rate for Liverpool is 14.715 per 1,000; therefore the standardising factor is  $\frac{15.192}{14.715} = 1.0324$ .

The crude death rate of Liverpool is 20.2 per 1,000, therefore the standardised death rate for Liverpool is  $20.2 \times 1.0324 = 20.854$ .

The following is an illustration of the use of standardised death rates:—

	Crude Death Rate.	Standardised Death Rate.
City of Liverpool . . . . .	20.2	20.9
Clitheroe Rural District . . . . .	19.8	14.3

By a consideration of the crude death rates alone it might be imagined that the rural district of Clitheroe is but little more healthy than the city of Liverpool, but the

standardised death rates show that, whereas the Liverpool death rate is high, Clitheroe, on the other hand, experiences a death rate practically equal to that of the whole of England and Wales. The standardised death rates show that Clitheroe must contain a large proportion of people who should normally be subject to higher death rates, that is, a large proportion of very old people, or very young people.

An excellent explanation of the methods of obtaining the standardising factors and the standardised death rates is given in the seventy-fourth annual report of the Registrar-General.

Dealing now with the causes of death amongst the general adult population, the Registrar-General gives, for the whole of the country, the number of deaths tabulated under no less than 189 different headings. For separate districts it is quite impossible to analyse the results so minutely, and therefore the list of 189 is condensed into a shorter list of only twenty-nine, that is to say, a number of similar causes of death are included under a general heading.

Formerly, the grouping of causes of death for separate districts consisted of only sixteen headings. The list now used is known as the International List, and is employed by many other countries, as well as by our own Local Government Board, and this is, of course, a very great advantage for purposes of comparison. There is, however, necessarily some disadvantage in the breaking of continuity with previous records. For instance, in the case of phthisis, which at the present time is a matter of such great importance, the change in the method of grouping makes it impossible to effect certain desirable comparisons with previous years unless troublesome adjustments are made.

Owing to the improved methods of classification employed since the advent of the present Registrar-General, a complete record of the deaths is now available in each of the more important administrative areas, classified according to:—

- (a) Cause of death.
- (b) Age groups.
- (c) Sex.

It will readily be seen that this great improvement places a new and powerful instrument in the hands of all those interested in the public health, and one which they should certainly not neglect.

The diagram on p. 58 shows the mortality from certain epidemic diseases.

Dealing first with enteric fever, which occupies the first place in the International List, we can trace the history of this disease since 1869, independently of typhus and pyrexia, with which it was included previous to that date. To quote from the 1910 report:—

“It will be seen that the statistical history of enteric fever mortality can be divided into three main periods, two of decline from 1869—1885 inclusive, and from 1900 to the present date, and one showing no decline from 1886—1899. The first period, however, may be subdivided into two portions; that prior to and including 1875, the date of the Public Health Act, which shows a very slight decline, and that from 1876—1885 which shows a sudden and relatively an enormous reduction in the mortality.”

I am unable to give any definite opinion as to the causes of the cessation in the improvement from 1886—1899, but I may mention that during the same period the death rates from all causes exhibited a somewhat similar characteristic.

It is satisfactory to note that the period of suspended

improvement has been followed by an almost continuous fall, and the death rate from this disease is now only about fifty per million persons.

ENGLAND AND WALES.  
ALL AGES.  
MEAN ANNUAL DEATH RATES  
PER MILLION LIVING.

