A Study
of
Infantile Mortality in England
and Wales:
its causes and prevention.

a thesis presented for the degree of M.D.
in the University of Edinburgh.

by

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Preface.

In the following pages the attempt is made to set forth the various facts and factors of infantile mortality. The means of prevention at present in use in this country and further measures necessary are also therein stated.

The choice of this subject by the writer for a thesis for the M.D degree has arisen from its general interest and importance to him, firstly, as a (late) medical officer of health to an urban district, and secondly, from his practice for over fourteen years in a manufacturing district in the West Riding of the County of York where he also holds the office of Certifying Factory Surgeon and which has made him familiar with some of the many influences bearing upon it.

The statistics given are always, except when otherwise stated, those of the Registrar General and are taken from the Annual Reports, Decennial Supplements, &c.

The authorities are collected together at the end and referred to by number. Occasionally where a name is only cited once the full reference is given in the text.

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Scheme of thesis.

Infantile Mortality

A. Introductory. Wide bearings of subject: national; social: hygienic. Its importance to humanity; to State. to Sanitarian.

B. General. Definition of term: Statistics (general): Infantile Mortality of different countries; mortality in each month of 1st year: male mortality greater than female: relation to birth-rate, to marriage rate, to general death rate: density of population: Town & Country; causes of growth of towns: national prosperity; Chief causes of death of infants: Registrar General's statistics: Class and social position; season and meteorological conditions.

C Causes & Indirect or ante-natal (a study of the causes of that large class of deaths occurring chiefly within the 1st month of life)

(a) Conditions of life of parents: unsuitable marriages: illegitimacy; marriage of minors; Factory & industrial employment.

(b) Conditions of health of parents: debility due to insanitation and other causes.

(c) Heredity: syphilis; alcoholism. Tuberculosis &c.

(d) Deaths attributable to these causes: Developmental diseases. Ill-defined & not specified causes. Syphilis. Convulsions.

Causes (continued)

ii Direct or Post-natal.

Conditions of life of parents; Factory & industrial labour; intemperance; ignorance, inexperience and neglect of mothers.

Improper food & feeding.

Insanitary surroundings of infant.

Zymotic diseases.

Baby farming.

administration of opiates.

Insurance.

Accident

Crime

Deaths attributable to these causes. Zymotic diseases Dietetic diseases. Parasitic diseases. Constitutional diseases. Local diseases. Violence.

Brief General summary of infantile mortality & its causes.

D Prevention General.

i By State. Education: temperance legislation. The Registration Acts, still births, inquests. uncertified deaths.

Historical. Various Acts. Compulsory notification of phthisis. State regulation of spitting.

Various.

ii By County Councils & Sanitary Authorities.

Education again. Enforcement of powers possessed. Establishment of depôts for sale of sterilised & humanised milk. Crèches.

iii. Duties of medical profession.

Introductory. It is a striking fact that while in England & Wales the general death rate and also the death rate at ages 0-5 years have steadily declined the mortality of infants under one year of age is of late years as high as it was fifty years ago.

In a consideration of the factors at work in the production of infantile mortality a very wide field is open to the investigator. The subject embraces questions of national and economic importance for example national education - prosperity, land tenure, depopulation of rural districts, which it is not intended to do more than mention here. Social conditions also are largely concerned e.g. conditions of life in towns, intemperance, industrial occupation, poverty, some of which must be treated at somewhat greater length.

Almost the whole realm of Public-Health or Preventive medicine is intimately concerned with the subject before us.

The importance of the subject is great. Not only is the needless loss of so many thousands of infant lives deplorable, but the suffering entailed is a distinct blot upon our civilisation. Its importance too is not to be measured only by the actual loss of so many lives for it must be remembered that the same causes which produce death in some infants, produce in others who survive weakness & damage, manifesting itself in stunted growth & possibly defective minds. The first named can be accurately estimated; the latter it is impossible to measure.

Apart from the question of mere humanity in view of

the declining birth-rate which this country as well as other Western European countries & N. America shares, the continued high mortality of infants becomes a matter of serious import to the State. The latter has not hitherto apparently shown a sense of its responsibilities in the matter but a continuance in the fall of the birth-rate to say the level of that of France will no doubt awaken it to the necessity of taking all steps to prevent as far as possible the unnecessary loss of infant life.

The mortality of infants in a given locality has, along with certain other factors been regarded as an index of the sanitary state of that locality. Correctly speaking it is more perhaps an index of the social and sanitary circumstances under which people live taken together. In this sense its importance is admittedly great. It can readily be shown that the incidence is high in certain towns or localities & the ratio borne is continuous year after year. The question then arises — why is the proportion of infantile deaths high year after year? There must be a local cause or causes. The discovery & removal of these local causes should become one of the first & most important duties of a Sanitary authority.

What are the causes at work which keep up the high Infantile mortality in the country generally notwithstanding all that sanitation has effected: eg. improved water-supplies, drainage, Vaccination, abolition of insanitary areas, & improved houses for the working classes?

It will be shown subsequently that they are various

and complex in nature, sometimes general, pandemic (in that all the infantile population of the country are more or less affected by them) sometimes local mainly. And when the general causes are most in evidence the local ones are intensified for example hot summers may be said to be a general cause while the insanitary state of the dwellinghouse may be regarded as a local one.

It is difficult to compare satisfactory the mortality of one year or one series of years with another year or series so much has to be allowed for the prevalence or absence of epidemics of zymotic diseases & climatic influences. But I believe it is only by a careful & complete comparison of this kind & with due weighing of effects of all purely local causes that the true understanding of this great question will be brought about.

An attempt therefore to refer back to their origin the main causes of infantile mortality is fraught with difficulties. As will be subsequently shown the dangers to infant life are to a large extent due to influences dependent upon epidemic & meteorological conditions, upon our social circumstances which favour the aggregation of persons in towns, lastly & not least upon ignorance & poverty. These factors so far as one can foresee will be always with us, and their effects are practically speaking very difficult to remove or even ameliorate. At the same time I should be the last person to favour a policy of laisser faire. On the contrary I think a great effort is demanded, in the first place, of the

medical profession in particular, and afterwards when the sense of responsibility is duly aroused, of the State & sanitary authorities to do all that in them lies to reduce this great infant sacrifice.

General.

Definition of term. The term Infantile Mortality refers to the deaths of infants under the age of 1 year. It is estimated in proportion to a thousand births. Thus the infant mortality of any year = $\frac{\text{no. of deaths under 1 year of age}}{\text{no. of births registered during the year.}} \times 1000.$

The births are taken in preference to the population living at the age 0-1yr. for certain well-known reasons, viz that the Census population of infants is always understated owing as Dr. Farr pointed out to the confusion existing in the minds of people between the current and completed years of life, many infants under 1 yr of age being returned as 1, & a certain number under 2 yrs of age as 2. Also the facilities offered by expression in terms of the no. of births are so much greater & more exact than by estimating the infantile population for any year other than perhaps the census year. Thirdly it is now adopted for uniformity. Newsholme (I p. 120) suggests that a more correct plan would be to take the mean of the births of the current & immediately preceding year as giving the true infantile population & express the infant mortality in terms of this.

The Infant mortality of England & Wales for the year 1900 (the latest available of the Registrar General's Annual Reports) was 154. The average for the preceding ten years 1890-99 =

153.

In previous periods the infant mortality was as follows :-

Table I.

Period	Infantile mortality	General death-rate	Death-rate - 0-5 yrs
1838-42 (5 years)	152		
1847-50 (4 years)	154 (5 years)		
1851-60	154	22·2	
1861-70	154	22·5	68·2
1871-80	149	21·4	63·72
1881-90	142	19·1	56·82
1891-1900	154	18·2	65·8

In 1899 it reached 163, the highest on record since 1851. It has varied from 130 in 1881, 135 in 1879, 136 in 1888 to 160 in 1849, 1853, 1864, 1865, & 1870 to 161 in 1895 & 163 in 1899.

In London the infant mortality for various periods since 1848 was as follows :-

Table II

Infant mortal. in London.

Period	Infant. mortal.
1841-50	154
1851-60	153
1861-70	162
1871-80	158
1881-90	152
1891-1900	160

It had varied from 140 in 1850, 141 in 1859, 143 in 1862 & 1894 to

141 in 1865-71. to 172 in 1866.
Since 860 in only 1 year (1859) had the infantile mortality of London been less than that of England & Wales while between 1848 & 1860 it was less for 3 times & the same level in three separate years.

On reference to table I it is seen as stated above that while the general death rate and the death rate at age period 0-5 yrs has continuously decreased since 1861, the infant mortality which dropped in the decennium 1881-90 rose again to the former level in the decennium last completed.

In the 33 Great towns (Annual Summary) in 1901. the infant mortality averaged 168. varying from 127 in Halifax. & 131 in Bristol to 201 in Sheffield, 204 in Salford. 216 in Preston, & 221 in Burnley.
In 67 other great towns in 1901 it varied from 86 in Hornsey & 102 in Bournemouth to 227 in Longton and 234 in Aberdare.

In Registration Counties in England & wales in 1900 it varied from 79 in Rutland & 91 in Dorset to 178 in Stafford, 179 in the East Riding of York, & 180 in Lancashire.

Infant mortality in different Countries.

Bertillon quoted by Newsholme (I p 130) gives the following table for European Countries :-

Table III.

Country.	Period.	The number out of every 1000 live births dying under 1 year of age
Ireland	1865-83	95.9
Norway	1866-82	104.9
Scotland	1865-81	122.0
Sweden	1866-82	131.9
Denmark	1870-82	137.2
Belgium	1867-83	148.2
England & Wales	1866-82	149.2
Finland	1878-80	164.9
France	1875-82	166.2
Switzerland	1869-80	195.2
Prussia	1874-82	207.8
Italy	1872-82	209.7
Austria	1866-83	255.3
Russia in Europe	1867-78	266.8
Bavaria	1866-83	308.4

In Manchester in 1900 the lowest infantile mortality of any district in the city was in Cheetham which is largely occupied by Jews. Most of the Jewesses work at home but suckle their children, & there is very little drunkenness. A similar lessened incidence of infant mortality among the Jews has been observed in some parts of the Continent & in New York. J. M. Rhodes (III Sept. 13/02) Dr Ekhund of Stockholm quoted by J. Wellington Byers (II) states that deaths of children

under 1 year of age average 25% of all deaths for Europe. For the largest cities of the United States of America he says "The infants dying under 1st of age average 30% of the whole number born" though Byers ibid Vol I p 135 states that the 10th census gave average death rate of such children for 31 registered cities as 267.5 per 1000.

Mortality of infants at different periods of 1st year of life

"Life is most liable to perish in its earliest stages" — "the liability decreasing in something like geometrical progression until the body becomes developed & the reproductive function is established, when the chances of destruction again increase, the succession of the species being thus secured" Rumsey quoted by Newsholme I) As each week after birth elapses the chances of survival increase. The Registrar General in his 34th Annual Rep: showed that mortal was greatest in 1st week of 1st month of 1st year of life. It falls in 2nd month & gradually declines to the end of the 7th month after which no change in infant mortality is observable.

Table IV. Annual Death-rate per 1000 at each month of age. Registrar General's Report 1875

age in months	Healthy districts	English Life Table.
0	447.51	571.32
1	145.49	218.37
2	102.05	157.10
3	87.16	131.87
4	81.09	126.04
5	75.54	120.50
6	70.54	115.09
7	65.97	109.92
8	61.83	105.01
9	58.32	100.33
10	55.28	95.84
11	52.86	91.61

Table V. Analysis of deaths during 1st year of life 1900.
England & Wales.

All causes	All ages	0-3 months	3-6 mos.	6-12 mos	Totals under 1 year
males	303.823	39,158	16,745	23,555	79.458
females	284.007	29.662	13.538	20.254	63.454
Totals	587.830	68,820	30.283	43,809	142.912

Births during 1900. { males 471.044
females 456.018.

The Registrar-General in his report for 1890 analyses the mortality during first year of life thus:-

Table VI. Mortality during infancy. (1890)

age	males	females	Ratio of male & female mortality
0-3 months	333	261	1·276
3-6 "	147	122	1·205
6-12 "	120	100	1·200
0-12 "	204	164	1·244

(Rates are per 1000 living at each age)

Male mortality greater than female mortality

As shown by the above tables IV. V. VI. this holds good in every month of the 1st year of life. with the result that though more boys are born than girls in the proportion of 1036-1000 (1900) at the end of the year more girls than boys are alive.
In 1900 the mortality of male infants was 168·6 while that of female infants was 139·1 per 1000 births of each sex respectively (see table XII p.23) The deaths of males & the deaths of females under 1 yr of age were in the proportion of 121 to 100 which tallied very closely with the proportion of previous years.

Table XIII. p.24 shows that in the twenty headings of causes of death in every one, with one exception only, the male mortality exceeds that of the female. The exception is whooping cough which always causes a slightly higher mortality in females.

Relation between Infant Mortality and the Birth-rate.

The infant mortality being stated in terms of the no. of births in a year, if the no. of births are increased so will the no. of deaths, but the death-rate is not necessarily increased. H. R. Jones (V.) 1894 showed a local connection in Northern towns between a high birth-rate & a high infantile death-rate.

Table VII. Northern Towns 1871-80. H. R. Jones (ibid)

Birth-rate	Rate of Infantile mortality
over 35	168
under 35	144.

Newsholme in commenting upon this (I) p 134. considers it neither regular nor constant. He takes the ten towns with the highest birth rate in 1897 & the ten towns with the highest infantile mortality & shows that four in the first list do not appear in the second. He considers it merely a coincidence. In big towns there is a high birth-rate but also other influences at work which affect the infant mortality, viz overcrowding, injurious industrial occupation of mothers, more drunkenness, ignorance, & neglect.

Relation of Infantile Mortality to Marriage-rate.

Jones (ibid) also showed that infantile mortal. has no regular relation to marriage rate, but local high marriage rates were apparently related to high infant-mortality in Northern towns. The marriage rate varies with national prosperity (of which it is an index) & is high in rapidly growing towns, eg. many of those of Yorkshire & Lancashire. There also commonly occurs from influx of country people & intemperance, crime & prostitution are prevalent. To these latter causes the increased infantile mortality is due.

Relation to general death-rate.

