A

Study of

INFANT SICKNESS

being

a

THESIS

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by

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C O N T E N T S.

INTRODUCTION.

1. Improvements in the public health over periods of years, and differences in health between one community and another and between different groups in the same community have hitherto been measured mainly by means of death rates. This is as true today as in the earliest days of vital statistics, though it is universally recognised that the common rates are in many ways imperfect instruments of measurement. Crude death rates are obviously rough and ready indices, since they relate to populations whose age and sex composition are not constant. More refined indices such as the Standardised Death Rate and the more recent Comparative Mortality Index, though an improvement on crude death rates, are still less accurate yardsticks than age specific rates. It is not astonishing, therefore, for this reason alone, that the Infant Mortality Rate, i.e. an age specific rate relating to the first year of life is recognised as one of the most valuable indices of community health. The Infant Mortality Rate, has, moreover, the additional advantage of being a highly sensitive index. The young infant is highly susceptible to adverse physical conditions and lack of care; and untreated illnesses which

might prove fatal during the first year of life would often be passing incidents for older children. And since after the first few weeks of life the infant's wellbeing is regarded as being almost entirely a reflection of his environment and the standard of maternal care he receives - of the economic and social circumstances of the family he is born into, and the capacity and diligence of his mother - the infant mortality rate is probably the most sensitive index available to us at the present time of the standard of living of a particular community.

2. In existing circumstances any death rate, however, is a less appropriate measure of community health than when whole populations were periodically scourged by epidemic diseases with high mortality rates. Even the infant mortality rate, though a better measure than the general death rate, has far less significance now (at a level of 34 per thousand live births - England and Wales 1948) than at the beginning of the century, when it stood at a level of 150 or thereabouts. And the nearer this rate approaches to a virtually irreducible minimum, the less it can be an indication of factors which operate differently in different groups of the community.

3. The obvious need today, when a high standard of social and medical services often obscures the significance of mortality rates, is for more sensitive and refined indices based on the incidence of disease (morbidity rates). And this is probably even truer of the infant than of later age groups. Yet, it is during infancy and early childhood, a period when we should like to have the fullest information, that virtually nothing is known of the total amount of sickness experienced.

4. The collection of morbidity statistics is always a matter of difficulty because the dividing line between illness and health is not easy to define; and the obstacles are particularly great during the early years of life because no machinery has existed hitherto for recording infant illnesses in the community. Limited morbidity statistics relating to adults have, of course, been made available through the National Health Insurance Scheme, the Industrial Medical Services, the Emergency Medical Hospital Services and by sample survey methods originating in the officially sponsored "Wartime Social Survey". But, with the single exception of the notifiable infectious diseases, there is no information

on a large scale about the incidence of infant sickness; and even in the case of the infectious diseases, national case rates and mortality rates have not been satisfactorily related.

5. In not a single instance do these sources of information furnish facts about the amount and kind of illness in infancy. We do not know, for instance, whether the remarkable decline in infant mortality during recent years has been accompanied by a corresponding falling off of infant sickness. It is reasonable to suppose a correlation between mortality and morbidity, though its degree in the present state of knowledge must be a matter for conjecture.

6. It follows that any addition to our knowledge of infant morbidity would have considerable value. First of all, case fatality rates could be determined and the significance of mortality, the end point of some illnesses, would be elucidated. Secondly, it would be possible to say whether a future reduction of infant mortality could best be secured, on the one hand, mainly by ensuring an improved provision of medical services for the treatment of infant sickness, or on the other mainly by preventing infant illness by means of further improve-

ment of the environment. Finally, health departments would be enabled to define the size and nature of the problem of preventing, not only the killing diseases of infancy, but also the minor maladies, which to say the least, interfere with ordered progress and throw a heavy burden on mothers and other members of a family. This objective, which is likely in the future to be more in keeping with the orientation of a preventive medicine whose accent is on the promotion of health, is unattainable without full information about infant illnesses, their origins and associations.

7. If little is known about the incidence of sickness in infancy no more is known with certainty about the significance of environmental influences which are frequent contributory causes of many disorders which affect the young baby. A great number of interacting factors are obviously involved. Climatic conditions, economic status, housing standards, cleanliness in the home, overcrowding, family size, standard of infant care, traditional methods of infant feeding and the availability of medical and nursing services all play a part. And most people are agreed that the most important identifiable factor during the

early months of life (in circumstances which usually prevail in England and Wales) is the method of infant feeding.