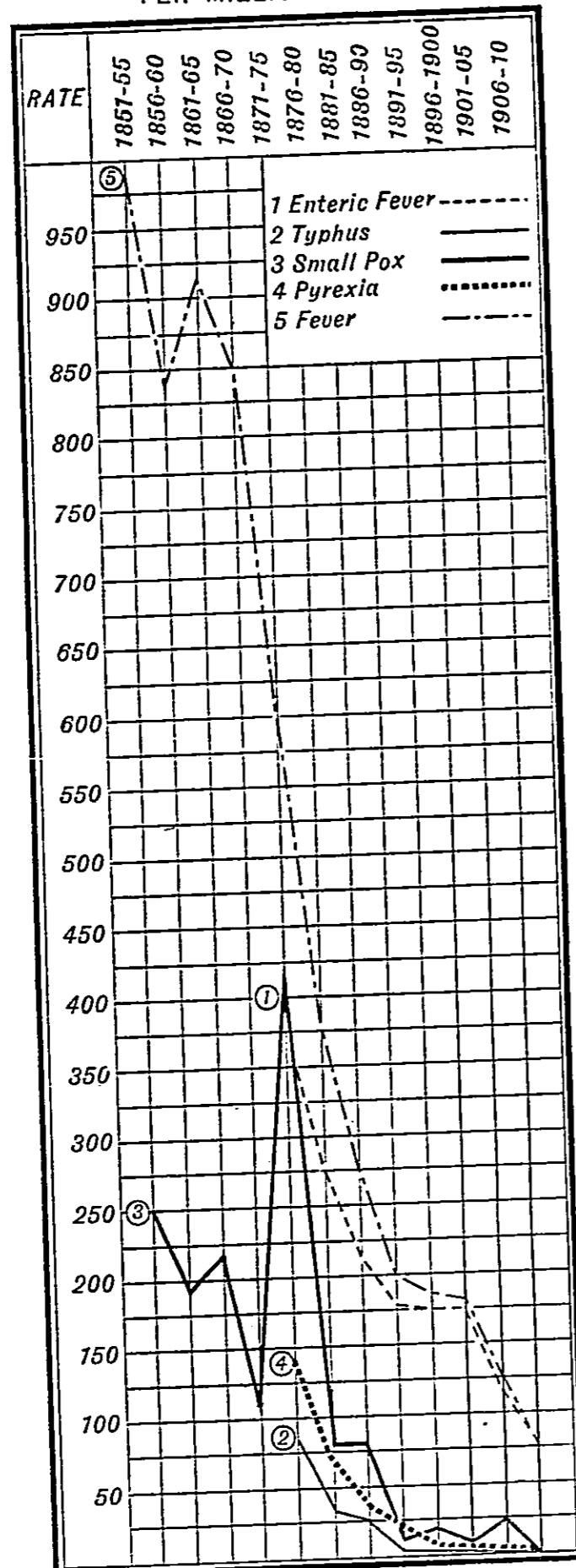


Diagram 10.

Following on a sudden increase in the death rate from small-pox from 1871—1875, there was an immediate and continuous fall until the year 1906, since which time it may be said to have been practically non-existent.

Turning next to a consideration of the national scourge of phthisis and tuberculosis generally, the diagram on p. 59 shows the rates from 1851—1910 in groups of five-yearly periods.

The first evident point to notice is that the rates of mortality are very much higher for males than females; the second point is that there has been an enormous decrease in the rates of mortality from this cause, which,

has resulted in the allocation of some deaths to this cause which, especially in the case of old persons, were previously returned under other headings, such as bronchitis. On the other hand, there is just a possibility that in the earlier years many fatal cases of lung affection associated with expectoration were certified as phthisical. However

if the facts are truly represented by the statistics, has decreased by considerably more than 50 per cent. during the period of sixty years. I think, however, there is room for doubt as to whether the two sets of figures are really comparable. On the one hand, improved diagnosis