Prof. Sir W. T. Gairdner (III) Aug 30. 1902. (VI) endeavoured to show that there is a normal relation between the infantile & the general death-rate. "insomuch that while in the most favourable circumstances actually existing the loss of infant life under 1yr. is commonly about 5½ times the death-rate at all ages, the proportion between the two death rates may be expected (normally as it were) to rise with each successive rise of the general death-rate, till in places where the conditions are unfavourable all round, the proportion may come to be as high as 15 or 9 or 10, or even 11." —— "in certain instances & localities this apparently normal proportion might be interfered with" —— "and that a locality having low or very moderate general death-rate might have an infantile death-rate so largely in excess as to point irresistibly to the conclusion that some special influences in those districts bore unfavourably on the domestic conditions &c".

I have only quite recently come across this article & have not

had sufficient time to investigate the propositions here set forth.

As stated above & shown in table I. the general death rate of England & Wales has continuously declined in each decennium since 1861 whilst the infant mortality though it fell in two decennia rose again in the last completed one to its former level. It would appear therefore that the latter has no definite relation to the former.

It is doubtless true that localities with a low general death rate may have a high infantile mortality eg Leicester. where the 'special influence' at work is epidemic diarrhoea.

Density of Population.

Dr Farr found that the rate of mortality of population varied as the twelfth root of the density, and this holds good in a general way of infantile mortality. "The direct consequences of close aggregation eg the fouling of air, soil & water, and the more easy spread of infectious disease, are probably as nothing in comparison with the indirect consequences" (Dr Ogle. (IV) supplement to 45th Rep.) These being want, filth, crime, drunkenness, dangerous & unhealthy trades.

Newsholme (V march 1891) has shown that a great density of population is not necessarily associated with a high infantile death rate. In his statistics of the Peabody Buildings where the density was 757 persons per acre as compared with 55 per acre in the whole of London, the infantile mortality averaged 139 in 9 years, 1882-90. as compared with 153 for the whole of London. He states that "the number of rooms occupied by each family"

"is of much greater importance in relation to health than the number of persons living on a given acre, as this fact throws important light on the state of each tenement as regards overcrowding. In the Peabody Buildings the average number of persons to each room is 1.8. Given houses properly constructed & drained, and given cleanly habits on the part of the tenants increased aggregation of population on a given area has no influence in raising the death-rate, except in so far as it is accompanied by overcrowding in individual rooms, an event which is by no means necessary under the circumstances named. In other words there is no causal relationship between density of population per se and a high mortality. The true index of density is the number of persons to each occupied room"

In the Peabody Buildings diarrhoea was slightly lower than that of London. But other zymotic diseases, eg. Scarlet fever, Diphtheria, & still more whooping cough & measles were more fatal & therefore probably more prevalent. So also the death rate from phthisis and tubercular diseases was higher. There is therefore even in these model dwellings an increased risk from these zymotic diseases & this is to be attributed solely to density of population. Still as regards infant Mortality Newsholme's deductions hold good because these diseases (diarrhoea being less in incidence) only account for a comparatively small proportion of their total mortality.

Town and Country.

Infant mortality is greater in towns than in the country. In counties it is highest in mining districts e.g. Durham, South Wales, & those with textile industries e.g. Lancashire. It is lowest in purely agricultural districts e.g. Rutland, & Wiltshire. (IV)

Table VIII. Infant mortality in England & Wales 1881-90.

England & Wales	142
28 towns	162
50 towns	153
Urban England 78 towns	160
Rural England	128.

The Registrar General. writing of the period 1889-91. 54th Annual Report. Comparing the town with the rural rate states that in the whole year 218 deaths occurred in the former & only 97 in the latter out of 1000 births. This higher death-rate holds good throughout all the year. It is in the later months that the chief excess of mortality occurs in the urban rates. In 1st week of life the town rate exceeds rural rate by 23%, in 2nd by 64% in 3rd by 83%, in 4th by 97%. In the first month the town rate is 27% above the rural rate, in 2nd month 121% above it. The excess goes on increasing till in the 6th month it is 273% above it & does not decline much below this point to the end of the year. He concludes :-

"The mortality from diarrhoea is more than seven times,"

"That from measles & scarlet fever more than three times as great in town as in country. Syphilis is more prevalent in towns. Also suffocation chiefly from overlaying & due to drunkenness generally is greatly in excess in towns. The mortality from premature birth is nearly twice as high in towns as in the rural counties. To these causes the excess of mortality in infants in towns is due. The mortality from congenital malformations is much the same in country & towns."

Towns vary amongst themselves. eg London is more favourable than many manufacturing towns. The differences depend upon many conditions which will be considered separately eg. occupation of mothers, insanitary surroundings. The various portions or sub districts of towns vary considerably in their rates of infantile mortality. Thus in Manchester in 1901 in one district it reached 255 and in another 304 per 1000 births. In York in 1898. ~~Ha~~ for the servant-keeping class it was 94: for city generally 176: for a large poor district 247. In one parish it rose to 334 per 1000 births. Rowntree (III ann. 1902)
It is the poorest portion of a town which always shows the highest infantile mortality.
The conditions favourable to high mortality in towns are various. The occupations are often unhealthy. in fact the unhealthy & dangerous trades are almost confined to towns. Life is at a strain higher tension in towns: physical & mental strain are both increased & more continuous Drunkenness, prostitution prevail. Overcrowding, which acts in a variety of ways, impeding ventilation, favouring

the spread of disease. "produces a lowered mental tone by bringing the sexes together". The influences due to confinement in schools, offices, factories, & workshops are great. It is well known that town dwellers are not the equals of country dwellers in stamina & physique. Amongst children rickets, scrofula, tuberculosis & choleraic diseases are more prevalent in town than country. Per contra towns at this date are now generally better drained & supplied with water than country districts, & moreover the general death-rate of towns is rapidly approaching that of country districts.

Country dwellers have purer air but not necessarily better houses, in fact often worse. ~~& generally more~~ In addition the lower classes in the country have a better dietary than the same classes in the town. They drink more milk & are on the whole better nourished, free from constitutional diseases inducing lowered vitality & therefore more fitted to beget healthy children.

Causes of growth of towns.

A short consideration of the migration ~~between~~ from the country into towns is of interest here. Between 1881 and 1891 the urban population had grown by one estimate (by Dr Ogle) 15·4% by another estimate (by the same authority) 16·34%. While the remaining population had only increased by the first estimate 2·98% or by the 2nd 4·57%. Thus there is a much smaller rate of increase of population in rural districts. In twelve English & eight Welsh counties (out of a total of 54) there was in fact an actual decrease.

The population of towns is largely recruited from country districts. According to Ogle (Journ 1889) "This

"This is a necessary consequence of the rigidly limited amount of land available for agriculture, & the practically unlimited amount of material available for manufacturing purposes". Other authorities consider that people leave the country districts because of our system of land tenure.

But there is no doubt that the chief cause is because of the higher wages to be earned in towns.

Whatever the causes may be the baneful effects on infant life is one of the most serious results of this "townward migration" This "urbanization" of the people is I think the principal ~~reason why~~ factor in keeping the rate of infant mortality at the point it stood at four or five decades ago, in spite of the improved sanitary conditions now existing.

From my general reading & information I do not see any tendency towards a return of the people to the land, in fact the stream still runs apparently as strong as ever in the opposite direction. The evil, and evil it undoubtedly is so far as infant life is concerned, seems to be inevitable.

National prosperity. This influences infant mortality in at least two ways; 1st By demand for labour & therefore better wages. This amongst other things increases employment of women, & mothers are tempted to go to work as soon after confinement as possible and stick closely to it. They leave their infants early & leave them to be fed & tended by others - a fruitful source of infant death. 2nd It means a greater consumption of alcohol per head of population. Therefore more drunkenness, poverty, privation, crime & neglience.

Social or class conditions

Dr. Grimshaw, Registrar-General for Ireland investigated the influence of social conditions on the rate of mortality of children under 5 years of age in Dublin. He found that among the upper classes the mortality was 18·2. among the middle class 59·2, & among the artisan class 72, while the mortality among the pensioners reached 116·9. (XXVII) Ansell VIII. (I p 128) gives in reference to 49,099 English children of the upper & ~~middle~~ professional classes, of whom 2% were still born, an infantile mortality of 80·5% per 1000. Farr's Healthy District's Life Table based on the experience of 63 rural districts, showed an infantile mortality of 103 (I p 128) Mention has been made of the high rates in certain poor districts of large towns. In London in 1901 it varied from 104 in Hampstead, 107 in St Marylebone, to 175 in the City of London & 197 in Shoreditch.

Körösi of Buda-Pesth (II) in writing of the susceptibility to infectious & contagious diseases among children states that in his experience Cholera, Small pox, measles, & typhoid fever are more prevalent among the poor, while Diphtheria, Croup, pertussis, & Scarlet fever are found among the well-to-do. Zymotic diseases as a whole are 60% more frequent among those living in basements than in higher domiciles. But the increased mortality in underground tenements applied only to certain diseases, especially measles & pertussis, while Diphtheria & Scarlet fever were 10% less than in people living above ground.

Season & meteorological conditions.

The general death rate of England & Wales as shown by the following table is usually highest in the first quarter of the year, & usually lowest in the third quarter; the other quarters having death-rates nearly equal.

Table IX. Death-rate to 1000 living. all ages. all causes.

period 1838-1900	quarter ending			
	March	June	September	December
	23·5	20·6	19·4	20·7

Unfortunately I have not facilities at command for comparing the infantile mortality rates of each quarter with the above rates. (The Registrar-General's Annual Reports do not always furnish them) A comparison of one year must suffice.

Table X. Annual death rate from all causes, & infantile mortality. England & Wales 1896.

1896	Annual death rate from all causes	Infantile mortality
1st quarter	17·9	143
2nd quarter	16·3	124
3rd quarter	16·3	178
4th quarter	17·9	146

Here the infant mortality is seen to be highest in the third quarter; lowest in the 2nd, & next lowest in 1st & ~~fourth~~ 4th. This is generally the case. It is due chiefly to the prevalence of epidemic diarrhoea in the third quarter.

Also in London 1901.

Table XI. Deaths at all ages, & under 1yr. London.

1901	Deaths at all ages	Deaths under 1 year of age
1st quarter	21.647	4332
2nd quarter	18.086	3717
3rd quarter	19.406	6704
4th quarter	20.785	4858.

Mild winters & cool summers both favour a low infantile mortality
A cold wet summer always has a low mortality – ex. that of 1902.
If the mean temperature of the air in June July & August
the infantile mortality from diarrhoea is small.
Conversely hot dry summers favour a high mortality
in infants.
In infants (as in adults) abdominal diseases are prevalent
in summer, respiratory diseases in winter. In other words
the excess of the summer mortality is chiefly due to diarrhoea, &
that of the winter to Bronchitis & pneumonia.
Excess of moisture in the atmosphere is said to favour bronchitis
but it is probably changeability of weather which most induces it.

The Causes of death of Infants.

The Registrar-General divides deaths into eight classes as follows:-

Table XII. Total deaths of infants under 1 yr of age in England & Wales 1900.

Causes of deaths	males total	Ratio of infant mortality (males)	females total	Rate of infant mortality (females)
I Specific febrile & zymotic diseases	15.402	30.5	13.772	30.2
II Parasitic diseases	139	0.29	120	0.26
III Diatetic diseases	250	0.53	230	0.50
IV. Constitutional diseases	3967	8.4	3057	6.6
V Developmental "	12.448	26.4	9852	21.6
VI Local "	34.449	73.1	26.300	57.6
VII Violence	1611	3.4	1386	3.0
VIII All defined & not specified causes	11.192	23.7	8740	19.1
All causes	79.458	168.6	63.457	139.1

In the above table is shown the rate of infant mortality of each of the eight classes of the Registrar-General, for males & females respectively. The male mortality in every instance exceeds that of the female -

Arranged in order of their fatality the chief causes of death in infants for the year 1900 were: — Table XIII

Analysis of Causes of death in infants under 1 yr of age. England & Wales 1900.

	Causes of death	Total numbers of deaths of	
		males	females.
1	Debility, atrophy & marasmus	10748	8327
2	Premature birth	10314	8162
3	Diarrhoea & dysentery	9292	8004
4	Convulsions	9123	6899
5	Bronchitis	7686	6077
6	Pneumonia	5873	4312
7	Enteritis & gastro-enteritis	4718	3719
8	Tubercular Diseases. {Tabes mesent. / Phthisis / Other forms}	3554	2733
9	Whooping cough	2675	2833
10	Congenital malformations	2134	1690
11	Measles	1668	1399
12	Inflammation of brain	1291	1024
13	Dentition	1250	970
14	Diseases of Stomach	1238	1006
15	Suffocation	1037	887
16	Syphilis	614	540
17	Influenza	354	263
18	Rickets	298	210
19	Starvation & want of Breast milk	246	213
20	Diphtheria	234	198

A consideration of this table seemed to indicate two chief groups of causes of infant mortality. Firstly those which are ante-natal or indirect. i.e. acting through the parents and chiefly the mother. Secondly those acting directly upon child after birth. or post-natal.

To the first or ante-natal class I would relegate all those deaths under headings 1. 2. that portion of 4 which occurs in the early weeks of life, 10 & 16. (Table XIII) viz atrophy debility & inanition, premature birth, convulsions (a portion, over 60% of deaths occurred within the first three months of life) congenital malformations and syphilis — a total of over 35% of the whole number of infant deaths in the year 1900.
All the other headings might be considered as due to post-natal causes.
The division is somewhat arbitrary but seemed definite enough for the purpose of this thesis.
The Registrar-General in examining the causes of death of 100,000 live born children who died in the 1st year found that the excessive mortality of the first month was almost entirely due to premature birth congenital malformations & feeble vitality (atelectasis, atrophy & convulsions). Over four fifths of the deaths of the first month were due to these causes. IV 1891.
Congental syphilis was most fatal in the first four months.

The Registrar-General's Statistics. A few remarks about the Above might not be out of place here. & firstly it is only necessary to mention that still births are not registered in this country.
There are certain fallacies in registration of causes of death which are partly due as Newsholme points out I. p 29. to differences in Nomenclature & Classification of diseases, & partly to imperfection of medical science & Medical men.

As an example of differences in nomenclature may be adduced the deaths certified as Enteritis, Gastro-enteritis, muco-enteritis. These should undoubtedly be returned as diarrhoea or as the Committee of Royal College of Physicians. Lond. have lately recommended Epidemic or Zymotic enteritis.

In classification the R. G's system can hardly be said to be up to date as regards the Tubercular diseases. These are at present classified under at least four different headings under the class of Constitutional diseases. They should undoubtedly, in the light of present knowledge, be returned ~~as such~~ under the heading of Specific febrile or Zymotic diseases.