8. Because of its admitted importance it might be supposed that breast feeding would have been the subject of exhaustive and conclusive studies. But this is far from being the case. Our knowledge of breast feeding habits is scrappy, and for the most part relates to infants in highly selected groups, e.g., infants born in hospital, infants attending infant welfare centres, or infants at a particular age. The causes of failure to establish or maintain breast feeding are also imperfectly understood; the relation between feeding history and infant health is for the most part based on speculation; and even the well established relation between bottle feeding and a high incidence of gastro-enteritis has not been clearly demonstrated as a cause and effect relationship. Both may be effects of a common ætiological background - the question is still an open one. The study of infant morbidity and its associated circumstances is, indeed, largely a virgin field.

9. The intention of this thesis, described in

greater detail below, is to report on an investigation of morbidity in an infant population born during a selected year (1945) in an industrial town of 110,000 inhabitants. It does not answer all the questions raised either overtly or by implication, in the preceding paragraphs. Indeed it raises as many questions as it answers. It does, however, furnish fairly complete information about the amount and kind of illness experienced by infants during the first year of life, and it throws some light on a number of aetiological problems which have hitherto been neglected.

ORIGIN AND METHOD.

10. The investigation described in this thesis had its origin in the wider investigation, mentioned above, of illness in early childhood in the Borough of Luton.[1] A survey of morbidity during the first five years of life is being conducted in the town, with the broad objective of obtaining a measure of the amount of illness at 0-5 years, its nature and its relation to certain social influences. The group of infants it is intended to study until they reach the age of 5 years, comprises all infants

born in Luton in 1945 whose birth was registered in the Borough.

11. In this thesis, however, the study is restricted to illness in the first year of life. To this study is added, first, an analysis of infant mortality in the Borough, and second, a report on a separate investigation based on individual case studies, (90 infants who suffered an unusual amount of illness during the first year of life and a control group of the same size).

12. The body of the thesis consists, therefore, of three parts:

(1) An account of illness at 0-1 year.

(2) An analysis of infant mortality.

(3) An account of infant case studies.

It is convenient to describe enquiry methods, standards adopted, definitions, etc., separately for each of the three parts.

A. Morbidity Survey.

13. In an enquiry into illness in early childhood it is clearly impossible to obtain information about every departure from health or "normality" and a decision had to be made about what should be recordéd. The illnesses and accidents recorded were: (a) those

needing treatment in bed for at least 48 hours, (b) those for which a doctor was called, and (c) those leaving a recognised disability.

14. This arbitrary selection does not automatically exclude the recording of a number of minor ailments and trivial departures from health, for cautious parents sometimes seek medical advice on the slightest pretext. Instances of minor disorders have crept into the records, and doubtless a few illnesses which should have appeared have escaped notice (we cannot, for instance, be certain that all mild cases of gastro-enteritis have been recorded). What is important from the particular point of view of this enquiry, however, is the unlikelihood of any serious illnesses having been excluded, and this is borne out by a close correspondence between the information collected in the course of the enquiry and information obtained from other sources*.

15. The enquiry was conducted by means of a record card (Appendix I) completed as regards housing

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* For example, during 1945, 36 cases of measles in children under one year were notified and the survey disclosed 39 cases.

circumstances and certain social particulars from existing departmental records, and as regards breast-feeding history, position in family and certain other particulars from existing hospital and clinic records. Finally, a record was compiled for illness and accident history by personal enquiries in the home. The enquiries were made by health visitors who obtained from the child's mother details of illnesses occurring during the first year of life, so far as the mother could recall them. The record was compiled within a week or so of the child reaching the age of one year.*

16. The record thus obtained was then checked against information obtained from notifications of infectious diseases and through records of local hospital admissions coming into the department at regular intervals.

17. Fairly complete social, housing and obstetric particulars relating to the group of infants selected were already available in the department before the enquiry began. This was so because a complete record relating to all births occurring in the Borough during 1945 was contained in "Report on Luton, 1945." [2]

* Sickness records relate, of course, to non-fatal illnesses. Only infants who survived to the age of one year were included in the general survey.