ENGLAND & WALES—TUBERCULOSIS  
(all forms) and PHTHISIS  
CORRECTED DEATH-RATES AT ALL AGES, IN QUINQUENNIA 1851-1910 \*

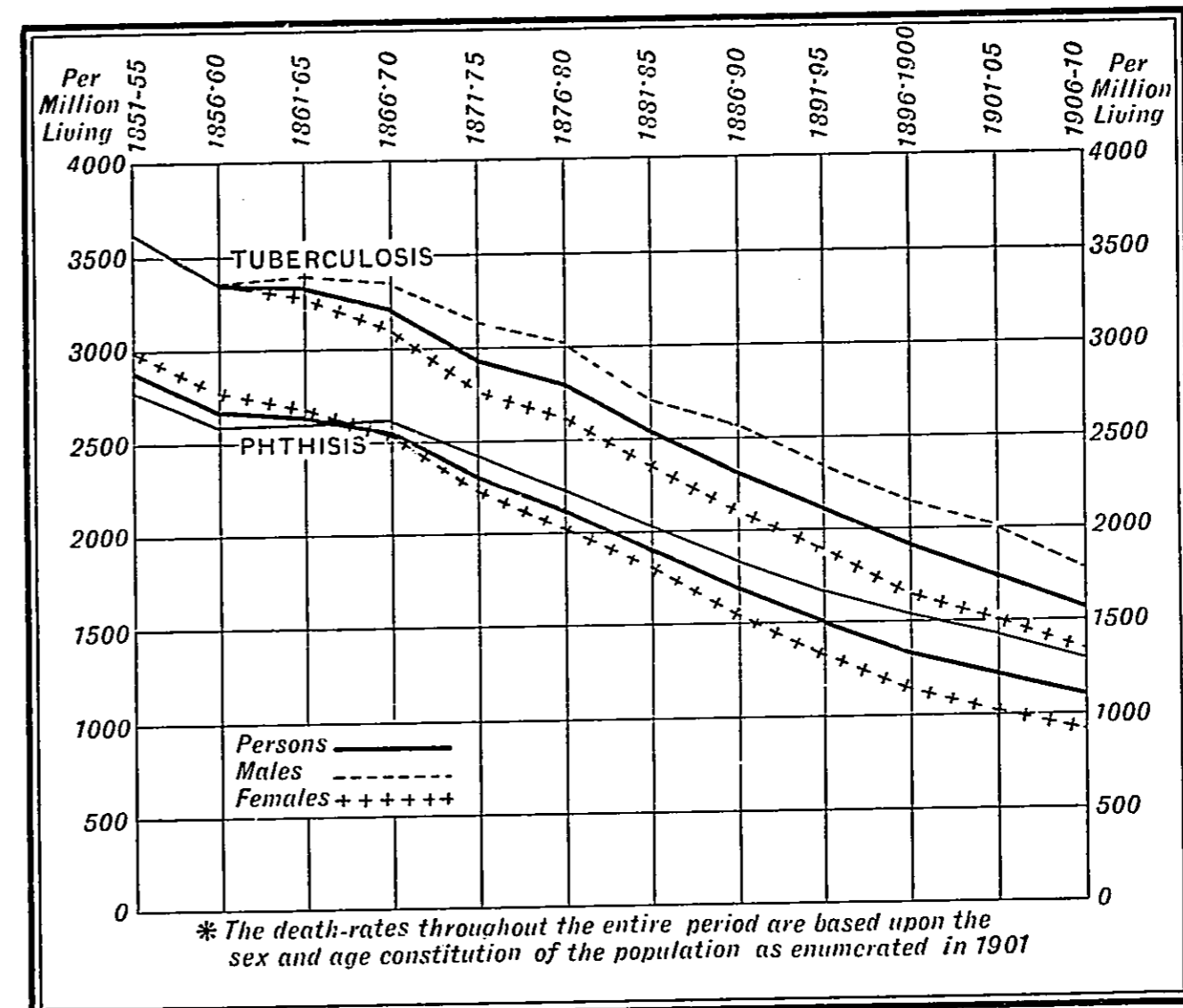


Diagram 11.

has resulted in the allocation of some deaths to this cause which, especially in the case of old persons, were previously returned under other headings, such as bronchitis. On the other hand, there is just a possibility that in the earlier years many fatal cases of lung affection associated with expectoration were certified as phthisical. However

this may be, if it is permissible to consider that the diagram correctly represents the course of the disease, is it possible for us to hope that the scourge may have practically disappeared by the middle of the present century?

In warfare the first consideration is to recognise the strongholds of the enemy, and, in the same way, I think that in our fight against the deadly enemy, tuberculosis, the greatest care should be taken in tracing out those districts where it is most prevalent, then endeavouring to ascertain the reasons for such prevalency, and immediately attacking those causes by every means in our power. In the diagrams on pp. 61, 62, I reproduce two maps taken from the supplement to the forty-second annual report of the Local Government Board, and these show the relative mortality from phthisis in each administrative county and in various county boroughs, for males and females.

In the annual report of the Registrar-General for 1911 the standardised death rates per million of the population from pulmonary tuberculosis for various parts of England and Wales are given as follows:—

	Males.	Females.
England and Wales . . . . .	1,210	910
Rural districts . . . . .	841	818
County boroughs . . . . .	1,499	1,048
London . . . . .	1,677	969
Other urban districts . . . . .	1,042	826

This table shows very clearly that the mortality from consumption increases with the density of the population, and that the increase is much more marked with regard to males than to females.