Difficulties of diagnosis (for which of course the R. G. is not responsible) render a large class of diseases debility, convulsions, dentition ~~difficult~~ difficult to deal with aetiologically.

The Diarrhoea death rate is shown by the R. G. in terms of 1000 living, but as diarrhoea in its fatal form at least is a disease of infants, or early childhood, it has been suggested that it should be shown in terms of 1000 births like the infant mortality.

In my opinion the deaths certified as Laryngismus Stridulus should be ~~included~~ classified with Rickets.

Causes. I Ante-natal or Indirect.

Unsuitable marriages

Consanguineous marriages are said to be harmful if there is a hereditary or family disease. The intensity of this latter is apparently greater in the offspring. marriages of weakly or diseased persons also no doubt a cause of a certain amount of infant mortality

Maternal influences.

Defective nutrition causing anaemia is responsible sometimes for death of the foetus in utero or results in a puny delicate child who dies early. The causes of defective nutrition are many, eg. chronic diseases, as cancer, phthisis malaria, nephritis (E. Cohn stated at a meeting of the Berlin Obstetrical Society that 86% of the children from mothers with nephritis would be born still or too feeble to survive long). A thought strikes me here that according to the R.G.'s statistics Trephritis is one of those diseases which is on the increase. Might this increased prevalence of nephritis account in some degree for the remarkable increase of premature births? Poisoning by lead will be mentioned later (see under factory & Industrial Laws p. 49)

Paternal influences.

A father too young or too old, one the subject of a debilitating disease, a victim of chronic poisoning (or a drunkard) is liable to beget an embryo that will die before maturity or else be born defective and unsound. "Men afflicted with nephritis, diabetes phthisis, or cancer (all these diseases except phthisis are on the increase vide Decennial Supplement to 55th Annual Report p. xxxiii)

"have been found in some instances unable to produce a foetus of normal growth. While their widows subsequently married have borne healthy children".
Barton Goodhart III. vol 1. p 220.

Illegitimacy. Illegitimacy is declining in England & Wales. In 1900. there were 36814 illegitimate births out of a total of 927,062. They were in the proportion of 40 per 1000 which was equal to the proportion of 1899 but 2 per 1000 below the mean proportion of the ten years 1890-99. In proportion to population the illegitimate birth-rate was 1·1 per 1000 which was the lowest rate on record. IV. 1900. Many statistics can be produced to prove that these children have a far less chance of survival than legitimate ones. Newsholme I p 181 gives the following figures for Brighton

	1892.	1893.	1894.	1895.	1896.	1897
Deaths of legitimate infants per. 1000 legitimate births.	134	158	135	151	129.	135
Deaths of illegitimate infants per 1000 illegitimate births	360	319	173	358	233	265.

showing as he puts it "that an illegitimate child born in Brighton during 1897 had less than one half the prospect of reaching the end of its 1st year of life which was enjoyed by a child born in wedlock".

Dr Farr statistics :-

	Number of deaths of legitimate infants per 1000 legitimate births	number of deaths of illegitimate infants per 1000 illegitimate births
Twelve districts with a low infantile mortality	97	388
Twelve districts with a high infantile mortality	192	366.

From Dr Sargent's (M.O.H. Lancashire) report for 1901 I take the following figures. In the whole County (Lancashire) 268 illegitimate children were born & 91 died within 1 year of birth i.e. 33%.

In Manchester in 1901. 46% of the illegitimate children born died within 1 year of birth. In the district of Ancoats the percentage rose to 60 & in the district of Crumpsall 66%.

It must of course be remembered that, as stated above, the total number of illegitimate children is small & therefore the effects of the high mortality among them is proportionately to the total infant mortality little.

The excessive mortality among these children is due to many causes. In the first place a large proportion of them are first-born children (in these the mortality is always higher) e.g. out of 361 illegitimate births 65·5% were first children, 21·94% second children. 11·67% third, 1·11% fourth, & 0·28 were fifth children. They occur chiefly among the poorer classes. The mothers are usually young & have been subjected to during the pregnancy much mental worry & anxiety. They may not receive due attention at the time of labour. After birth they are often put out to nurse with relatives or others. The relatives often regard the infant as an incubus and an evidence of shame, & there is no doubt a wilful desire to get rid of it. This induces neglect. Sometimes the infant is abandoned.

The statistics of Dr Lankester in his evidence before the Committee on Infant Life Protection in 1871 was significant:-

Inquests	0-1 year.	1-7 years
Total inquests on legitimate children	2728	2712
& " " illegitimate "	1251	193.

The inquests on illegitimate children were 31% of all inquests held on infants although such children formed less than 5% of the total number of births.
The high mortality among these children, judging from the number of inquests held, is largely preventable, & due partly to the special circumstances of their birth, & partly to such causes as neglect, criminality, poverty, improper food & other causes which affect legitimate infants also.

Age at marriage. Marriage of minors.

Matthews Duncan quoted by Newsholme I p 129. showed that the vitality of infants in a maternity hospital was greatest when the age of the mother was about 24 years.
Körösi of Buda-Pesth quoted by Newsholme I p 129 showed the influence of the mothers age both as a prenatal cause of infantile mortality & a postnatal one, the latter on account of her ignorance & inexperience.
In 1900 in England & Wales among the persons who married 51 per 1000 of the husbands & 163 per 1000 of the wives were minors.
Below is given a table showing the counties in England & Wales in 1900 with the highest & lowest proportions of wives under age at marriage & their infantile mortality rates.
From this table there it seems to be a distinct relation between under-age at marriage & infant mortality.
It must however be remembered that other factors must be taken into account. The counties with the highest proportion are all counties with large urban populations where intemperance, ignorance prevail, & some female labour is employed.

Table XIV. Counties with highest & lowest proportions of wives under age at marriage & infantile mortality. Vide supra.

Registration Counties Reg	proportion per 1000 women under age at marriage	Infantile mortality
Lowest North Wales	81	138
Hereford	84	106
Westmoreland	100	110
Shropshire	101	113
Dorset	104	91
Highest Staffordshire	204	178
East Riding Yorkshire	204	179
Monmouth	208	150
Derbyshire	211	152
Nottingham	224	176
Durham	224	167
England & Wales	163	154

Youth of parents has been assigned as a cause of scrofula in children.

Combe quoted by Ashby II vol II p 139 quotes instances where parents were 19 & 17 years of age or thereabouts, their first-born being scrofulous & their later children healthy.

Advanced age of parents is also said to predispose to scrofula

Factory & Industrial Employment. This is to some extent an ante-natal cause of infant mortality but its greatest effect is a post-natal one & will be considered under the latter heading. See page 46

Conditions of health of parents.

Debility of parents due to insanitation & other causes.

To assert that the health of the parents must affect the well-being of the child is merely to state a truism. The influences upon child bearing & child life of certain diseases, e.g. Syphilis is fairly well known. But what can be said of the numerous unhealthy & debilitating conditions of modern life under which a large proportion of the population live & which go to make up what is known as civilisation? Something definite perhaps can be told of the results of actual vice & drunkenness for these sins bring their votaries under the observation of medical men in hospitals or elsewhere where their effects can be studied & recorded. But outside the question of vice or drunkenness it would appear that there is an influence or influences at work injurious to infant life. How are we to explain the large & growing number of deaths registered as due to premature birth & also those due to congenital defects, to debility, convulsions & atelectasis? To what features of modern life is this large & increasing class due? Is it to one or several? Probably the latter. It would appear as if that these influences, whatever their nature may be, are increasing. They are felt in both Town & Country, but more so in towns. e.g. premature births (deaths from) are nearly twice as high in towns as in rural counties (R.G. IV. 54th Supplement)

These are questions of great importance to the nation & the state. There are elsewhere evidences that a serious physical degeneracy is taking place in our town populations as shown by the wholesale rejections of recruits for the army. The causes at work in producing this result & those of infantile mortality are probably to some extent identical.

Impure air & overcrowding. These are in my opinion among the most fertile causes of disease in towns. The breathing of impure air produces a lowered state of vitality manifested by anaemia, dyspepsia & lassitude. This lowered condition of health is quite common among those who spend most of the day indoors in offices, workshops, & factories. Those who live thus are more susceptible to acute diseases & offer less resistance to them than people living an outdoor life. Osler showed that the healthiest industrial workers were gardeners, farmers, & agricultural labourers & policemen who worked out of doors. These people have only half the death-rate from phthisis that the rest of the community have & nearly the same decrease in other Respiratory diseases. The relation between foul air & overcrowding & deficient ventilation & phthisis is well recognised. Soldiers, sailors, & prisoners in jails formerly suffered more than the general population. Now they suffer less from more attention to cubic space & ventilation, food & other factors remaining the same. We have only to think of the large towns with their narrow streets, courts & alleys, with their immense populations breathing an atmosphere almost always polluted under the most favourable conditions to realise what in the aggregate must be the amount of lowered vitality of the thousands of inhabitants.

This lowered vitality of parents must injuriously affect their offspring.

Back-to-back houses which are to be found in enormous number in Leeds & other towns of Yorkshire & Lancashire & other places & in which ventilation is always deficient show a greater incedence in phthisis, pulmonary disease in the inmates than in Overcrowded communities zymotic diseases are more prevalent though this may be due to difficulties of isolation.

The products of combustion of coal gas assist & vitiate the atmosphere & intensify the effects on health of impure air. Overcrowding "predisposes to moral, mental & physical deterioration, to all communicable diseases including all septic & parasitic conditions, & especially to typhus fever & tubercle; to pulmonary affections; & to a variety of nervous diseases. By lowering the morale of populations it increases all other predispositions & in fact passes into an active exciting cause of disease" Irvine & Murray (xii) to have considered impure air. To one living in the West Riding of York impure water suggests itself as a prenatal cause of infant mortality. Here lead poisoning from water supply is extremely common. Sheffield, Bradford, Huddersfield, Halifax, Batley, Keighley & other towns are all supplied with plumbo-solvent water. It was stated before the House of Lords Committee on the Sheffield Water Bill that between 4 and 8 millions of people in England were supplied with water which acted on Lead. An indefinite Cachexia, & anaemia is produced in those who drink this water as well as certain specific effects upon the reproductive organs (vide. Factory & Industrial Labour page 49)

In this connection Dr McMaster. M.O.H for Whitwood Mere in his annual Report for 1891 (XIII) stated that 46 children had died within a few hours of birth & that the mothers showed unmistakeable evidence of lead poisoning.

Poverty. It has already been mentioned that infantile mortality is highest amongst the poor & especially among the poor of towns. Here many other conditions must be taken into account besides mere poverty. Poverty implies deficiency of food. clothing. & housing. all conditions which conduce to physical degeneracy. The housing question has already been partially considered (impure air &c &c) It can scarcely be held I think in these days that want of sufficient food & clothing are appreciable causes of infantile mortality. That the former (want of food) can probably be so was seen in the effects of the Siege of Paris. — The "enfants du siège" for some time distinguishable from children born before & after them. Whether the quality of the food eaten by the lower Classes in towns is the most suitable for the growth & reproduction of the species I have grave doubts, but the question cannot be pursued here fully.

Heredity. That peculiarities of feature, temperament, structure & tendency are transmissible from parent or ancestor to child no one can for a moment doubt.

In Hutchinson's new Vol. vol 1. p 40. "Not only may offspring derive from parent cells peculiarities of cell & tissue structure with the proclivities attaching to them, but it is also in a high degree probable, that in some instances parasitic elements, or specific poisons may pass directly into the tissues of the embryo".

Hereditary. Syphilis. As defined by Hutchinson XI vol II p. 251. This is a specific fever similar to the Exanthemata but slower, & probably due to a micro organism which however has not yet been demonstrated.

Syphilis in infants may be congenital or acquired. With the latter form we need not be concerned here. ~~The study of syphilis is best studied at some length because as a hereditary disease more is known concerning it than probably of any other disease.~~ As Hutchinson says it may be regarded as a 'type' of hereditary diseases.

Congenital syphilis may be derived from one or both parents. It is fatal in a large percentage of cases.

The father may infect his offspring or the mother may do so not only at the time of conception but at any later period up to the last few weeks. Both parents may of course be syphilitic, then the offspring has a double chance of inheriting the disease, "but not necessarily or invariably so". The more recent the disease in the parents the more likely is the child to suffer & the more likelihood of ch bring a severe type. Generally speaking the earlier in the disease if the parents the child is born the more likely is that child to die. Liability to die decreases with each subsequent pregnancy, but this is not an invariable rule. Syphilis of parents is apt to cause miscarriage & premature labour. In other cases the child is carried to full term & may die soon after or may live & recover.

Hereditary syphilis always shows itself within 3 months after birth usually within the first two. It is most fatal in the first 4 months. Reg (IV. supplement p 54.)

Syphilis (continued) Extent of the disease - As still births are not registered in this country it is impossible from statistics to judge of the full extent of the ravages of this disease. The number of deaths of infants in 1900 in England & Wales was 614 males & 540 females.

Stat. Journal XCI. Vol II p 263. makes use of these expressions :- "Thousands of men marry at or about the end of two years after primary syphilis & many at much shorter periods. Yet the instances of communication of the disease to their wives & children are but infrequent. On the other hand if marriage takes place within a years of the primary disease it is perhaps exceptional for the children to escape, & by no means uncommon for the wife to acquire a chancre" In speaking of marriage in reference to syphilis "we have always to remember that syphilis in young men is and always will be very common, & that the cases are really very numerous." He regards "the physical evils & sufferings produced by syphilis not so great as those produced by scrofula (or tuberculosis) or the neurotic diatheses, or that of arthritis or of cancer". & states that "there is no reason to believe that infantile syphilis is more common now than in the past".

Fournier writing in 1885 on the depopulation of France says syphilis destroys 68% of infants born of syphilitic parents. Le Pileur writing of cases in prison 1881-85 & states that of 643 cases of syphilis he analysed 130. 60 of these contracted syphilis after having had children, 52 before having had children, 18 had children before & after. The 60 women had 166 pregnancies, 72 live born children dying soon, 8 still births, 86 surviving children. The 52 women had

122 pregnancies, 95 still births. 22 live-born children soon dying, 7 surviving children. The 18 women had no abortions before contracting syphilis, no still-births, 27 live-born children dying soon & 16 surviving children. After infection they had 21 abortions, 6 still births, 3 live born children dying soon, and 1 surviving child. She concluded that in France 14% of pregnant women were syphilitic; 7% of children conceived by syphilitic women will survive danger of foetal & early infant life. Of 100 conceptions 13 perish solely from syphilis in the mother.