18. The original group of infants studies numbered 1897, but losses reduced the number at the end of the first year of life to 1,498 (49 infant deaths and 350 infants who were removed or could not be traced). The magnitude of the loss is attributable to the fact that the year 1945 was one during which a post-war resettlement of population was taking place on a large scale.

19. Because of the relatively large number of infants who could not be traced at the end of the first year the question arises whether the observed group of 1,498 infants is representative, i.e. whether illness rates in the unobserved group are likely to differ from rates in the observed group. The question of bias is a technical one, and need not be discussed here in detail. It is sufficient to say that the group examined was fairly representative of all infants under 1 year of age, as may be seen from Table I , Appendix I , which compares the circumstances of the observed and unobserved groups.

B. Infant Mortality.

20. With one exception, the data relating to infant mortality were already available in the form of departmental records. The exception was that no information was obtainable from these records about the occupational

group to which a child's father belonged. This information was obtained from the local Registrar of Births and Deaths (i) in respect of all births registered in the Borough during 1946, and (ii) in respect of infant deaths in the years 1945-47. A classification according to social class was derived from this information in accordance with the Registrar General's list used in connection with the 1931 census. (Appendix IV).

C. Case Studies.

21. In the section devoted to infant morbidity (Page 30), the whole observed group of infants is divided into two parts: (1) infants who had two or more illnesses or 99 days or more of illness during the year (referred to as the high incidence group), and (2) the rest, i.e. infants who had only one illness or no illness at all. The high incidence group comprised 97 infants whose illness, as will be described later, accounted for almost half of all the known non-fatal illness recorded.

22. Since the high incidence group represented a concentration of infant illness in the population surveyed, it provided also a convenient group for detailed study. Its members were made the subject of individual case

studies into illness and related environmental circumstances. Homes of children in the group were visited and detailed information was obtained about social condition, economic circumstances and standards of infant care. The particulars were recorded on an enquiry card (Appendix I).

23. A control group of children who had not been ill, matched for social class, family size and breast feeding history, was studied concurrently.

24. With the object of formulating a scale of standards of infant care, a pilot investigation was carried out, but it was very quickly apparent that it was impossible to define standards according to independent criteria.* Infant care is measurable against such factors as cleanliness of the home, cleanliness of the child, the mother's will to learn and ability to carry out instructions, her age, the care she exercises in the preparation of milk feeds, and in some instances the success of her breast feeding efforts. Its assessment is complicated by such factors as the presence of 'in-laws' in the home, arrangements for handing over the care of the infant to other people,

* I carried out the pilot survey by personal visits to a number of homes.

and the time a mother of a large family can devote to her young infant. It was apparent also that over indulgence can sometimes be as harmful to the child as relative neglect.

25. Once the difficulties of assessing standards of infant care were realised, it was decided to use a simple scale, viz., A, good; B, fair; and C, poor. The assessment was entrusted to health visitors who were already familiar with the homes and who were able to supplement their general knowledge of the household by fuller observations when they visited for the purpose of completing enquiry cards. The health visitor not only had the advantage of knowing the family, but she was already in the mother's confidence. In order to exclude pre-judgment or prejudice, the health visitor was not told that her visits were made in connection with a study of a high incidence group and a control group. She did not, therefore, know at the time of her visit whether a home in question housed a child in one group or the other.

SECTION I.

INFANT MORBIDITY AND SOCIAL CIRCUMSTANCES.

26. Taking the whole group of 1,498 infants, 564 disease incidents were recorded during the first year of life, or an average of 1 incident for every 2.6 infants.

27. Table I gives the distribution of illnesses classified under nine headings. The somewhat large number included under heading (9) "All other" consisted mainly of feeding difficulties, mild throat and ear conditions associated with teething, skin rashes and mild degrees of ophthalmia. Included also under this heading were 7 operation cases and 15 cases of chicken pox.

TABLE I.

Disease and Accident Incidents of all Durations at 0-1 year.