In the report of the medical officer of the Local Government Board for 1912—1913, the death rate from phthisis in age groups for all the above, except England and Wales, are given, and these, in the main, confirm the standardised death rates given above. There are one or

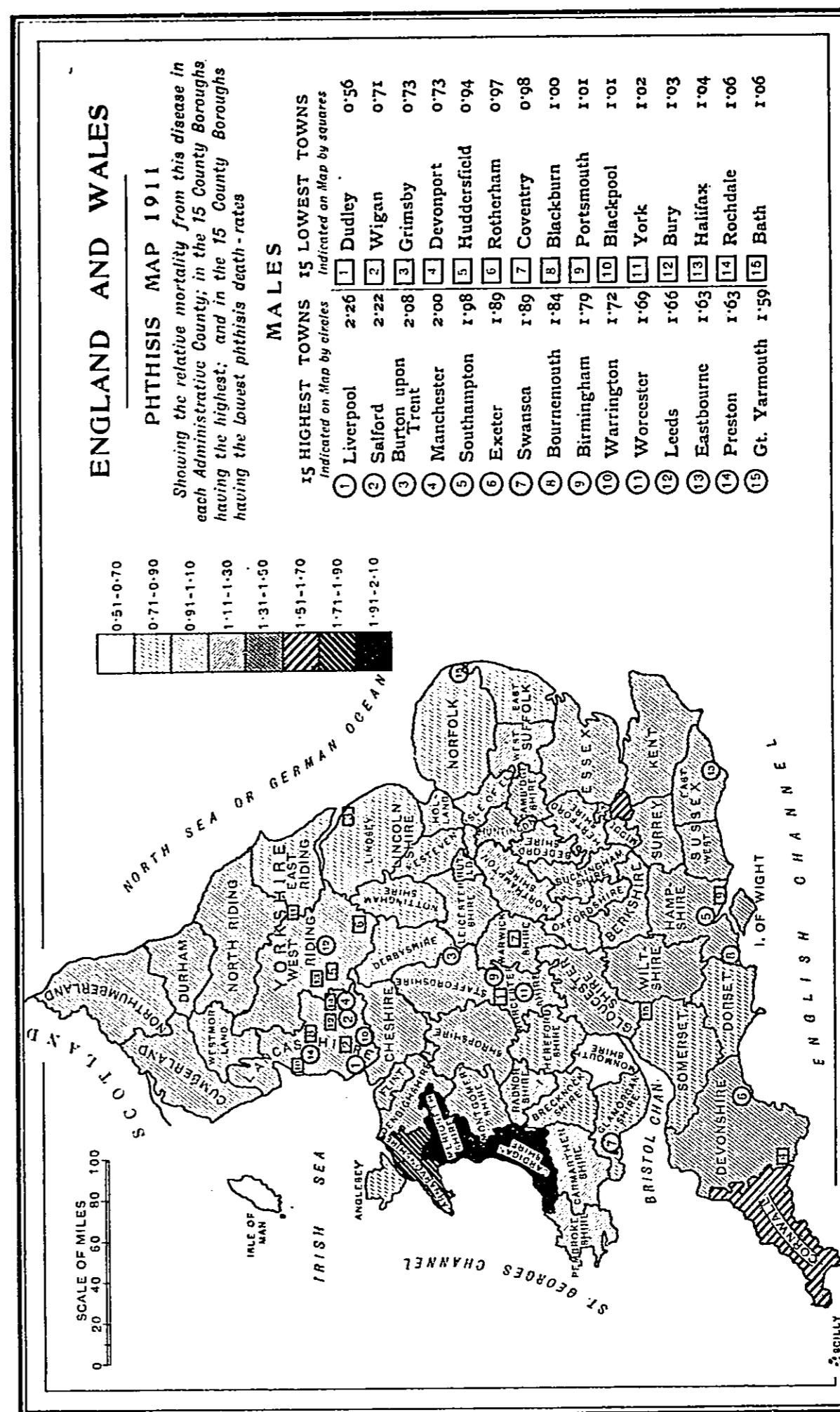


Diagram 12.