Syphilis of parents often stated to be a cause of Scrofula in children. The elder children of marriage may show signs of congenital syphilis while the younger ones are scrofulous & suffer from caseous glands &c.

Alcoholism. As to the extent which alcoholism plays as an ante natal cause of infantile mortality it is difficult to speak with any certainty. Much has been written upon the subject. One set of so called authorities can be adduced to prove the baneful effects of alcohol on the progeny of drunkards, whilst another set could be quoted to show quite the opposite. On the whole it is generally believed that alcohol causes a degeneration in the offspring of those who indulge in it to excess.
The Society for the Study & Cure of Inebriety appointed a Research Committee in 1899 to investigate certain points. Its conclusion was "There is no evidence that acquired"

"characters are heritable. In particular there is no evidence that characters acquired by the parent through indulgence in drink are inherited by the children subsequently born. The Committee are aware that it is possible that the mental & physical states produced in the parent by indulgence in alcohol do affect the child in some way through inheritance: again, they admit as possible, though strictly speaking this is no question of the inheritance of an acquirement, that indulgence may do damage the parental tissues that the germ is ill-nourished, & the child thus affected; yet again, they admit as possible that the alcohol circulating in the parent's blood may directly affect the germ, & in this manner affect the offspring, as by producing degeneracy. But these speculations have not been strongly supported by any evidence tendered to the Committee."

~~Death attributable to Acute total cancer~~.

Tuberculosis & Scrofula. Some deny the effect of inheritance in these diseases. They account for the origin of all cases seen in the young by infection by the bacillus from without. But in regarding the question if we look beyond the one class of tubercular affections, that of the lungs, & include all other tubercular manifestations those of bones, joints, glands, & skin, the whole realm of tuberculosis & scrofula in short, it is difficult to disbelieve that heredity plays no part in their causation. In a disease caused by bacterial agency there are always two factors to be considered – the bacillus, & the state of the tissues of the organism in which it lives. Either a

bacillus or the particular state of the tissues may be inherited or both. Tubercle Bacillus has been shown to exist in the foetus in utero. It is possible it may remain there & develop only when suitable opportunity occurs. Universal tuberculosis has been found in an 8 months foetus Calf by Johne. Jacobi II vol II p 167 reported a case of a 7 month foetus which was born & lived only a few minutes where numerous gray miliary tubercles in the tissue of the liver, with others in the peritoneum over liver, & in were found. Baumgartner, Steiner, Neurenther, F. Weber, Demme, Steffen. quoted by Jacobi (ibid) all found tuberculosis in the early weeks of life & often so advanced as to make its starting during foetal life probable. But on the whole tuberculosis, & especially that form which is transmitted, is admittedly rare in the first weeks of life. As regards the state of the tissues the fact that any peculiarity can be transmitted has also been denied by some. The majority, I believe, of observers, believe that the transmission of a condition of tissues, a proclivity or tendency in them, to take on more readily than natural inflammatory & other processes some leading to the deposition of Tubercle Bacillus with its subsequent growth & multiplication. I am disposed to regard this what I may call tubercular constitution as predisposing in a very marked degree to a large infant mortality. A child is born into the world with tissues having a decided proclivity to take on forms of inflammation under slight provocation. This 'slight' provocation soon appears, inflammation results, with death perchance.

Thus I would account for many deaths registered as Bronchitis, inflammation of the brain, &c.

Parents the subject of scrofula & phthisis are apt to beget children who also suffer from scrofula, eg. children with scrofulous glands in the neck are often brought by the mother who herself shows scars in the neck from similar affection in childhood. or the father or mother may have had hip or other bone disease. Consanguinity & Youth of parents have been assigned as causes of scrofula in children. Rapid child-bearing also appears to be a cause.

Infants of tubercular parents then when they become tuberculous may either be (1) examples of hereditary transmission, or (2) have contracted the disease by contagion or tuberculous food (having a congenital predisposition) It is often difficult to determine the extent heredity plays in a given case, eg. where members of a family live together & one after the other dies there is an infectious environment always present in the dust of the dwelling house. What appears to be heredity is often only really ordinary infection by inhalation.

Heredity in relation to marasmus. How is one to account for the large class which waste & die early, many of them without any discoverable lesion, post mortem. Some say in these cases there are always lesions to be discovered microscopically in Lieberkuhn's follicles or Peyer's glands. Others deny this.

We cannot in the present state of knowledge state definitely the reason of such cases but we know clinically that they are often found at the end of large families when the

reproductive power of the parents is on the wane.
Probably a number of children are born into the world with an inherent inability to absorb nourishment. Unhygienic surroundings & bad feeding are also contributory causes of death in these cases.

Heredity in relation to rickets

Rickets has an appearance of heredity in that a number of children of the same family are affected. It is a well known fact that the later children of a family are more likely to be affected than the earlier, probably owing to the mother becoming debilitated from child-bearing or prolonged suckling, & from the necessary hardships entailed by the increasing family, as well as want of good food & other conditions. Intra-uterine rickets occur but are not common. Though Felix Schwarz, abstract in Allgemein, Wien, Med. Zeitung Jänner 1888 claimed to have found signs of rickets in 403 out of 500 new born infants examined. Cases of Intra uterine rickets are said to be related to congenital syphilis. Other observers have noted the characteristic beading of the ribs in still born children. In a few cases they have been observed at a month old. but it is not till after the 3rd month that they are often seen. Many of the cases of severe & early intra-uterine rickets die soon after birth. Barlow & Judson Bury (III vol ii p 252).
"The influence of heredity is probably limited to transmission of weakly constitution, or to some factor of imperfect nutrition of foetus in womb" Barlow & Judson Bury (ibid).
Parents who have been rickety themselves often have children without a sign of rickets. On the other hand children of healthy

parents may become rickety & indeed the majority of cases seen are of the latter class.
There is no actual proof that rickets is transmitted by father to the child but as already stated the mother's health during pregnancy has a fairly certain relation to the causation of the disease.

Heredity in relation to convulsions.

Very little is known of the relation of heredity to convulsions In some families a slight exciting cause will induce convulsions in children which would be quite insufficient in other families. This is explained only by the supposition of a "convulsive tendency" which apparently may be inherited. Some observers consider convulsions in infancy to be closely connected with the epileptic diathesis, but my experience in practice does not bear this out. Convulsions may be due simply to low vitality as seen in children born of parents who are aged, or debilitated, or who suffer from lead poisoning.

Deaths attributable to ante-natal causes.

As stated above the large majority of the deaths of infants in those two classes of the Registrar-General viz Developmental Diseases, & Ill defined not specified causes, together with those from Syphilis & a large proportion of the early deaths from convulsions may be set down as due to ante-natal causes. It is possible that some of these deaths registered as due to atrophy & debility are really due to unrecognised tuberculosis Anderson (XVII) It has been stated that these deaths (atrophy debility &c) are more common after epidemic diarrhoea but the diarrhoea incidence falls mostly in the age period 3-6 months. Whilst these deaths are most frequent in the period 0-3 months. see table XV. p44

Table XV

Deaths from Diarrhoea & Debility, Atrophy & Inanition. 1900.

Disease		age period 0 – 3 months	3 – 6 months	6 – 12 months
Diarrhoea	males	2376	3275	3834
	females	1833	2760	3561
	Total	4209	6035	7395
Debility Atrophy & Inanition	males	7938	1773	1037
	females	5843	1493	991
	Total	13781	3266	2028.

From these figures I do not think the assertion justified that these deaths are largely due to the after effects of diarrhoea. On the contrary they appear to be quite independent of it. Aetiologically they may be said to be due to :-

i Congenital weakness. (many occur at the end of large families)

ii Inability to digest artificial food

iii Existence of organic disease, eg. Syphilis a latent tuberculosis,

iv. no discernable cause -

Developmental diseases (Registrar General)

These may be divided into two classes

i Premature births

ii Congenital malformations.

They amount to 2% of the births. All the deaths occur in infancy & early childhood, & are due to ante natal causes. There is an almost continuous increase in these deaths for the last forty years. while the infant mortality has been stationary. It has been suggested that this increase is due to

(1) increased employment of women, but N. A. Humphreys IV 1894. showed that premature births were more frequent in Norfolk & Suffolk than in West Riding of York & Lancashire where most women were employed - 37-43% of women being employed in the latter counties & 20% in the former.

(2) Another explanation given is that it is due to marriage of minors, but these marriages are decreasing & the relation can be shown not to be constant

3. It has been stated that some of these deaths have been transferred from other headings.

None of these explanations are satisfactory being unsound & the whole subject requires working out.

The deaths from syphilis have been mentioned. pp 37. As regards convulsions. see pages 43.876 ~~Jacobi on XXV p. 178 analysed 365 deaths from convulsions. He found that nearly one half of the deaths of 1st years from convulsions occurred in 1st month. Most observers differ from Jacobi in saying that convulsions are rare in 1st month except those occurring just after birth. which are generally due to disease injury to brain or labour.~~ Malformation of Diseases of Heart & Blood vessels of foetus in utero are said to account for a certain number of these deaths, owing to disturbances in the circulation, & especially in the condition known as Morbus caeruleus or cyanosis. Eustace Smith (XXVI) has several times seen convulsions in children following the internal administration of lead & apparently due to it. This observation is of interest in connection with plumbo-solvent action of Water & with employment of women in lead compounds. (quod vide).

Post-natal or Direct causes of Infant mortality.

Parental influences. Factory & Industrial labour.

Labour in factories & workshops has been alluded to as an antenatal cause. But, with exception of workers in lead compounds, (p. 49). labour itself may be said to be not injurious, It is owing to the fact that it is performed often in close & badly-ventilated overheated rooms for long periods. which induces a state of malnutrition in the operatives who suffer from anaemia, dyspepsia & ~~rheumatism~~ rheumatism. That factory labour may be regarded as an antenatal cause. It may be briefly put that the child of a female factory operative is not so healthy nor so likely to live as if the mother had followed a more healthy employment. But if the antenatal effect of factory labour is somewhat vague & indefinite the post-natal effect upon infant-mortality is very marked as can be easily proved by statistics.

Deaths of children under 1 year of age in 3 classes of artisan towns in Staffordshire per 1000 births. Dr. Reid. M.O.H. Table XVI

Period.	Class I. many women engaged in work	Class II. Fewer women engaged in work	Class III Practically no women engaged in work
10 years (1881-90)	195	166	152
10 years (1891-1900)	211	177	167.

Thus it is seen that where many women were employed in factories in Staffordshire the infant mortality was higher than in those towns where women were not so often employed - the three classes of towns being comparable in point of population, ~~climate~~, & other factors.

From the report of the Chief Inspector of Factories for 1901 I take the following table by Dr Reid. showing the enormous rate of infant mortality in six towns in the Potteries ; -

Factory & industrial labour. (continued)

Table ~~XVII~~. (Dr Reid. H.M.I. Staffordshire)

Period.	Deaths in children under 1 year per 1000 births.							
	Bilston	Burslem	Darlaston	Longton	Newcastle	Tunstall	Urban Districts in County	Large towns in England.
3 years 1889-93	203	193	214	225	167	213	173	168
" " 1894-96	207	204	212	247	184	224	176	171
1899	189	197	243	245	185	181	179	181
1900	221	230	224	255	204	241	176	172

The above towns are the chief industrial centres in the pottery districts, where large numbers of women are employed. No doubt other factors are to be taken into account but it is impossible to dissociate the employment of women & the very high infant mortality shown here.

Dr. Templeman. M.O.H. Dundee. reports that in 1881. 19·4% of married women were employed in mills & factories. In 1891 24% were so employed & the infantile mortality rose correspondingly.

Table ~~XVIII~~. Dr Templeman. Dundee.

Period	Average General death-rate	Infant mortality
1860-69	30·4	not ascertained
1870-79	25	153
1880-89	22·2	155
1890-97	20·8	176

During the Lancashire cotton famine while privation increased the actual death rate, the infant death rate was greatly lessened owing to mothers being compelled to suckle their infants. III 17/4/94

Again the Registrar-General writing of effect of prosperity of trade in Coventry in 1861 says "The care of the mothers in

Coventry has it would seem, counteracted some of the effects of privation. so that neglect of their homes by mothers at work in factories is apparently more fatal than starvation".

This last sentence gives the clue as to the injurious effect of factory & industrial labour of women. It is owing to the fact that mothers are induced to return & work as soon as possible after the birth of a child, leaving it to be brought up by hand & nursed during the day by others. (One month is the period of abstention from work prescribed under the Factory & Workshops Act 1901.) Nothing of course could be more injurious to a child. It loses at once the two chief essentials for its well-being, i.e. breast-feeding & proper nursing. Indigestion from hand feeding is commonly the result to the infant: & sometimes this leads to the administration of opiates. Other evils to the home follow from the mother's absence. The mother herself becomes callous to her children, the home is ill kept as she has often to do her housework at nights after her factory work is over. The domestic arts e.g. baking, washing, are lost to those children who are growing up. The girls go to the mills as soon as they are old enough & pass the required educational standard of proficiency. These girls marry, become mothers, go to the mill in their turn & a bad system is perpetuated.

Much evidence was collected by Sir John Simon (X) showing the evils of the system of female employment in factories. He says (ibid) "Inquiries conducted between 1845-9 & 1872 by the Medical Department of the Privy Council — "abundant proof of the large mortality among"

"children of female factory operatives was obtained during the enquiry". "It was frequently found that two-thirds or three fourths of the children born to these women had died in infancy".

Though the evils of employment of mothers in factories cannot be doubted I am of opinion that whatever the facts were at the time of which Sir John Simon wrote, the circumstances are improved now.

There may still be examples of the horrors of which he wrote but that it exists to the same extent I do not believe. Simon (ibid) makes mention of the high infant mortality in purely agricultural districts & states that inquiry shows the cause to be employment of adult women, the same influence in fact which was at work in manufacturing populations. I have not been able to assure myself that this high mortality exists in purely agricultural districts. The Official statistics on the contrary show these districts to have the lowest mortality.

In this connection it may be observed that the county of Durham shows year by year a high mortality among infants. In this county comparatively few women are employed in factories - so that the high rate there cannot be attributed to that cause.

Lead working. The employment of women in White lead factories has since 1898 been abolished owing to its great danger to health, but ~~this~~ women are still largely employed in other trades where lead compounds are used. Oliver (IX): Chap XIX p.301. shows that women suffer more rapidly & certainly more severely than men when equally exposed to the influence of lead.