Disease	1st illness	2nd illness	3rd & over illness	All illnesses No.	All illnesses %
1. Pneumonia	16	5	1	22	4
2. Bronchitis	168	25	9	202	36
3. Influenza, colds and other respiratory infections	38	9	3	50	9
4. Gastro-enteritis	56	6	-	62	11
5. Measles	32	3	4	39	7
6. Whooping cough	51	10	-	61	11
7. Scarlet Fever	1	-	-	1	-
8. Accident - injury, burn or scald.	4	4	-	8	1
9. All other	102	13	4	119	21
Total	468	75	21	564	100

28. Nearly half the recorded illnesses fall within the respiratory group under the first three headings, and 11% are accounted for by gastro-enteritis. The risk of contracting measles or whooping cough in Luton is shown to be relatively small during the first year of life. Thus, for every hundred infants, only three had suffered from measles by the time they were a year old, and only four from whooping cough. Added significance is given to this low rate of measles by the fact that the disease had an unusually high incidence generally in 1945. In the succeeding years, 1946 and 1947, when measles was less prevalent, notifications show that the measles risk for children under 1 year was even less than that disclosed by the survey. The very small number of children who sustained accidents during the first year of life - only eight in the whole group of 1,498 infants - is noteworthy.

29. When the proportionate distribution of the causes of first and second illnesses is compared (we may ignore the third and subsequent illnesses for the figures are too small to be significant) it is apparent that they do not differ substantially.

30. The social factors examined in the general investigation and their influence on the incidence of

infant morbidity were: social class, family size, standard of housing and breast feeding history.

A. Social Class.

31. There were no big differences when illness incidents were analysed according to the social class of the father. Taking first illnesses alone, there was one incident to 3.0 infants in social classes I, II and III; one to 4 infants in social classes IV and V; and a similar ratio for infants whose parents were unclassified. These figures might, it was thought, have concealed a concentration of the more serious incidents in one or other of the social classes, but an examination of the distribution of protracted sickness, which is used as a rough measure of severity, disclosed no evidence of such a concentration. When incidents of 14 days' duration and over are analysed separately it is equally clear that social class differences are not significant for incidents of long duration. (Table II).

TABLE II.

All Disease Incidents by Social Class at 0-1 year.

	Social Class	
	I, II & III	IV & V
Incidents of all durations	352	155
No. of infants per incident	2.5	2.8
Incidents 14 days' duration and over	228	110
No. of infants per incident	4	4

B. Family Size.

32. As regards family size, there is a general belief that the infant born into a family of several young children is at a greater risk than the only child of contracting ailments (presumably infectious). An analysis of illness histories according to family size confirms this. The only child appears to enjoy a small advantage during the first year of life (Table III).

TABLE III.

Incidence of Infant Illness according to Family Size.

No. of children in family.		No illness	One or more Illnesses
One child	600	425 (71%)	175 (29%)
Two children	508	342 (67%)	166 (33%)
Three children	222	144 (65%)	78 (35%)
Four or more children	168	104 (62%)	64 (38%)
All	1,498	1,015 (68%)	483 (32%)

C. Standard of Housing.

33. An analysis under disease headings according to social class, and according to whether the house was classified as "fit" or "unfit" showed no significant differences in either case. This is somewhat surprising, even though in the present serious housing shortage, a classification based on fitness or unfitness according

to Housing Act standards is not a reliable indication of the degree of overcrowding. Indeed, it is a matter of common knowledge that many good class houses are grossly overcrowded at the present time, whilst some unfit houses are not. The relation of room density to infant sickness is examined in Section III; but to anticipate it can be said now that there is no evidence in Luton of an appreciable difference in the disease experience of infancy according to housing standards.

D. Breast Feeding History.

34. In the course of the survey particulars of the breast feeding history were recorded. The age at which breast feeding ceased and the connection between family size, social class and breast feeding history were also investigated.[3]

35. This investigation revealed that breast feeding was not established at all or ceased within 10 days in about 20% of all infants. Thereafter the rate of weaning, which was about 8% per month up to 6 months, accelerated to 12% in the 7th month and finally slowed down to 6% per month during the 8th and 9th months. It was shown, moreover, that the weaning rate was independent of family

size, social class and standard of housing. When, however, the weaning rate of infants with sickness experience was examined it was found that not only was the percentage weaned in the early weeks greater, but also that the weaning rate in the early months thereafter was relatively faster than for infants who had no illness at all. In addition, the survey showed that infants who experienced most sickness (reckoned in number of illnesses recorded) had a still higher initial incidence of weaning, and higher subsequent weaning rates, than those with only one recorded illness. (Table IV).