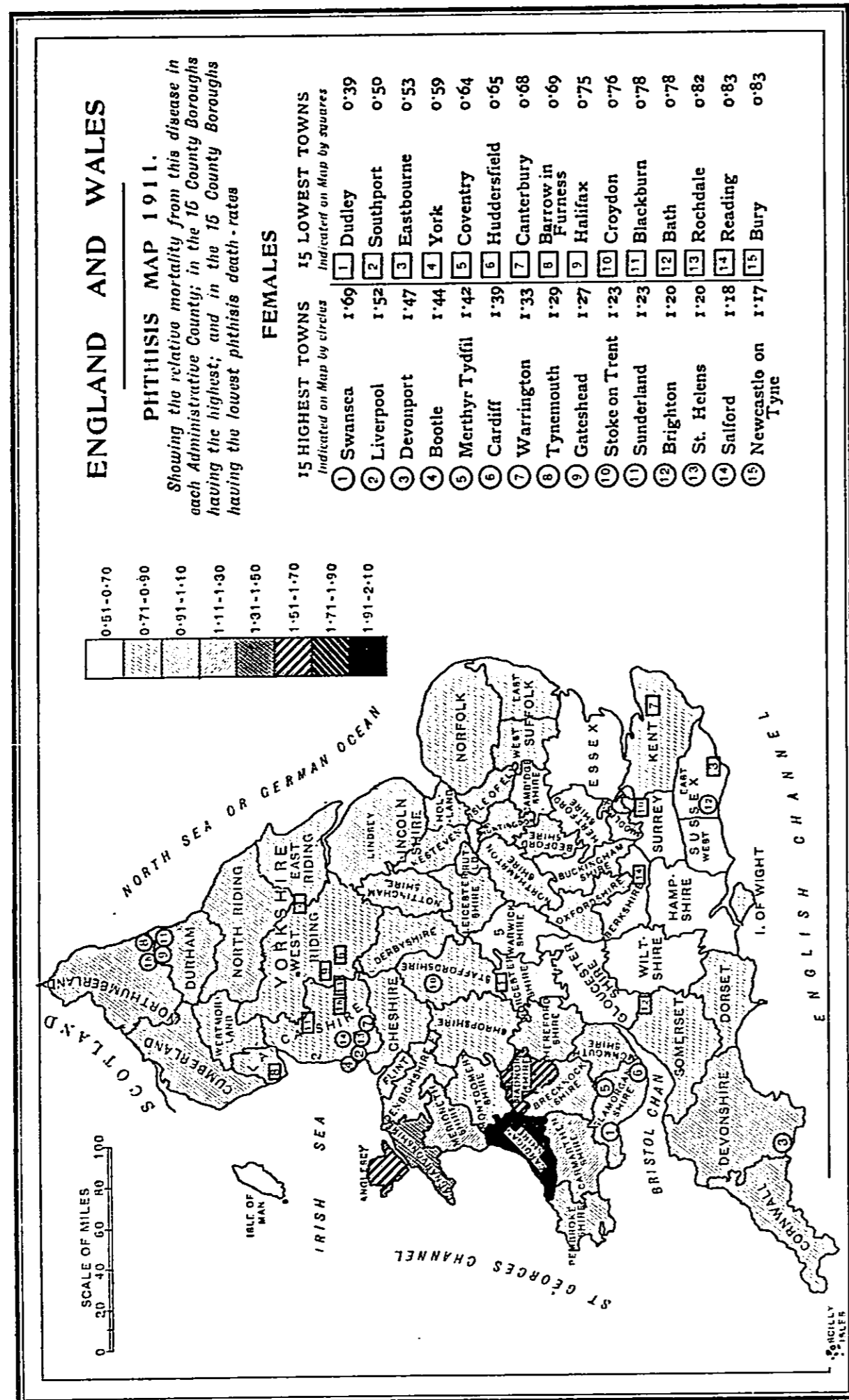


Diagram 13.

two points worthy of notice, however. In the first place, the rates at the younger ages for males and females are practically equal, the excess mortality amongst the males occurring at the later ages. As regards the various districts, it is curious that although phtisis is considered more particularly a disease of the younger middle ages, the death rate amongst males in London reaches a secondary maximum at age 60 (about 3,700 per million), the rate at this age only being exceeded by that at age 40 (3,750 per million). With regard to the females for London, the rate reaches its maximum at age 40 (about 1,750 per million), and thereafter rapidly decreases. Dr. Stevenson attributes the excessive rates shown at the old ages in London to better diagnosis.

The rate for county boroughs exceeds that for London up to about age 27 for males and age 37 for females, thereafter being consistently below. In the Local Government Board report, also, the standardised death rates for 1911 are given for each county borough. From these tables it appears that, for 1911, Liverpool shows the highest rate amongst males (2,260 per million), and is closely followed by Salford (2,220 per million). Amongst females, Swansea shows the highest rate (1,690 per million), Liverpool being second with 1,520 per million.