In pregnancy lead is an ecbolic & abortifacient.
"When a white lead worker becomes pregnant it is almost impossible for her to go to term, the child is either born dead, or dies shortly after birth from convulsions." Oliver (ibid). He instances the experience of M. Constantin Paul, a French physician. In 15 pregnancies of 4 women working in a type foundry, 10 pregnancies ended in abortion, 2 in premature labour, 1 in a still-birth & 1 in a living child who died a few hours after birth. In another series 5 women type workers working in lead had borne 9 children without 1 abortion. After exposure to lead there were 36 pregnancies. Of these 26 ended in abortion 1 in premature labour. 2 in still births, while 5 of the children born at full term died within 1½ of birth. Paul in 123 pregnancies found that 64 ended in abortion, 4 in premature labours, 5 children were born dead, & 20 of the infants died within the 1st year. Of 1000 pregnancies reported by Jardien 609 ended in abortion. (Poisons Industriels, Office du Travail. Paris 1901. p 5) In the Potteries Miss Paterson & Miss Deane, two of H.M. Inspectors of Factories (Annual Report of Chief Inspector 1897. p 53) found that "out of the 77 married women reported as suffering from lead poisoning during the year ending March 31. 1897. 15 had been childless & have had no miscarriages. 8 have had 21 still born children, 35 have had 90 miscarriages. & of these 15 have had no child born; 36 have had 101 living children of whom 61 are still alive. The great majority of the 40 who are dead succumbed to convulsions in infancy".
Dr. J. T. Arlidge, XXII. vol 1. p 104. gave similar statistics

of married women working in lead processes in the china & earthenware industry.

Paul. Thèse de Paris 1861. in 39 pregnancies in women whose husbands were sufferers from chronic lead poisoning, found that 11 ended in abortion & still births + only 9 of the children survived early infancy. Thus lead poisoning of either parent is disastrous to the infant.

Intemperance

To this cause is due much of the poverty, privation, neglect & crime which are to a certain extent contributory causes of infant mortality.

N. R. Jones IV. 1894 showed the connection between intemperance & infant mortality.

Table XIX. from N. R. Jones.

Intemperance & Infant mortality

Number of towns	Rate of intemperance	Rate of infant mortality
3	26·5	217-200
16	16·5	199-170
28	15·9	169-140
9	12·6	below 140

The mortality statistics of this table are those of the decade 1871-80. & the drunkenness statistics as measured by the number of apprehensions for drunkenness per 1000 inhabitants for the mid-year 1876.

Intemperance is most marked where wages are good & trade brisk i.e. in towns.

Ignorance, inexperience & neglect of mothers.

It has been suggested that deaths of first born children should be classified apart from the general infant deaths. Such a return would show it is believed that first born children die at a higher rate than those born later owing to the inexperience of the mother. But as Newsholme I p 126 states some of the excess would be due to greater difficulty of parturition as well.

Want of experience is of course common to all classes, but whilst the purse of the rich overcomes it to a great extent, in the case of the poor it is unfortunately often only by the loss of one or more infants that the requisite experience is gained.

J. Nelson Rhodes III Aug. 16/02. attempted to show by returns taken from the Registrar Generals report that the infant mortality is highest in those counties where the women are most illiterate, as shown by signature by mark at marriage, & thus prove its connection with ignorance –

In the following table is seen the counties with the highest & lowest numbers of illiterate women per 1000 marriages & their respective infant mortality Rates.

Table XX. Illiterate women & infant mortality. 1900.

Lowest	highest	illiterate women per 1000 marr.		infant mortality.	
Huntingdon		6		127	
Surrey		10		120	
Sussex		10		117	
Bucks		11		117	
Hampshire		12		112	
Wiltshire		12		127	
Middlesex		14		94	
Dorset		14		142	
Oxford		15		91	
Devon		17		100	
Kent		17		133	
Berks.		17.		130	
				175.	
	Cornwall		42		146
	Staffordshire		44		178
	Worcestershire		37		141
	Warwickshire		36		175
	Lancashire		41		150
	West Riding York		39		166
	North Riding York		36		154
	Durham		40		167
	Monmouth		64		150
	S. Wales		50		174
	N. Wales.		52		138.
All England & Wales		37		156.	

No doubt a general relation is here shown (Table XX.) but here again many other factors must be taken into account. For example the counties with fewest illiterate women are almost entirely rural. Whilst many of those with most illiterates are largely urban in character. Factory employment of women comes in in other points. Of the 11 counties in the latter list 4 had materially ratios below that of England & Wales. in 2 it was equal & the ratio. & in 5 above. Illiteracy is decreasing year by year IV 1900. To ignorance is partly due the larger mortalities of towns. There the girls are attracted at an early age by higher wages to factory Employment to the neglect of home arts. & do not on that account make such good mothers as those country girls who usually stay at home till old enough for service & during this period of home life & life in domestic service became better trained & fitted for motherhood.

Ignorance too shows itself in improper feeding. & also in the want of proper care & nursing during sickness & other illnesses of the child. Eg in measles. (quod vide p. 67) The fashion in the clothing of infants may be mentioned here. In this part of the country infants are clothed for the first 10 or 12 weeks of life in long gowns which prevent due movement of the lower limbs — are clothed in fact. At the end of that time they are 'shortened' their arms & legs being left almost bare & often the abdomen imperfectly protected. — Now underclothed Ignorance & improvidence is also shown by those mothers of the lower classes common in large towns who take their tender infants out late at nights into the streets, perhaps to the Theatre. Bronchitis being a common sequel.

Improper food & feeding.

It is estimated that 30% of infant mortality is due to this cause. That a breast fed child has a better chance of life than a hand fed one is common knowledge.

Unfortunately under modern conditions it is the minority of women who can or do nurse their own children. In the vast majority of cases it is inability not unwillingness which prevents them from doing so. This holds good not only for this country but for Europe & America also. Sweden & Norway have the lowest infant mortality (10-13 per cent) of any European country (see table III) Here almost every child is nursed by its mother. In Wurtemberg only 33% of infants are suckled. The mortality of these was 13·5% while that of the artificially fed rose to 42·7%. In Lower Bavaria the infant mortality reached 50%. Here suckling was the exception. In Munich the mortality of breast fed children is 15% that of artificially fed is 85% In Berlin only 30% of the children are suckled, & the infant mortality is 30% XIV. Uffelmann.

During the siege of Paris while the general mortality was doubled that of infants is said to have been reduced by about 40% owing to mothers being obliged to suckle their infants Newsholme I. p 128.

Improper food & feeding causes indigestion & diarrhoea which may lead to atrophy ~~& death~~ & other diseases. Convulsions also may follow the irritation induced by them. Improper food is the chief cause of the disease Rickets which underlies as a basis to many other diseases from which infants suffer & die.

Improper food may be classified as follows:-

i Too much starchy food.

ii Too little proteids & fats or incorrect preparations of these

iii Impure milk (a) Sour milk. (b) Intercurrent milk.
(c) milk with other disease germs accidentally ~~added~~ contaminating it: eg. those of Epidemic diarrhoea.

I Too much starch - For infants under the age of 7 months starch of any kind is as a rule injurious. Yet it is the common experience to find numbers of infants brought up on 'pobs', i.e bread scalded with milk + water + sweetened, or cornflour, arrowroot &c. Some infants thrive well on it but the majority suffer from dyspepsia + diarrhoea. & perhaps waste + die. Many of the proprietary foods err in the respect of containing too much unaltered starch.

II Food containing a deficiency of proteids & fats. is certain if the use be continued long enough to result in the appearance of Rickets. An ~~error~~ incorrect proportion of these leads to indigestion &c.

III Impure milk. Sour milk. due to exposure to atmosphere in hot + thundery weathers (B. acidi lactici.) Lactic acid + fatty formed from the milk sugar. It may be cause of diarrhoea + vomiting.

Milk from tuberculous cows. It is asserted by some that tuberculosis is only seldom conveyed by milk but the fact remains that tuberculosis in infants shows itself pathologically as an abdominal lesion ~~etc~~ this points strongly to milk infection. Tuberculous milk causes intestinal & peritoneal tuberculosis Sydney Martin XI. vol II p 29.

Milk with other disease germs accidentally added. As stated elsewhere (vide diarrhoea) epidemic diarrhoea is regarded as being due to milk contamination as a rule.

That the virus of scarlatina, enteric fever, diphtheria can be introduced through milk has been abundantly proved in many epidemics in which children suffered. eg the Wimbledon epidemic + the Hendon disease (both scarlet fever)

It is not proved if whooping cough, small pox + measles can be conveyed by milk.

Improper feeding. Unsuitable & unclean bottles. Those with tubes are bad because of the difficulty of cleaning. India rubber tubes are prohibited by law in France & America.

Insanitary surroundings of the infants.

The effect of these conditions upon infant mortality is undoubtedly great.

1 The Dwelling house. The influence upon the loss & health of infants of the dwelling house has been shown by several observers. eg Barry & Sordon-Smith (XV) Newsholme Vital Statistics of the Peabody Buildings (V. March 1891) Tatham (Manchester Statistics 1870-83). & Russell of Glasgow & others.

The injurious effects of back & back houses are well known & need only be mentioned. Briefly it has been shown that diarrhoea was much more prevalent where back & back houses were numerous. Barry & Sordon-Smith. (ibid)

Zymotic diseases. pulmonary diseases & the mortality from all causes were increased in ratio with the proportion of these dwellings.

Russell. quoted by Newsholme I p 162. showed the connection between the type of the house & mortality & especially the greater incidence of disease special & children under 5 years of age (as convulsions, & other diseases of nervous system, atrophy, & premature birth.

~~Carnelly. Haldane & Alderson XVII. communicated upon the use of houses with 1. 2. 3 & 4 rooms & compared the comparative with the mortality of the inhabitants.~~

Other defects of dwelling houses such as dampness of soil & walls favour catarrhs in infants. eg bronchitis pneumonia. & also diphtheria.
Absence of sunlight is favourable to all diseases. ~~including~~
It is not generally recognised, I think, by ordinary people what an important factor for good health sunlight in the house is. Houses in narrow courts, alleys & in close proximity to large buildings where light & ventilation is obstructed are all conducive to ill health of children.
Dirt is a factor which occurs to one who has practised among the poor. One can imagine how the 'dummy teat' so often used by mothers & nurses when it falls out of the infants mouth on to the dirty floor picks up filth, perhaps materies morbi more especially in the hot summer months.
Dust is known to be a fertile source of disease & has been shown to be a common factor, if not the most usual one, in the causation of tuberculosis. Tubercle Bacilles has been demonstrated in the dust of houses where a tuberculous patient has lived.
Dirt & dust are related to impure air & surrounding.
The effects of these conditions upon adults has been mentioned what has been said applies with even more force to the case of children. The experiments of Carnelly, Haldane & Anderson in Dundee XVIII showed that the death-rate especially that of children increased in proportion to the impurity of the air which varies with the size of the tenements. The general death rate in 1 roomed houses was double that of 4 roomed houses, & the death rate at ages below 5 years was quadrupled. the increase

being most pronounced in diarrhoea. measles, whooping cough. bronchitis & pneumonia all fertile causes of infant deaths.
Erysipelas which is very fatal to infants is largely favoured by ~~the~~ polluted air
2ly The surroundings of the dwelling house. It is probably in the curtilage & near neighbourhood of dwellings where the soil ~~is~~ is liable to pollution that the germs of Epidemic diarrhoea are bred.
In the North of England there is commonly in small towns, often in large ones, a defective system of refuse removal. There the system of privy middens ~~are~~ is largely in use. The emptying is often done by contract. the consequence being that they are left unemptied usually until a nuisance is complained of. In the hot weather the stench from these places is abominable. It often pervades the neighbouring houses & must be injurious to the infant inhabitants either directly or through the milk used for food. I know of a small court in the town where I live with a large open (till lately) privy midden in the centre with houses all round - each door being probably within 12 or 15 feet of the central midden. In one of these houses one mother lost six children under 1 year of age one after the other - Some from diarrhoea. It was impossible in this case to dissociate the insanitary surroundings from the cause of death -

Baby farming is said to be carried on on a large scale & the mortality of children so nursed is said to be enormous. Time alone prevents me from referring to the evidence given before the Select Committee of the House of Commons 1890. & the reports of Inspectors under the Infant Life Protection Act: 1897. Let it suffice to say that two Acts of Parliament were specially passed to mitigate the evils of this system. (vide Newsholme p. 90)

Administration of Opiates. Evidence on this point was given by the late Mr Ernest Hart & others before the Select Committee on protection of Infant Life in 1871. The practice is still general & believe in certain districts, especially manufacturing districts, by baby farmers. Amongst the general public the custom is far from uncommon.

Soothing syrups are the most common form of presentation, but paregoric & laudanum are also used. Jones (V. 1894) mentions a case where 3 quarts of laudanum were sold in 1 week at one shop to the inhabitants of a colliery village in N. Wales.

It is unnecessary to speak of the ill effects of this system.

Insurance of Infants. There is still prevalent, even amongst well informed persons, an impression that insurance of infants is responsible for a certain amount of mortality. This idea was fostered doubtless by the conflicting evidence given before a committee of the House of Lords in 1890 on the Children's Insurance Bill. Two judges of the High Court gave evidence. One, Mr

Justice Wills, being in favour of child insurance, the other, but Justice Day, being opposed to it. On the whole convincing evidence of cases of child murder by parents for the sake of insurance money was not tendered to the Commissioners. but a strong belief was expressed that insurance was an incentive to crime.
Insurance of children is general among the industrial classes, & there is no doubt that it is a legitimate business & one appreciated by them. The maximum sum which is legally payable on the death of a child under 5 years of age is £5. The Prudential Assurance Company have a table based on the experience of 9 millions assured lives which shew that the mortality under 1 year of age among the assured is less than the general mortality among infants according to Farr's English Life table, & this even if the deaths which occur during the first month of life are omitted, the figures being English Life table 10δ. Prudential 99·5. Newsholme I p 133. states "There are other similar statistics, and it appears fairly clear that ——— there is no trustworthy statistical evidence of the ill effect on the life prospects of children from life insurance".

Accident and negligence - (Vide Deaths from violence p. 82)
As is shown by the Registrar General's statistics the chief cause of death under this heading is Suffocation. This is usually due to overlaying. It is connected with intemperance & almost criminal.
The majority of the other deaths ascribed to accident might be said to be due to neglect, want of care & proper oversight on the part of parents & nurses.

Crime. In 1900 the Registrar General shows that in England & Wales 46 males & 39 females infants died from homicide out of totals of 139 & 139 at all ages from this cause. the majority occurring at ages 0-3 months. The following table shows deaths from homicide for 25 years 1863-67.

