CURRENT DIFFERENTIAL INFANTILE MORTALITY
ENGLAND AND WALES

BY

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A recent publication (Taylor, 1954) reviewed the decline of infantile mortality in England and Wales during the past half-century from a diagnostic viewpoint in as far as it is possible to do so by recourse to official sources. The outcome was a strong presumption in favour of the view that there is no likelihood of stabilization at the present level, since the tempo of decline is still steep. One might be more confident about the long-range prospect if it were possible to speak with greater assurance about the local distribution of high rates, to what extent areas with high rates share common social characteristics, to what extent it is true that such areas have always had a high level of infant mortality, and to what extent inordinately high local infant death rates are associated with a single or few causes.

Official sources unfortunately supply too meagre data to answer these questions fully, even if we supplement information issued from the office of the Registrar-General with what we can learn from annual reports of Medical Officers of Health; and a deeper understanding of the present situation must await extensive ad hoc enquiries. Meanwhile, it may be useful to summarize what relevant figures are to hand as an indication for fruitful investigation in the field, more especially because the one per cent. sample of the 1951 Census supplies for the first time in 20 years a conspectus of the social characteristics of certain local areas. On that account the local unit of what follows is the population under the administration of a County Council.

The accompanying maps (Figs 1 and 2, overleaf) show that a high level of infantile mortality in 1935 was mainly located in the north and west. In 1952 the northerly concentration is less striking but in the west the infant death rate is still high. The history of localities with conspicuously high or conspicuously low rates as set forth in Table I discloses some striking regularities. That the absolute range has dropped from 77 (Dorset, 100; Lancashire, 177) in the quinquennium 1891–95 to 23 (Herts and East Sussex, 20; Montgomery and Westmorland, 43) in 1950, tells only part of the story. If \( h \) and \( l \) stand for the highest and lowest rates referable to local units of

### Table I

<table>
<thead>
<tr>
<th>Year</th>
<th>1876–80</th>
<th>1891–95</th>
<th>1901–05</th>
<th>1910</th>
<th>1936</th>
<th>1950</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highest Rates</td>
<td>Leicestershire 169</td>
<td>Lancashire 177</td>
<td>Lancashire 161</td>
<td>Carmarthen 136</td>
<td>Durham 71</td>
<td>Montgomery 43</td>
</tr>
<tr>
<td></td>
<td>Lancashire 165</td>
<td>Glamorgan 173</td>
<td>Glamorgan 158</td>
<td>Lancashire 129</td>
<td>Northumberland 70</td>
<td>Westmorland 43</td>
</tr>
<tr>
<td></td>
<td>Staffordshire 168</td>
<td>Leicestershire 167</td>
<td>Durham 158</td>
<td>Glamorgan 128</td>
<td>Staffordshire 67</td>
<td>Glamorgan 39</td>
</tr>
<tr>
<td></td>
<td>Westmorland 107</td>
<td>Wiltshire 92</td>
<td>Dorset 100</td>
<td>Wiltshire 69</td>
<td>Denbigh 67</td>
<td>Monmouth 39</td>
</tr>
<tr>
<td></td>
<td>Cardigan 99</td>
<td>Dorset 103</td>
<td>Hertfordshire 92</td>
<td>Hertfordshire 63</td>
<td>Caernarvon 66</td>
<td>Northumberland 36</td>
</tr>
<tr>
<td>Lowest Rates</td>
<td>Wiltshire 108</td>
<td>Westmorland 107</td>
<td>Wiltshire 91</td>
<td>Wiltshire 69</td>
<td>Hertfordshire 38</td>
<td>Wiltshire 23</td>
</tr>
<tr>
<td></td>
<td>East Sussex 67</td>
<td>Essex 37</td>
<td>Cambridgeshire 37</td>
<td>East Sussex 35</td>
<td>Surrey 22</td>
<td>Cambridge 21</td>
</tr>
<tr>
<td></td>
<td>West Riding Yorkshire 63</td>
<td>Peterborough (Soke of) 20</td>
<td>Cambridge 21</td>
<td>Peterborough (Soke of) 20</td>
<td>East Sussex 20</td>
<td>Peterborough (Soke of) 20</td>
</tr>
<tr>
<td></td>
<td>Hertfordshire 20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>70</td>
<td>70</td>
<td>73</td>
<td>35</td>
<td>23</td>
<td></td>
</tr>
<tr>
<td>Per cent. of Mean Range</td>
<td>52</td>
<td>56</td>
<td>73</td>
<td>65</td>
<td>73</td>
<td></td>
</tr>
</tbody>
</table>

*Holder of a Research Fellowship from the Rockefeller Foundation*
Fig. 1.—Infant mortality in administrative counties, England and Wales, 1935.
Fig. 2.—Infant mortality in administrative counties, England and Wales, 1951.
population in a given year or quinquennium, we may specify the range as a percentage of the mean, i.e. \(100(h - l) \div \frac{1}{2}(h + l)\); and this has increased from 56 in the quinquennium 1891–95 to 73 in 1950.