A word of warning should be given, however, in dealing with local tuberculosis statistics. While inaccuracies with regard to age and sex distribution are eliminated by using standardised death rates, and corrections for deaths in institutions have been made, there still remains a certain proportion of the death rate which is due to persons who have contracted the disease in districts other than that in which the death occurs. Another reason for caution, and one that particularly affects large towns, is the migration into these towns of vagrants, casual

labourers, and other of this class amongst whom the death rate is excessive. This has a very considerable effect on the death rate from tuberculosis in such towns as London and Liverpool and Manchester. With regard to the two latter, the immigrants include the Irish casual labourers, amongst whom the death rate is high.

I am unable to trace any reliable statistics which would enable me to show the improvement which has taken place in Liverpool in the past, but it is pleasing to be able to record, on the authority of the medical officer of the Local Government Board, that the death rate from tuberculosis both in Liverpool and Manchester has shown great reduction, and that some of the best anti-tuberculosis work in the country is being done in these cities.

It was with the liveliest satisfaction that I recently read Dr. Hope's short paper which he contributed in 1912 to the National Conference on the Prevention of Destitution. In this admirable little *résumé* Dr. Hope mentions that, in 1854, owing to the Irish famine, there was a great influx of the poorer class Irish into Liverpool. In order to meet the demand for cheap dwellings, a number of back to back tenements were erected, which were undoubtedly hot-beds of disease. These have now been absolutely replaced, and, with the many other sanitary improvements that have been effected, I have little doubt that still greater reductions in the death rates from phthisis, as well as other causes, will very shortly become apparent.

I must warn anyone interested in mortality rates from phthisis or tuberculosis that, in standardising the crude rates of mortality for any particular district, the standardising factors are not those to which I have previously referred as published in the Registrar-General's report, but are those published in the supplement to the forty-

second annual report of the Local Government Board. They are available for the more important areas for (a) phthisis, (b) tuberculosis other than phthisis, and (c) for all forms of tuberculosis.

The subject of phthisis cannot be dismissed without some reference to the question of over-crowding. It is not possible to deal with this point in any very satisfactory manner, as the necessary information has only been collected in the three last censuses, viz., those of 1891, 1901 and 1911, and, as I have already stated, the initial returns collected on any subject are always more or less unreliable. In the case in point only those householders who occupied less than five rooms were required to answer the question in 1891 and 1901, and it was therefore necessary to assume that the house contained more than four rooms in every case where the question was unanswered. This must have led to a certain amount of under-statement. Again, the term "room" was not defined until 1911, and it is quite possible that many a humble dwelling became possessed of more than four rooms owing to a too generous interpretation of the term. I therefore give the following diagram (see p. 66) with a distinct warning that too much importance must not be attached to it, and that it is chiefly interesting as showing a most welcome reduction in over-crowding, a reduction which may be confidently expected to yield the most beneficent results. The horizontal divisions in each pillar represent the percentage of the population living in tenements, with one, two, three, four, or more than four rooms respectively; the shaded portion of each section denotes the percentage of the occupants living in over-crowded conditions, *i.e.*, with more than two persons in a room. That is to say, that in a four-roomed house there must have been at least nine persons.

So far I have dealt with those diseases which appear to be amenable to medical treatment, or are rendered less virulent by better sanitation. The remainder of the