Table XXI. Deaths from homicide 1863-67

age	male	female	percentage
0	1626	1629	per cent 61
1	51	35	
2	32	38	
3	24	30	
4	15	25	
under 5	1748	1777	66
over 5	908	881	34
Total	2656	2658	-

Thus 3525 out of a total of 5314 cases of homicide occurred under 5 years of age & 3335 or 61% under the age of 1 year.

These figures & the statistics of the Society for the prevention of Cruelty to children together show a large amount of crime. It is only however amongst a small proportion of the lowest classes, the intemperate, the criminal & worthless that this occurs.

Post natal causes of death.

Zymotic diseases (Infants may suffer from prenatal zymotic disease).

The chief zymotic diseases resulting in the death of infants are Epidemic Diarrhoea. whooping cough, & measles in the order stated. Then come Syphilis. Diphtheria. Influenza (in some years) erysipelas & Scarlet fever. usually in the order

here given. The other zymotic diseases take their toll of infant life but only to a small extent; with the exception of small pox, will not be considered here. Zymotic disease accounts for nearly 20% of infant mortality & about 35% of all deaths from zymotic disease occurs under 1 year of age. & about 75% under the age of 5 years. The case mortality of these ailments is very high in infancy & early childhood. ~~cf. Smallpox~~, hence the importance of protecting infants from them as much as possible.

The Registrar General IV Supplement p 54th. 1891. Commenting on the deaths of 100.000 live born children ~~says~~ remarks the comparative immunity from zymotic diseases in the earliest months: whooping cough appears earliest. The deaths from measles do not become numerous till the 8th or 9th month. Scarlet Fever scarcely makes its appearance in the first year. These features hold good for both urban & rural districts.

Diarrhoeal Diseases. The death rate per 1.000.000 living at age 0-1 year from these causes ~~was~~ in 1881-90 = 16.044. In 1871-81 it was 19 817. & in 1861-70. 19.645. In 1900 these diseases caused a mortality of 28 per 1000 births. Diarrhoea may be merely a symptom of some ~~irritation~~ intestinal irritation preceding or coincident but it is not this which is the cause of so much infant mortality. The disease which so largely figures in the mortality returns of infancy is an epidemic or zymotic disease which until the researches of Ballard, & Jenkins was but little understood.

Ballard (XVIII) is the standard authority on this disease.

The various factors in the causation are :-

i Soil - pollution of all kinds, dampness followed by exhalation - 2nd.

ii Temperature of air & soil. Dawson Williams collected evidence to show that a high minimum temp. of the air was an element. Henry Jonkins was the first to point out the importance of the Earth temperature. He found that as soon as the thermometer registered 59° to 62°7 at a depth of 1 ft below surface the disease increased rapidly. Ballard experimented at 4 ft & his observations were confirmed by J. Priestley. He showed that temp. of the soil was the essential factor.

"(a) The summer rise of diarrhoea mortality does not commence till mean temperature by 4 ft thermometer is 56°7 ——— "

(b) Maximum mortality attained when the temp. of 4 ft thermom. attains its weekly maximum."

(c) The decline of mortality —— coincides with decline of 4 ft thermometer.

Rainfall, wind, density of population, density of buildings, site, want of ventilation & light; dirt; foul air from sewers & cesspools, social position, food, & maternal neglect are all factors of greater or less importance in the causation.

Briefly (Epidemic Diarrhoea) may be said it is a disease of towns or crowded areas, being endemic in certain towns, eg Preston, Leicester; the poorer classes are most affected & dirt & the majority of cases are due to contamination of food; breast fed children are almost exempt, next those partially breast-fed, the

mortality being highest in those hand fed.
Dr Hope. M.O.H. Liverpool (Liverpool medico-Chirurgical Journal) analysed 1000 fatal cases of diarrhoea in children aged 0-5 years.

Table XXII. Analysis of 1000 Fatal cases of Diarrhoea. Dr Hope.

Age at death	Under 3 months	Over 3 months under 6 months	Over 6 months under 12 months	Year 1-2	Years 2-5	Total
Breast alone	16	7	7	—	—	30
" & food	70	50	55	34		209
" bottle & food	40	35	30	4		109
Bottle alone	33	19	13			65
" & 'food'	69	115	115	16		315
Cow's milk & 'food'	5	3	5			13
Breast & any kind of food		1	16	20		37
any kind of food			14	156	52	222
Total	233	230	233	230	52	1000.

Thus of 718 infants, 30 only were fed on the breast alone,

391 entirely artificially, & 297 were partially breast fed. Hope's conclusions were :- under 3 months of age every infant fed entirely on the breast dying of diarrhoea, 15 die who receive other food in addition to or instead of breast milk. And if it be assumed that 15% of infants under 3 months of age are reared exclusively by artificial food the deaths among infants so fed are literally ten times as numerous as they are amongst equal numbers of partly or entirely breast fed infants. From the age of 3 months to 6 months of 80% of infants are supposed to get some breast milk, for every infant so fed dying of diarrhoea, 6 die amongst an equal number getting no breast milk at all. These facts show the importance of feeding as a factor in the disease.
Age : It is most fatal in the period 3-9 months. Symptoms

says "infants & young children form only a small proportion of those attacked although they furnish nearly the whole of the deaths".

Sex. Males are more liable than females, & the mortality is greater among males. Ballard. (ibid).

Season. Fatal cases occur all the year round but the great annual incidence is in summer time In London the mortality curve begins & rise in June increases rapidly in July. reaches a maximum in August & declines in September & October.

Epidemic diarrhoea occurs every year but the severity & the exact period vary according to the season & locality. The microbe has not yet been identified. Delepine XXII. vol III no 1. 1903. concludes that the changes in milk which give rise to epidemic diarrhoea are due to bacilli of the Colon group of which B. Coli communis & B. Enteritidis (Gaertner) are probably two extreme types. He believes the varieties of most importance are those resembling the bacillus of Gaertner.

So far as it is due to insanitary surroundings & contamination of food, neglect: diarrhoea may be regarded as a preventable cause of death.

Whooping cough In the decennium 1881-90 the death rate per 1,000,000. living at age 0-1 yr was 7085. In 1871-80 it was 7394. & 1861-70 = 7253.

The rate of infant mortality from whooping cough is fairly constant as shown below.

		rate of infant mortality
1857-60	=	5·744
1861-70	=	6·083
1871-80	=	6·198
1881-90	=	6·007.

The prevalence is greatest in London in March & April least in September & October. The greatest mortality of this disease occurs in the 1st year of life. 40% of the whole number of deaths occur at that age. As stated before it is the next most fatal zymotic disease & diarrhoea & curiously enough the mortality is greater among females than males.

The deaths are due to Bronchitis, pneumonia, Convulsions & other complications. The disease is conveyed by fomites. Unhygienic surroundings favour the spread & the danger to life, especially overcrowding &c. Epidemics are said to recur at short but irregular intervals. (2-3 yrs usually)

Measles. The death-rate per 1,000,000 living under 1 year of age in 1881-90 = 3365. In 1871-80 it was 2767 & in 1861-70 = 2737.

Measles has been increasing in prevalence as shown thus.

	Measles.	Rate of infant mortality.
	1851-60	2·095
	1861-70	2·291
	1871-80	2·319
	1881-90	2·85

The seasonal curve in London shows two maxima - a chief one in December, a secondary one in June: the minima being in February & September.

The mortality is greater among male infants.

The deaths are due as a rule to pulmonary complications or diarrhoea.

Epidemics usually recur within 2 or 3 years.

Insanitary conditions, eg. overcrowding; exposure, & want of food increase the danger to life.

Measles is not regarded by many people as being of a serious nature. Often no care is taken to prevent other children in the house from infection when a case occurs. Indeed they are often exposed to it purposely in order "to get it over & done with". Moreover in some cases when a child has the disease he is not properly kept warm & quiet but is allowed to run about after a day or two. The doctor may not be called in & very often complications or sequelae follow.

Diphtheria The death rate per 1000,000 living at the age 0-1 yr in 1881-90 was ~~706~~ 287. In 1871-80 it was 287, & in 1861-70 = 581. ~~A remarkable increase in this disease.~~

Season. The maximum mortality occurs in November & December & It is more prevalent in the country than the town districts on an average but tends to increase in towns.

A disease resembling it occurs in cats & other animals. Milk has been known to convey it. The milk may be infected from a previous case or possibly from the cow itself.

Bad drainage & other insanitary conditions, eg. dampness often have a relation to it but are not found in all cases.

The mortality is greater among males.

Diphtheria like Scarlet Fever is less fatal in the 1st year of life than in any other year of the first five.

Influenza. Unlike other diseases influenza is purely epidemic or pandemic. Since 1889 there have been in England a series of epidemics at intervals of about a year. Children have suffered as well as adults, in some localities more so than adults.
In 1900, 354 males & 263 female infants died from influenza, being a rate of infant mortality of 0·66.
The mortality of the disease is not great except in children (& persons) weakened by disease or predisposed to bronchitis & pneumonia.
The death rate of a district is increased after invasion by Influenza & is shown by the increased number of deaths from Bronchitis & pneumonia.

Scarlet Fever. The death rate per 1,000,000 living at the age 0-15 in 1881-90 = 671. This showed a considerable decrease from the two previous decennia the corresponding rates for these being. 1871-80 = 1414. & 1861-70=2026.
Expressed in rates of infant mortality the decline was as follows:-
removed rate of infant mortality
1851-60 = 1·685
1861-70 = 1·698
1871-80 = 1·185
1881-90 0·5694.
In England the towns suffer more than country districts. mining & manufacturing districts being most affected. probably because infection is more easily spread.
In England the curve of mortality is greatest in October lowest in March & April.
Age. Children under 3 months of age are comparatively rarely attacked, but afterwards during the first year the incidence rapidly increases.

The average severity of attack as determined by the proportion of fatal cases is greatest in infancy & in the 2nd year. Females are said to be more liable to attack but the attacks more fatal in males. Whitelegge. XIX. p 288.

~~Scarlet fever like Diphtheria & unlike whooping cough is less fatal.~~

It is epidemic in character, the usual interval between epidemic maxima being 5 or 6 years.

In many North of England towns scarlet fever is said to be endemic Whitelegge (XIX p. 289.). although subject to frequent epidemic outbreaks.

Some epidemics are more fatal than others

Newsholme I p 195 gives a table from which I extract the following figures showing the case mortality per cent in 39,253 males & 42,354 females under 1 yr of age admitted to the metropolitan hospitals in years 1892-97.

age	Fatality per 100 cases of scarlet fever	
	males	females
0 - 1 yr.	24.8	27.1.

These figures it will be noticed show a greater mortality among females. (vide supra)

The sequelae of the disease are kidney disease, & Ear disease. So that the mortality shown in the Registrar General's reports as due to scarlet fever does not probably always show the real number of deaths which should be ascribed to it.

Erysipelas. is chiefly sporadic in character. It is more fatal in early infancy than at any other period of life. 155 males & 168 females under 1 year of age died from this disease in 1900. the majority at this age period 0-3 months. The disease is favoured by bad hygienic surroundings.

Small-pox. Bernoulli (quoted by Ernest Hart XL 16th 1905) writing of the 18th century in Europe states that fully two Hundr of all children born were sooner or later attached by small pox. and that on an average one twelfth of all children born succumbed to it.

Mc Vail (XX) has shown from the Kilmarnock registers that in prevaccination times 90% of deaths from this disease were at ages 0-5 years.

Of late years it has been shown that the deaths under 5 years of age being of unvaccinated children only amounted to 30% of the Total small pox deaths. And in this age-period the greatest mortality occurred in the 1st year of life & was highest in the first 3 months of life. Whitelegge. (XIX. p 264)

There has been no widespread epidemic in England since 1871.

The deaths from small-pox 1881-90 numbered 1389. Of which 40 occurred in vaccinated children, 583 in unvaccinated. & in 766 the condition as to vaccination was not stated.

At the present time the disease is prevalent in certain towns in Yorkshire & Lancashire & Midlands. & not long ago (1901 (1902) was epidemic in London.

Owing to the evasion of the law in certain districts & to migration in some cases a certain proportion of children are lost sight of by vaccination officers & remain unvaccinated. For some years the proportion of 'unaccounted for' in England & Wales was 6·5%. Since 1885 this proportion had increased so that at the end of 1891 there were unaccounted for 9·9% Whitelegge ibid p. 278. In certain districts this proportion was much higher & in a few districts at the present day it is ~~about Half~~ only a very small

proportion who are vaccinated. eg in Keighley. Gloucester. Leicester. The Medical Officer of the Local Government Board states (in 1901) that there is at the present time "a larger amount of default in reg and to vaccination than any which has been recorded since the passing of the Vaccination Act 1871." and "a steadily growing increase in the younger population of persons who are altogether without protection from small-pox".
In countries where small pox is widely prevalent it was a disease mainly of children like scarlet fever, measles & whooping cough. The critical age of the disease is 0-5 years
It is chiefly on account of this default of vaccination that the disease is mentioned here. In connection with this default perhaps on account of it the disease has of late shown an altered age incidence. "Up to 1870 the mortality in infancy formed 20% or more of the total mortality from the disease; between 1870 & 1890 the small pox mortality at this age did not greatly exceed 10% of the total: but since 1890 it has again begun to form an increasing proportion of the mortality at all ages" Newsholme I p 217.
The disease then apparently tends to revert to its original type as one chiefly fatal amongst children.
It is unnecessary to speak of the value of vaccination as the specific for smallpox.

Brief Summary of Zymotic diseases.

(1) These diseases are most fatal in the order stated on page 61.

(2) Great importance of protecting infants as far as possible from these diseases because of:-

(3) Large case mortality at this age. &

(4) The mortality is not to be measured wholly by death returns because many organic diseases, e.g. of lungs. Kidneys & heart are primarily due to zymotic diseases. & deaths often result from these at considerably later periods.

(5) Tubercular diseases, whether general or local, and bronchitis & pneumonia. often follow after measles &c.

Dietetic diseases.. 2983 deaths of infants were registered as due to the above in 1881-90. of these 2968 were returned as due to Starvation & want of Breast milk. In 1900. 450 deaths were returned as due to Dietetic diseases. 4 5-9 only due to Starvation &c.
Improper feeding probably accounted for a large number of these deaths.

Parasitic diseases. Deaths of infants from these causes 1881-90 numbered 6889. In 1900 there were 259.
The majority of these occurred in the first three months of life & were returned as due to Thrush.
Here also improper feeding or want of care & cleanliness (ignorance & neglect) enter into the question.