TABLE IV.

Age at which Breast Feeding ceased for Infants with sickness experience as stated.

Age in months B/F ceased	Infants with no illness		Infants with one illness		Infants with two or more illnesses		All infants	
	No.	%	No.	%	No.	%	No.	%
Under 1 mth.	254	25	109	28	30	40	393	26
1-2	77	7	42	11	11	15	130	9
2-3	65	6	45	11	9	12	119	8
3-4	80	8	41	10	4	5	125	8
4-5	57	6	18	5	-	-	75	5
5-6	45	4	23	6	2	3	70	5
6-7	132	13	38	10	9	12	179	12
7-9	125	12	31	8	3	4	159	11
9 mths & over	195	19	45	11	7	9	247	16
Not stated	-	-	1	-	-	-	1	-
Total	1030	100	393	100	75	100	1498	100

36. This apparently significant relationship between infant sickness generally and early weaning was, however, shown to be somewhat illusory. For when infants who suffered from gastro-enteritis (62) were excluded from the total number with sickness experience (483), there was virtually no difference in the weaning rate of the three groups, i.e. "no illness" "one illness" and "two or more illnesses". This finding, though serving to discount any relationship which might be expected to exist between early weaning and general infant morbidity, also heightens the meaningful relationship between premature weaning and gastro-intestinal disorders.

37. The breast feeding history of the 62 recorded cases of infantile enteritis revealed that in only 8 instances was an infant who developed enteritis still breast-fed at the date of occurrence of the enteritis; in 47 instances the infant had ceased to be breast-fed; and in 7 the evidence was equivocal, i.e. the enteritis occurred at or about the time of weaning. A high proportion of the recorded enteritis occurred, as might be expected from its demonstrated connection with non-breast feeding, over the age of six months. Only 19 cases were recorded as occurring before the age of six

months; 12 from six to nine months; and 31 (or half of all the cases) at the age of nine months and over.

38. There can be little doubt that bottle feeding and 'gastro-enteritis' are associated, but it is still an open question whether the disorders are physiological disturbances or infections. The practical importance of finding an answer to this question is that it would indicate to what extent gastro-intestinal disorders could be prevented by the adoption of hygienically safe methods of artificial feeding.

SECTION II.

INFANT MORTALITY AND SOCIAL CIRCUMSTANCES.

39. The trend of infant mortality in England and Wales during the last half century is well known. A rate of 151 in 1901 had fallen to 125 by 1911, to 79 by 1921-23, to 62 by 1930-32; and by 1948 had reached the lowest recorded level of 34 per thousand live births. The improvement is attributable to a number of factors; increased material prosperity, improved standards of housing, better education, better feeding and smaller families. Child welfare services, whose provision has

been general since the end of the first world war, also doubtless contributed by encouraging a higher standard of maternal care. They helped particularly by providing for the general supervision of infants by public health officers familiar with the domestic circumstances of ordinary people.

40. Whatever weight is given to individual causes of the improvement - a matter not beyond dispute - available statistics show a consistent correlation between the infant mortality rate and social class, a relationship which has been analysed in a number of studies (e.g. "Birth, Poverty and Wealth" Richard M. Titmuss).[4]

41. The latest national* figures relating infant mortality and social class were compiled for the three years 1930-32 in connection with the 1931 census. They show that the difference in infant mortality rates between the extreme social groups was still very wide (see Table III, Appendix IV). For social class I$^{\phi}$ the rate

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* England and Wales.

$^{\phi}$ Social class according to the Registrar General's classification.

Class I. Upper professional and managerial strata.
Class II. Lesser employers, managers and professions.
Class III. Skilled and black-coated workers.
Class IV. Semi-skilled, including agricultural workers.
Class V. Unskilled labourers.

was 33 per thousand legitimate live births and for class V, 77 per thousand (i.e. 1 to 2.3); and Titmuss showed in his study that in relative terms the gap between the social classes was wider in 1930-32 than it was in 1911.

42. A question we should obviously like to be able to answer is how social class differences have moved since 1930-32, with the substantial fall in the infant death rate which has since occurred (from 62 to 34 in 1948).