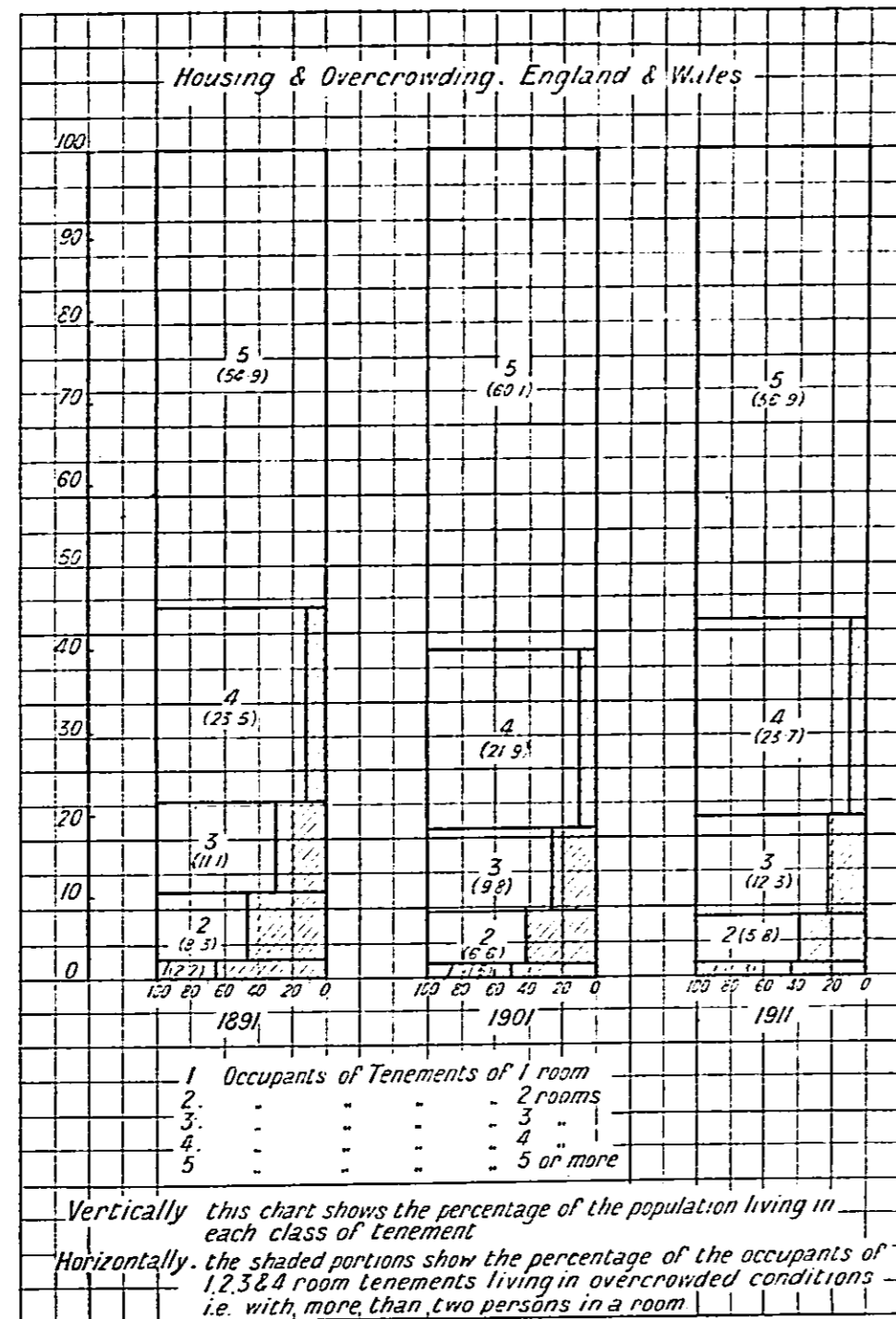
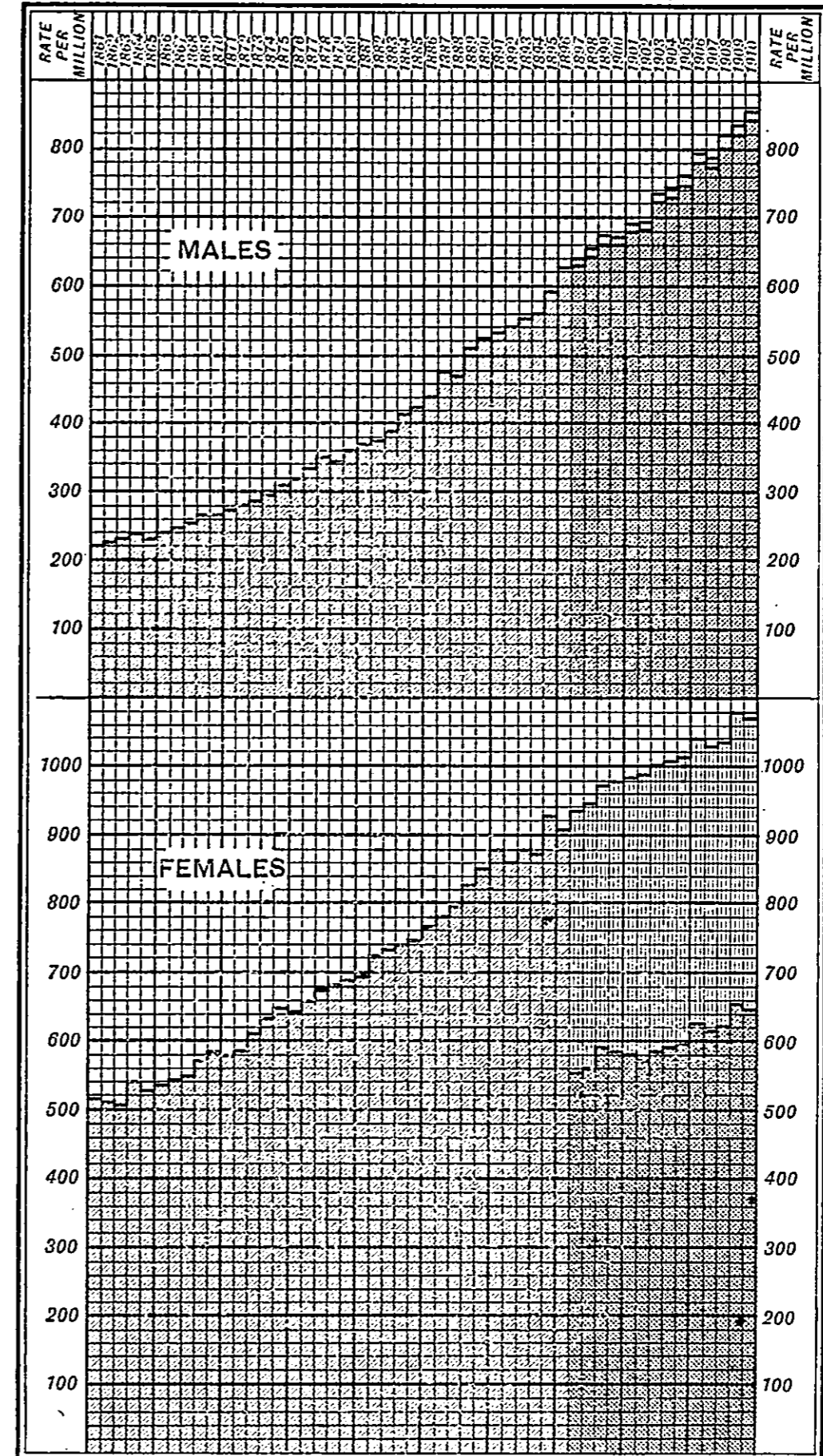