Broadly, the data disclosed by Table I point to a high concentration in mining and quarrying regions and a low concentration in residential areas; but there are anomalies which provoke inquiry and defy any simple explanation in the light of data available. Thus Wiltshire has retained over half a century its place among population units with a very low level of infant death, but its population (392,400 in 1951) and the annual number of births (about 6,000 per annum at this time) are so small as to encourage the expectation that the infant death rate would be subject to wide fluctuations.

We may probe a little more deeply into the nature of these differences if we use a selected group of counties (Appendix) to which we can assign a current figure supplied by the 1951 Census for percentage of males employed in various occupations. Table II shows product-moment correlation coefficients referable to such percentages and to the infant death rate of the listed local units. The occupational picture which emerges indicates a striking association of high mortality with a high proportion of males engaged in mining or quarrying and of low mortality with a high proportion of black-coated or agricultural workers. Against the fact that a high proportion of persons engaged in personal services also goes with a low infant death rate, we should of course give due weight to the fact that such a concentration of individuals signifies a large body of residents able to pay for such services, whence a comparatively high level of material prosperity.

**Table II**

<table>
<thead>
<tr>
<th>Occupational Group</th>
<th>Persons per Room</th>
<th>Standardized Neonatal Mortality Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 1</td>
<td></td>
</tr>
<tr>
<td>1. Mining and Quarrying (III)</td>
<td>-724</td>
<td>15.8</td>
</tr>
<tr>
<td>2. Unskilled Occupations (XXVI)</td>
<td>-459</td>
<td>16.0</td>
</tr>
<tr>
<td>3. Metal Manufacture and Engineering (VI)</td>
<td>-153</td>
<td>17.2</td>
</tr>
<tr>
<td>4. Building and Contracting (XIV)</td>
<td>-86</td>
<td>18.3</td>
</tr>
<tr>
<td>5. Textile Manufacture (VII)</td>
<td>-153</td>
<td></td>
</tr>
<tr>
<td>6. Agriculture, Horticulture and Forestry (II)</td>
<td>-978</td>
<td></td>
</tr>
<tr>
<td>7. Professional and Technical Occupations (XIX)</td>
<td>-471</td>
<td></td>
</tr>
<tr>
<td>8. Personal Service (XXII)</td>
<td>-552</td>
<td></td>
</tr>
<tr>
<td>9. Administration, Directors, Managers (XVI)</td>
<td>-566</td>
<td></td>
</tr>
<tr>
<td>10. Commerce, Finance, and Insurance (XVIII)</td>
<td>-597</td>
<td></td>
</tr>
</tbody>
</table>

That overcrowded homes and a low standard of parental education may be contributory to the higher infantile mortality rates invites us to invoke the technique of partial correlation. As a criterion of parents' educational standard, we employ the proportion of persons leaving full-time schooling before the age of 15. Several indices of overcrowding may be computed from the 1951 Census data, *inter alia*:

(a) households per dwelling;
(b) rooms per household;
(c) persons per dwelling;
(d) persons per room;
(e) percentage households in unshared dwellings.

None of these is entirely satisfactory for our purpose, since size of room, number of rooms, and age-sex structure of the household are all relevant to a proper criterion of overcrowding. However, Charles (1951) noted that "in the City of Birmingham a very high proportion of babies were born to households with two or more persons per room", and "in a check survey on a very small randomly selected sample of households the standardized neonatal mortality rate rose according to degree of overcrowding". Thus she calculates:

\[
\text{Persons per Room} \quad \text{Standardized Neonatal Mortality Ratio}
\]

Accordingly, we have calculated the zero-order correlation between infant mortality and persons per room in shared dwellings as \(r_{mh} = 0.536\), which is very highly significant. It is known that a very high proportion of children are born into families sharing dwellings, so that this correlation is probably of high value as providing evidence that a major proportion of infant loss may be associated with overcrowded homes.