Constitutional Diseases.
The chief of these which affect infant mortality are Rickets and the Tubercular diseases.
Rickets. This disease is due in the main to improper feeding but other causes assist.

Rickets continued.

The number of deaths registered as due to it is no indication of its prevalence or of its ultimate fatal effects. It accounts for many cases of Convulsions, (including Laryngismus Stridulus) respiratory diseases, hydrocephalus.

We have only to look at the number of deformed persons in the streets of our large towns to estimate its prevalence. Children suffering from it are weak & very liable to be attacked by intercurrent prevalent disease.

It may originate in utero (vide p. 42) but such cases are rare & are attributed by some to congenital syphilis.

It is a result of imperfect & faulty nutrition & due to faults of diet, want of sunlight & fresh air, deficient clothing, dirt & general insanitary surroundings, & hereditary influences. As a rule several of these causes are in operation. Cases are most frequent where children are kept largely indoors & where there is want of sunlight, fresh air & warmth. Generally the disease is one of large towns, London, Manchester, Liverpool, Leeds, & most prevalent among the poor. It is very common in the manufacturing districts of Yorkshire & Lancashire & the Black Country. Here other factors enter into the causation, eg the employment of mothers & neglect of infants & ignorance.

In the period 1881-90. 2096 deaths under 15 years are registered as due to Rickets In the year 1900. 505 deaths were ascribed to it.

The Tubercular Diseases.

These include Tabes mesenterica, Tubercular meningitis, (acute hydrocephalus) phthisis, & other forms of tuberculosis & Scrofula. In 1881-90 these diseases accounted for 6·47%

of the total deaths under 1 year of age. No doubt if a correct diagnosis could be made always this class would be found to include many deaths registered under other headings, eg. pneumonia + bronchitis; inflammation of the brain; atrophy, debility + inanition; peritonitis; + ill defined causes.

Hospital statistics of various parts of the world show that about one third of all children who die in hospital die of tuberculosis in some form or other + further in about 12% of the remaining cases tubercle is present in a latent form. R. Hutchison ~~XXIII~~. March 11th 1903.

The aetiology centres round the Tubercle Bacillus. Whether the infection is conveyed chiefly by ingestion or by inhalation is still undetermined. In a series of 216 cases Dr Still. of the Great Ormond St Children's hospital (quoted by R. Hutchison ibid) found that access of the bacillus had been through the lungs in 68·8%, through the intestine in 29·1%. + through the middle ear in about 15 cases; but the majority of observers regard ingestion as the mode of infection in infancy, adducing as evidence the great preponderance of abdominal lesions. (Infection may be transmitted from the mother + the foetus in utero. p. 39)

The liability to tubercular diseases is strongly hereditary + said to be greater in children of relations who intermarry. It is often a sequel to zymotic disease especially measles + whooping cough + common after bronchitis or pneumonia. It is favoured by bad hygiene, damp want + neglect. It is more common in towns.

and amongst the poor. & especially those living in narrow courts, alleys & in back & back houses. Ransome found that it tends to make itself endemic in houses & even rooms. (Tuberculous infected areas) These endemic areas occur as a rule in the worst parts of towns where predisposing conditions exist.

Sources of infection - The Sputum of phthisical patients is capable of producing the disease in others either by inhalation (when dried) or by ingestion. The danger is greatest in rooms & houses. The dust of houses may contain either the Tubercle Bacillus or its spores. Direct infection by sputum is recorded in the case of a midwife who used to blow down the mouths of newly-born children. Ten of these became tubercular.

Milk. All cattle in this country are said to be tuberculous in proportions estimated variously from 10% to 20%, Stallfed cattle being most liable.

Tubercle bacilli have been found in milk from tuberculous cows, but it is said, only when the udder is diseased. If the udder is not diseased the milk is not infective however contains tubercle bacillus. If however the cow is elsewhere tuberculous the udder may at any time become diseased.

Local Diseases.

Diseases of the nervous system. In 1900 there was a total of 18,964 deaths registered under 1 year as due to the above causes. In other words they accounted for 20·8% of the total deaths of infants.

Diseases of the nervous system. (continued.)

Convulsions In 1900 the total deaths in infancy from convulsions & the age periods were as follows:—

Table XXIII. Deaths from convulsions in infancy. England & Wales 1900.

Sex	months of age 0 - 3	months 3 - 6	months 6 - 12	Totals
males	5682	1890	1551	9123
females	4160	1578	1161	6899
Totals	9842	3468	2712	16022

as previously stated a certain number of these deaths are attributable to ante-natal causes. The above table shows that over 60% occurred under 3 months. Jamieson (XXIV) analysed 365 deaths from convulsions. as follows:-

under 1 month	104	1 - 2 years	73
1 - 3 months	33	2 - 3 "	32
3 - 6 months	28	3 - 4 "	13
6 - 12 "	71	4 - 5 "	11.

Thus nearly half the deaths of the first year occurred in the first month. Most observers differ from Jamieson & coincide in saying that convulsions are rare in the 1st month (but see Registrar General's Report: mentioned at p. 25 of this thesis) except those occurring just after birth which are frequently due to direct injury of brain in labour.

The aetiology is complex. By some they are considered to be "only a mode of dying & one incidental to the time of life". As a rule convulsions are merely a symptom of other diseases which may however be so masked as to cause great difficulty in diagnosis hence the symptom only is returned as the cause of death.

They often usher in or supervene in any acute disease, eg.

Convulsions (continued), the exanthemata, bronchitis & pneumonia. Tubercular meningitis.
Improper food causing gastro-intestinal irritation, chronic diarrhoea, Rickets, (Dentition)? are all causes of convulsions. They are not uncommon in epidemic diarrhoea & usually indicate the beginning of the end.
Morris & Lewis II. vol IV. p 871. found a connection between the mortality curve from convulsions & that due to Diarrhoea (epidemic) in Philadelphia U.S.A. 1875-86. both being highest when the temperature was at its highest mean elevation, viz in June, July, August & September.
In Philadelphia he found the convulsion curve the lowest in November. It then rose till March & fell again till June.
He considered high temperature of the air to be an important factor in the causation.
Barlow III June 15/87. found at Manchester, England that Convulsions & particularly Laryngismus stridulus occurs most frequently in cold weather. 70 out of 114 cases in 1885 occurring in the months of October, November, December, January & February (61.4%) & being quite evenly distributed among them. The months of May, June, July show but 10 cases (8.77%) March 4 & the remaining months 9 each.
Sir J. Crichton Browne (XXV) states that convulsions have a minimum death rate in September & October. a maximum in February & March.

Diseases of the Respiratory System.

In 1900 there was a total of 25,107 deaths registered to these diseases, accounting for 31·6% of the total deaths in infancy. By far the greater number of deaths referable to these diseases are due to Bronchitis & Pneumonia.

As regards pneumonia it is Broncho-pneumonia or Lobular pneumonia from which infants & young children suffer as a rule & which is the cause of so large a number of deaths. Croupous or Lobar pneumonia does occur in infancy & early childhood but is comparatively rare & when it occurs is not nearly so fatal as the former disease. Baginsky quoted by Minot (II vol ii p 396) reported that out of 60 children with croupous pneumonia, nearly ½ of whom were under 2 years of age, there were 4 fatal cases. A similar experience has been found by others.

Bronchitis per se & uncomplicated may be said to hardly ever cause death. This has been verified by post-mortem examinations J. Gordon Morrill II. vol ii p 617.

The majority of deaths ascribed to Bronchitis are really due I believe to Broncho-pneumonia which is a very common & fatal disease in children. Bronchitis is an essential factor of the latter disease.

The Aetiology of both these diseases is practically similar, & will be considered together.

Damp & cold have long been associated as the causes of these ailments. Either one or both may follow exposure to them, the relation between the skin & the bronchial mucous membrane being very close in infancy. The influence of damp & cold is seen in the following table taken from statistics given in the 'Annual Summary' 1901:—

Table ~~XXIV~~. Deaths from Bronchitis & Pneumonia. London. 1901.

	Quarter ended			
	March 30th	June 28th	Sept. 28	December 28
Bronchitis	2832	1355	580	2330
Pneumonia	1931	1490	882	1818

The lessened incidence of these fatal lung diseases in June, July August & September of these shows

Climate or season then is a factor, especially frequent & sudden changes of humidity & temperature.

Home surroundings & influences, e.g. defective drainage & ventilation, overcrowding, defficient or excessive heating, unsufficient & unproper nourishment, unsuitable clothing. (the short frocks & sleeves of infants) & exposure to extremes of temperature are all prominent causes of these. I believe impure air is the most common.

During the period of dentition children are particularly liable to catarrh of the respiratory tract.

Certain diseases too e.g. measles & whooping cough are always accompanied by more a less bronchitis & sometimes broncho-pneumonia. & after their occurrence the child is liable to have a recurrence of the bronchial catarrh.

Attacks of summer diarrhoea are apt to leave children so debilitated that on the advent of cold & changeable weather they contract Bronchitis or broncho-pneumonia & often succumb to it.

There may be unknown atmospheric influences at work. It is a common experience to me to have several cases, in different parts of the district, all beginning together. The conditions of no two being alike except the atmospheric ones.

These diseases are more common amongst the poor. Children the subjects of scrofula & rickets are very prone to them. Attacks of either of these complaints render the bronchi unhealthy; the bronchial glands inflame, & are then liable to invasion by Tubercle Bacillus.

In conclusion. Chronic ~~age~~, poverty season, prevalence of measles & impaired health from various causes eg. rickets are all important factors in the causation, the chief being rickets, measles & bad hygiene.

Croup. is a subsidiary cause of death in infants under 1 yr. In 1900 it accounted for 109 deaths 66 males & 43 females. It is contended by some that these deaths should properly be registered as Diphtheria. With this statement I entirely disagree. In my opinion croup is totally distinct from diphtheria. From a sufficient experience I can testify that there is no difficulty in diagnosis whatever. In diphtheria there is always the well known greyish membrane covering the tonsils & perhaps other parts of the pharynx & larynx. In croup on the other hand this is never seen. It is a disease of the larynx only, diphtheria being primarily at least one of the pharynx.

Diseases of the Digestive System.

In 1900 there were 14.970 deaths from these diseases, making a percentage of 18·8 of the total number of infant deaths. The largest number under a single heading of this class was that of Gastro-enteritis with 5226, the next largest being enteritis with 3211. As to how many of these should properly be transferred to diarrhoea it is difficult to say but undoubtedly the majority should be

so transferred. They coincide in age incidence almost entirely with those of diarrhoea. This is an example of confused nomenclature, & imperfect certification & classification.

In considering the aetiology of the remainder of this section, everything points in a general way to improper food & feeding as being the cause of the majority of these deaths. The comparative smallness of this class is no real measure of the ~~the~~ evils of improper food however, as many deaths due to these causes are classified under other headings, e.g. rickets, convulsions, debility, &c.

Dentition In the period 1881-90. 25,257 deaths of infants were registered as due to this cause. In the year 1900 2220 were so registered. It may be said that children rarely if ever die from dentition alone. There is always some other superadded cause, often gastro intestinal irritation due to impure feeding, or bronchial irritation due to cold & damp or other cause, & to these latter the death should really be assigned. Dentition is entirely a physiological process but during its progress children are more liable to intercurrent disorders from slight causes.

Violence. The deaths from violence are primarily divided by the Registrar General into those from (1) Accident & Negligence & (2) Homicide.
Whilst the total deaths from these causes in the age period 0-5 years show a gradual decrease in the three last decennia as stated below the Rate of infant mortality for Violence in 1881-90 is the same as that for 1871-80 viz 2·87.
The annual mortality per 1,000,000 living at ages 0-5 years was :-

1861-70 = 1317
1871-80 = 1215
1881-90 = 1142.

The Rate of mortality for these causes varies every year not only for the whole country but for different districts. It has been shown to vary with the rate of intemperance & with the rate of infant mortality from all causes. Jones (V. 1894). The latter writes gave Rates of infant mortality from violence of certain towns for the

decennium 1871-80 (ibid) I have compared these with those for the decennium 1881-90. It was struck with the close comparison of the various towns in the two periods named. If one might use the expression a high degree of violence to infants seems endemic in certain towns :-

Table XXV. Rates of Infant mortality from Violence 1871-80 & 1881-90.

~~All England~~.	1871-80.	1881-90.
All England	2·37	2·37
Liverpool	14·00	14·06
Birmingham	10·92	9·96
Newcastle	4·25	3·59
Huddersfield	2·87	2·06
Manchester	2·41	4·82
Oldham	0·93	0·94
Bolton	0·93	0·79

Suffocation. Deaths from suffocation form the majority of those registered under Violence. In 1900, 1037 males out of a total of 1565 males under 1 year of age and 887 females out of 1347 female infants under the age of 1 year dying from violence lost their lives by suffocation. chiefly in bed. The majority of these were under the age of 3 months. These deaths showed a considerable increase in the latter years of the decennium 1881-90.

The Registrar-General analysing deaths from suffocation in bed according to the day of the week upon which death occurred found that most of them happened on Sundays, i.e. on Saturday night, which is the night when most drunkenness occurs & the two circumstances are thus associated.

Table XXVI. Inquests on Infants.

Day	Suffocation.	Other causes.
Sunday	283	180
Monday	124	132
Tuesday	137	146
Wednesday	116	139
Thursday	115	136
Friday	107	128
Saturday	118	140
	1.000	1.000

Stomicide. see page 61.

Brief General summary of infant mortality and its causes.

In the foregoing pages it has been endeavoured to show that:-

I. Infant mortality is greater in towns.

II. Its incidence is greatest amongst the poor & especially the poor of towns.

III. Roughly speaking in 1900 about one third of the total mortality was due to ante-natal causes. leading to premature birth &c. These may be referred to hereditary disease, & the conditions of modern life, insanitation &c

IV. In the same period the remaining two-thirds were due to post-natal causes. dependent upon insanitation (zymotic diseases), respiratory diseases) climate (respiratory diseases) social conditions, especially ignorance & poverty, occupation of mothers, neglect, violence & largely upon improper food.

Prevention. It is not my intention to depict any Utopian scheme whereby people should live healthy lives amid healthy surroundings & rear healthy children with the lowest possible rate of infantile mortality. Such an idea would be merely visionary & unpractical & would not take into account human nature nor the social conditions of to-day. Large towns, with their overcrowding on area & in houses, intemperance, vice, great wealth of the few & poverty of the many, must be accepted as more or less inevitable. It is rather my endeavour to point out what can best be done by remedying present existing conditions as far as practicable. With this end in view I have considered together the means already in force & further measures desirable on the part of (1) the State, (2) County Councils & Sanitary Authorities, & (3) the Medical profession.