Diagram 14.

twenty-nine causes mentioned in the Registrar-General's list do not call for special reference, with the notable exception of cancer. In the diagram on p. 67, I give the corrected death rates from cancer during the years 1861—1910 for males and females respectively, which

**ENGLAND & WALES - CANCER**  
**CORRECTED DEATH-RATES AT ALL AGES 1861-1910 \***  
 Note:- The portion shaded vertically represents the mortality ascribed to cancer of the Generative and Mammary Systems during the years 1897-1910.



\* The Death-rates throughout the entire period are based upon the age Constitution of the population as enumerated in 1901.

Diagram 15.



apparently show an alarming increase. I remarked, when discussing phthisis, as to the effect of better diagnosis, and the same applies with added force in the case of cancer, for there is no doubt that this disease has not always been duly noted in the certificate of death.

It is stated in the supplement to the sixty-fifth annual report that "the practice of writing to medical attendants for further information concerning indefinitely stated causes of death, has resulted in the addition of a large number of deaths under the heading of cancer."

One satisfactory feature is evident—the less rapid rate of increase of the disease during recent years among females. This, I think, is probably due to better diagnosis in the earlier stages of the disease, when it is more susceptible to treatment.

The records of recent years indicate the wonderful progress which the army of workers for the improvement in sanitation and the general health of the population has accomplished, and cannot but act as an incentive to all to press forward with unabated vigour.

## CHAPTER V

### THE PREPARATION OF MORTALITY TABLES : (a) NATIONAL, (b) MUNICIPAL, (c) OCCUPATIONAL

THE subject of life tables, or mortality tables, as they are usually termed, is of enormous importance, for it is by the aid of such tables alone that improvements in the death rates can be accurately measured. This is true whether the comparison relates to the death rates of the whole population or to particular sections of the population. It is also equally true of the death rates of particular diseases or occupations.

It is well known that the mortality rates prevailing amongst persons engaged in different occupations vary very considerably, and it would be of great value if tables representing the general mortality rates relating to the more usual occupations in various districts could be readily obtained. Speaking from my own personal experience, I am bound to confess that such tables are almost impossible to calculate. The difficulty is that persons engaged in any given occupations subject to rates of mortality differing from those of the general population, remain in such occupations whilst well, but on becoming in any way impaired take up some other occupation, either from choice or necessity, and when death occurs are classified in accordance with their more recent occupation. Generally, it is found that men actually engaged in any specialised occupation are subject to abnormally