Table III (opposite) summarizes all we can infer concerning the interrelations of infantile mortality (\(m\)), percentage of males engaged in mining and quarrying (\(q\)), defective education specified above (\(e\), and the foregoing criterion of overcrowding (\(h\)). The zero-order correlations, \(r_{mq}\), \(r_{me}\), and \(r_{mh}\), between \(m\) and \(q\), \(m\) and \(e\), and \(m\) and \(h\), are all high; but so are those \(r_{qh}\) and \(r_{qe}\) between \(q\) and \(h\) or \(e\). First-order partial coefficients other than \(r_{mh,q}\) and \(r_{mh,e}\) are fairly high, especially \(r_{mq,h}\); the highest second-order coefficient is \(r_{mq,he}\). From this we may conclude that high infantile mortality associated with a high percentage of males employed in mining or quarrying is by no means largely attributable to the separate or joint effects of prevalent overcrowding, or of a low educational level characteristic of regions in which mining and quarrying are dominant occupations. Our sources do not permit us to explore the relevance of the wage level. Apart
CURRENT DIFFERENTIAL INFANTILE MORTALITY

TABLE III
ZERO, FIRST, AND SECOND ORDER CORRELATION

<table>
<thead>
<tr>
<th>Zero-Order Correlation</th>
<th>Significance (n = 36)</th>
<th>First-Order Correlation</th>
<th>Significance (n = 36)</th>
<th>Second-Order Correlation</th>
<th>Significance (n = 36)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( r_{mq} ) = -7244</td>
<td>**</td>
<td>( r_{mq.h} ) = -5822</td>
<td>**</td>
<td>( r_{mq.h.e} ) = -4776</td>
<td>**</td>
</tr>
<tr>
<td>( r_{mh} ) = -5359</td>
<td>**</td>
<td>( r_{mq.e} ) = -5157</td>
<td>**</td>
<td>( r_{mh.q.e} ) = -0038</td>
<td>**</td>
</tr>
<tr>
<td>( r_{me} ) = -6326</td>
<td>**</td>
<td>( r_{mh.q} ) = -0920</td>
<td>None</td>
<td>( r_{mh.q.e} ) = -3708</td>
<td>None</td>
</tr>
<tr>
<td>( r_{hq} ) = -6752</td>
<td>**</td>
<td>( r_{hq.m} ) = -4930</td>
<td>None</td>
<td>( r_{me.hq.e} ) = -2562</td>
<td>None</td>
</tr>
<tr>
<td>( r_{he} ) = -6382</td>
<td>**</td>
<td>( r_{me.h} ) = -2216</td>
<td>None</td>
<td>( r_{he.mq.e} ) = -3148</td>
<td>None</td>
</tr>
<tr>
<td>( r_{ge} ) = -6853</td>
<td>**</td>
<td>( r_{me.h} ) = -4471</td>
<td>None</td>
<td>( r_{he.mq} ) = -2581</td>
<td>Doubtful</td>
</tr>
</tbody>
</table>

\( m \) = infantile mortality  
\( q \) = percentage adult males employed in mining and quarrying  
\( h \) = overcrowding  
\( e \) = deficient education  
** = highly significant (\( P < 0.01 \))  
* = significant (\( P < 0.05 \))

from the conclusion last stated, all that we can conclude by recourse to the new data made available from the 1951 Census one per cent. sample is that:

(a) Regional black-spots of infant mortality cannot be ascribed to a climate of locational causes.
(b) They are highly associated with the occupation of the males resident in these areas.
(c) The worst areas are of long-standing character.
(d) A poverty syndrome as depicted by Woolf and Waterhouse (1945) may still play a part.

It might be possible to learn more of the agencies contributing to the present tempo of decline, and hence to make short-term forecasts with some assurance, if all county medical health reports cited a diagnostic breakdown of infant deaths, comparable to what is available for the country as a whole through the annual reviews of the Registrar-General.* Unfortunately, reports which do this are mostly referable to localities in which the rates are low, and an examination of material available seems to show that good records are available only for population units which have least need to profit from them. We can anticipate little further enlightenment without recourse to field enquiries on a costly scale.

Acknowledgements are due to Prof. Lancelot Hogben, F.R.S., for advice and assistance.

REFERENCES

* The county tables in the Registrar-General's reviews are not adequate for this purpose.

APPENDIX
Administrative County Areas used in Text

Bedfordshire  
Berkshire  
Buckinghamshire  
Cheshire  
Cornwall  
Derbyshire  
Devonshire  
Dorset  
Durham  

Glamorganshire  
Gloucestershire  
Hertfordshire  
Leicestershire  
Lincolnshire (Lindsey)  
Monmouthshire  
Nornfolk  
Northamptonshire  
Northumberland  

Nottinghamshire  
Shropshire  
Somerset  
Southampton  
Staffordshire  
Sussex East  
Sussex West  
Warwickshire  
Wiltshire  

Worcestershire  
Yorkshire (North Riding)  
Essex  
Kent  
Lancashire  
London  
Middlesex  
Surrey  
Yorkshire (West Riding)
Current Differential Infantile Mortality: England and Wales

Wallis Taylor

doi: 10.1136/jech.8.4.157

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