I The State. Of course everything which makes for the health and well-being of the people tends to check undue infantile mortality. Religious & moral teaching, both bearing upon the subject, must be left to others. Poverty & neglect so probably to be referred to ignorance can only be imperfectly legislated for. But it is only by overcoming ignorance (& therefore poverty) that I can see any likelihood of real advance. The ignorance & poverty referred to are interdependent on each other & are of such a nature that as to make their victims (the poorer classes chiefly) practically helpless. Education then must I think be the remedy to adopt to diminish the excess in mortality in infancy. By this is not meant merely an elementary education but a hygienic

one also. The State, the sanitary authorities, the people must all be educated to regard to regard this lamentable loss of infant life, not as at present with indifference, but as a blot on our civilisation. A full discussion upon Education though it undoubtedly affects the subject deeply would be out of place in this medical essay.

The state by the care it shows for the eyesight & proposes to take of the teeth of school children (see Recent questions in the House of Commons) & by other indications shows signs I hope of awaking to a sense of its responsibilities in the matter of protection of infant life.

To mention a few details, the instruction of elder children in the rudiments of hygiene would surely lead to good results in time. The elder girls too might with advantage be instructed in the principles of domestic hygiene & the feeding of infants. It is important that this instruction should be given in elementary schools on account of the difficulty of getting the pupils together again later in life. By such means the future generations of fathers & mothers might come to a better understanding & application of the laws of health.

Education tho' is probably the best remedy for intemperance but here other legislation is necessary. Limitation of the number of licensed houses - a movement apparently at present in action - is desirable. The recent licensing bill with its 'Black list' & the prohibition of sale to children - is another movement in the right direction.

The Registration Acts need revision. Still-births which are estimated to amount in England to 6% of the total number of births should be registered. This would prove of use statistically,

would incidentally further the study of the effects of syphilis, and would tend to prevent the procuring of abortion, foeticide & child murder by preventing burial till the registrar had obtained full information.

Uncertified deaths. In 1900, the causes of 91·81% deaths were certified by medical practitioners, the causes of 6·27 by coroners after inquest, the remaining 1·92% were uncertified. Of these last, 11,254 in number, 5045 were those of children under 1 year of age viz. 44% of the total uncertified deaths, & of these 3461 or over 30% of the total uncertified deaths were those of infants under 3 months old. At present as the law stands the registrar, after inquiries made, if satisfied that there are no suspicious circumstances connected with the death, may register it as 'not medically certified'. This option should not be left to registrars who are often imperfectly educated men without medical knowledge. The door is opened for crime. Medical chief registrars or medical certifiers as advocated by Farr, Newsholme & others should be appointed to inquire into all doubtful deaths.

Inquests as at present conducted are often little better than a farce, at least in the exception in many parts of England & Wales to hold an autopsy. Such verdicts as 'died by the visitation of God' or 'found dead' are common & apart from the deterrent effect upon crime which the mere holding of an inquest has, are of little use. As Newsholme says 'as matters now stand there is little reason to doubt that crimes occasionally remain undetected which skilled investigation would have brought to light' (I p 25.)

The recommendations mentioned above along with certain

in a Report

others were introduced by a Committee of the House of Commons on Death Certification 1893 but have not become law.

Historical. A brief history of legislation bearing directly & indirectly upon this subject might be interesting. (XXVIII)

In 1601 the first English poor law was passed, which provided for the support of children by their parents or grandparents, & in their default it established a system of child apprenticeship. In 1747 the cruel treatment to which these helpless children were subjected was partly remedied by an Act which empowered justices to discharge parish apprentices for ill usage. This Act was evaded by some employers & in 1792 an act was passed by which the duty of prosecuting masters guilty of ill treatment was laid upon the parish officers. In the meantime (in 1788) it had been enacted that no boy should be employed as a chimney sweep under the age of 8 years; the hours of work were restricted & the number of apprentices was limited. In 1802 the first of a series of Factory Acts was passed. It provided for the cleanliness of factories, for the clothing & education of apprentices, prohibited night work, & limited the hours of labour to twelve. The second, in 1819, regulated the employment of children in cotton mills. The lowest age at which children could be employed was fixed at 9 years, & the hours of labour for children between the ages of 9 & 16 years were limited to twelve. More recently child employment has been prohibited under the age of 11 years. In 1826 further restrictions were imposed upon the employment of children, and better provision for meal times was made. In 1833 the distinction was first drawn between 'children'

of the ages 9 & 13 years, and 'young persons' of the ages 13 & 18 years. Children were not to work more than 9 hours a day & were compelled to spend two hours at school. Inspectors of factories were also appointed.
Regulation of other industries & occupations was also adopted; for example in 1842 children were prohibited from working underground, & more lately (in 1877) canal boat children were protected. In 1844 the hours of work for children were reduced to six and a half; & three hours' daily attendance at school required. The better protection of apprentices & servants was secured in 1851 by an act which enabled Guardians to prosecute in certain cases. Necessary food clothing & lodging were to be provided. These provisions were extended to the cases of parent & child in 1868; and neglect to provide medical aid was made punishable in 1875. Reformatory & industrial schools were established in 1866, & provision was made to receive therein not only destitute & orphan children, but also children having a surviving parent in prison, and children found in the company of thieves. In 1870 the Education Act was passed. In 1872 the first Infant Life Protection Act became law to prevent the evils attendant on baby farming. In 1875 child insurance, which had been prohibited by an act of George III., was permitted with certain restrictions & the numerous burial clubs were then suppressed.
In 1889 the Prevention of Cruelty to Children Act was passed & in 1897 the second Infant Life Protection Act.
In 1901 the last Factory & Workshops Act.
With these of course must be remembered the various Public Health Acts; the Housing of the Working Classes Act. &c.

As the urban mortality of infants is always greater than that of the country further legislation is required to deal with the vast amount of overcrowding in large towns, of London especially. The desirability of taking as many families as possible into the country from the more crowded districts is a question well worthy of the earnest consideration of parliament. Just lately a small scheme for London is being tried in the new colony at Tooting which it is hoped will prove a success, & induce others to follow. The rapidly increasing facilities for many large English towns of locomotion by rail or tram should enable this to be effected so as not to prove unduly expensive for the people for whom it is intended to benefit.

As regards the Factory & Workshops Act 1901. this Act leaves little to be desired. but it might, with great advantage, have included a clause prohibiting mothers from returning to work within at least three months after child birth. Six months would be still better.

The Infant Life Protection Act 1897. came into force January 1st 1898. Section 2. provides that "any person retaining or receiving for hire a reward in that behalf more than one infant under the age of 5 yrs for the purpose of nursing it ——— such infants apart from their parents for a longer period than 48 hours, shall, ——— give notice thereof to the Local Authority" &c &c It is made the duty of the Local Authority to provide for the execution of the Act within the district, & Inspectors may be appointed. This Act is practically a dead letter. Miss Zanetti, an Inspector under the Act to the Charlton

Union found that some of the worst cases got rid of one child so as to be out of reach of the Act. At the meeting of the British Medical Association at Manchester in 1902. a resolution was passed by the Section of Public Medicine "That the provisions of the Infant Life Protection Act shall be extended to all single cases".

The Prevention of Cruelty to Children Act 1889 gives power over the graver forms of neglect. At present the Act is usually invoked by voluntary Societies. This is a duty which should fall upon some legally constituted authority as the Sanitary authority.

Legislation upon the subject of overlaying might with advantage be included in this or a separate Act.

Compulsory notification of phthisis is desirable & would no doubt be followed by disinfection of houses after death or removal of phthisical cases. Also State regulation of indiscriminate spitting. An Act of this kind would I think have a very valuable educational effect on the people by drawing attention to the danger of indiscriminate spitting.

Time is now ripe in my opinion for such legislation as the above.

Further regulation of the milk trade is very desirable, so as to prohibit the sale of milk from tuberculous cows and to ensure a sufficient ~~& wholesome~~ supply of wholesome pure milk to all classes.

Prevention of Syphilis. Whether anything could be done by the State to prevent Syphilis seems doubtful. The Contagious Diseases Act has been repealed & is unlikely to be put in force again either as it stood or subject to modification. To the medical mind it would be easy to make out a case for the enforcement of statutory regulation

of this kind, but, practically, in the present state of public opinion, it would be quite another matter to get it passed by parliament.

Marriage of unsuitable persons. Could the State prevent the marriage of degenerate persons & those suffering from hereditary or transmissible diseases, or consanguineous marriages? In some States in America I believe marriages are not allowed unless the contracting parties can show a medical certificate to the effect that they are of sufficiently sound health & family history. III. Feb. 14th 1903. Theoretically there is much to be said in favour of this system but whether it would be possible in England at present to pass such a law I have grave doubts, and whether other evils such as prostitution would not be encouraged thereby it is difficult to say.

The administration of Opiates to children except under medical advice should be prohibited by law.

II Sanitary Authorities, including County Councils.

Here again I would put Education in the foreground. By this I mean so called technical Education (under the County Councils) in Hygiene to all classes & in Domestic hygiene & infant management to girls & young women.

Education by means of Lady health missioners should be mentioned here. This system was first initiated I believe by the Buckinghamshire County council (Dr Dr Ath M.O.H) & found successful. Other places have adopted it eg Chesterfield where it is carried on by a benevolent institution. There Lady missioners hold classes of mothers & also

visit from house to house of the lower classes, giving practical instruction in the management, care, & feeding of infants. This work is a duty which should not be left to benevolent enterprise but should be recognised as one of the Sanitary authority:

Insanitation has been frequently mentioned as a factor in the production of infant mortality. It is unnecessary to mention the various powers vested in the Sanitary Authorities under the Public Health Acts, the Housing of the working classes Act 1890, the Dairies, Cowsheds & Milkshops' Order 1885: the Adoptive Acts, & others. As the influence of the dwelling house & its environment has such a great influence upon the health or sickness of the inmates, & particularly the infant inhabitants, the powers possessed by Local Authorities should be strictly enforced - Insanitary areas should be swept away & housing found for the displaced inhabitants in suburban districts if possible. Open spaces should be provided where needed. Buildings unfit for human habitation should be demolished, yet how often do we see this ~~abominable~~ primary duty of the Sanitary Authority neglected. Whilst acting as M.O.H. it was my duty to represent to the Local Authority certain dwelling houses in my district as unfit for habitation. Though I brought the subject up year after year in my quarterly & annual reports no action in any single case was ever taken by the Authority & this I find to be the experience of many Medical Officers of Health. Exactly the same statement may be made of the cowsheds in my district. Sanitary authorities from mixed motives appear to be bad

often unwilling to take proceedings where vested interests are at stake.

Every S.A. should adopt the model byelaws of the Local Government Board & strictly enforce them. It is only by a strict enforcement of all the powers possessed by Corporations & Sanitary authorities than any appreciable reduction can be made in infant mortality.

Privy middens should be abolished & water carriage substituted wherever possible. Yards should be paved or concreted & all nuisances (in view of the seriousness of Epidemic diarrhoea) should receive special attention before the expected advent of hot weather.

The sickness of many of the smaller S.A.'s is very great & is attributable to ignorance & a disinclination to spend money even when the public health is at stake. In the larger towns a keener & more intelligent appreciation of their duties is no doubt shown by the Corporations but even there there is much still to be desired. Insanitary areas are left year after year — a standing disgrace, & a serious menace not only to infant life but to public health generally.

Establishment of depôts for the sale of Sterilised & humanised milk. This system was first introduced into England at St Helens by Dr Harris. M.O.H. in 1899. Dr Leon Dufour had previously established one at Fecamp in Normandy. Other places have followed the lead of St Helens. viz Ashton-under-Lyne, Liverpool. Battersea, Dukinfield & (in March of this year) Bradford.

Humanised milk depots are used largely in America

France, Germany & Sweden. At Dukinfield it was found necessary to close the depot for want of support from the people whom it was intended to benefit. (see report of Dr Vacher, M.O.H. for County of Chester, 1901) Leeds is at the present time considering the adoption of the System. That much good will result from this plan I have no doubt, but proper organisation & business-like methods must be adopted to make it a success.

Dr Harris at St Helens claims that the mortality of children supplied with milk from the depot was 70 per 1000 born less than the general infant mortality of the town.

Dr Hope, writes from Liverpool. "Upwards of 900 infants are fed daily on this prepared milk & we have adequate evidence that we are saving life".

Dr Freeman writes from New York "Pasteurised milk has been distributed during a period of 3 years to the poor of N. York in the summer months & more than 1,000.000 bottles were given out. The number of deaths from diarrhoea have been less by 860 than in the three preceding years".

Crèches. In manufacturing towns the establishment of one or more day nurseries where working mothers can leave their infants to be properly tended & fed on humanised & sterilised milk would seem to be a necessity, particularly perhaps for widows without children of earning age. To be a success they must of course be well managed & even then the infants are often exposed to inclement weather in being taken to & from the nursery at early & late hours. So far I believe

these institutions have been of a philanthropic character. It has been suggested that Borough boroughs should establish & work them.

iii Duties of the medical profession

Education has been more than once prominently mentioned as the most hopeful remedy of ~~success~~ success infant mortality. It is the duty of those who know to instruct those who do not know. Here lies the path of the medical profession. A crusade must be started perhaps similar to that we have lately witnessed against consumption (there are signs that such a crusade has already ~~begun~~ begun) and in time may be we shall arrive at a state of things when it will be accounted a disgrace to have in any district a higher infant mortality than say 100 per 1000 births. The honour of starting the Crusade would appear to belong to those of the profession who have adopted Preventive medicine as their rôle in life. But perhaps we await a Théophile Roussel, who in the early seventies roused so deeply Public opinion on infant mortality in France, & whose exertions led to the passing of a law known by his name, & the subsequent establishment of "Consultations for infants" & improvement in the milk supply. upon the whole profession falls the duty of strenuous advocacy of proper feeding & good supply of infants especially for the poor in our towns. In view of the increasing inability of mothers to suckle their infants, the establishment of depots for the supply of good & wholesome milk, humanised & Pasteurised or not, is surely a step in the right direction, & if developed after the lines of the French or American systems must lead to the saving of much infant life, to the relief of much infantile suffering, to the prevention of our so called national disease, Rickets, with its cachexia & deformities, & to the development of a stronger & more virile race.

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