43. Before examining this question, however, it is worth while looking at two fractions of the infant death rate, i.e. mortality during the first 4 weeks of life and mortality during the remainder of the first year.

44. Broadly speaking, during the last 50 years the neo-natal death rate has been much more resistant to change than the rate at 4-52 weeks. For England and Wales the neo-natal rate fell only from 41.9 in 1906 to 24.5 in 1946, compared with a fall in the rate at 4-52 weeks from 90.6 to 18.5. The explanation of these facts is, of course, that the causes of infant death after 4 weeks of age are largely environmental; and the main improvements affecting the infant's chances of survival are to be found

in the environment. As might be expected, there is much less difference between the neo-natal rates for the five social classes than for the corresponding rates at 4-52 weeks. The most recent figures for England and Wales (1930-32) showed the neo-natal rate for class I to be 21.7 and for class V, 32.5, i.e. 1 to 1.5. The corresponding rates at 4-52 weeks were 11.0 and 44.5, i.e. 1 to 4.

45. As we have seen, no information is available about the social differential of the infant mortality rate for England and Wales since 1930-32; and the information could not be obtained without a census comparable with that of 1931.* For the purposes of this thesis, however, it was possible to examine differences between the social classes for certain recent years in the Borough of Luton. And it is obviously valuable to know what the present situation is, not only because the infant mortality rate for England and Wales is now little more than half the rate for 1930-32, but also because great social changes have taken place since 1931 and more particularly during the last decade. Social class according to occupation may not now have the significance

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* See note P 29.

it had formerly.

46. The trend of infant mortality in Luton since 1900 is virtually the same as for England and Wales as a whole. The Luton rate has been consistently somewhat lower, for although an industrial town, Luton lies in the relatively favoured and prosperous South East region of the Country. In 1900, the infant mortality rate for Luton was 120 per thousand live births; by 1911, 85 per thousand; by 1920, 60 per thousand; by 1930, 44 per thousand; and in 1948 reached a new low level of 27. The trend of the neo-natal rate for Luton has also been very similar to the national trend. By 1948 the neo-natal rate was 14.3 per thousand and the rate at 4-52 weeks, 12.7 per thousand live births.

47. What can be said of social class differences in recent years? Table V below sets out an analysis of 217 deaths related to 6,000 legitimate live births recorded during the three years 1945-47 in the Borough of Luton. It reveals that notwithstanding the low infant mortality rate (36 per thousand legitimate live births) there was still a noteworthy difference between the social classes.

TABLE V.

Infant Mortality by Social Class of Father, Luton, 1945-46-47.

Class	Legitimate live births	All infant deaths	Death rate all infants per 1,000 legitimate live births	Neo-natal deaths	Neo-natal death rate
All classes	6000	217	36	152	32
I	240	4	17	1	4
II	720 4560	27 142	37 51	18 95	25 20.8
III	5600	111	31	76	21
IV	1080	56	52	30	28
V	360 1440	19 75	53 52	7 37	19 25

48. The figures for class I are too small to be reliable, but it is apparent that classes I, II and III taken together enjoy a substantially lower rate at 0-1 year than classes IV and V, i.e. 1 to 1.6. When the infant death rate is broken down into a neo-natal fraction and a rate relating to the period 4-52 weeks, a much gentler gradient for deaths attributable mainly to causes other than the post-natal environment is revealed. The neo-natal rate for classes I, II and III is 20.8, and for classes IV and V 25, i.e. 1 to 1.2; whereas for the same social groups the rates at 4-52 weeks are 10.2 and 27, i.e. 1 to 2.6.

49. Though judging by Luton the gap has been narrowed,

there is nevertheless still a wide difference for infant death rates at 4-52 weeks, i.e. 1 to 2.6. This difference which persists between the social groups could arise, broadly speaking, in one of two ways: (a) from a higher sickness rate in the less favoured groups but the same case fatality rates or (b) from a higher case fatality rate in the less favoured groups with little or no difference in sickness rates. In other words, a greater proportion of infants in social classes IV and V may die because the incidence of infant disorders is greater in the poorer classes, or alternatively because there is less chance of a sick child in a poor family recovering from an established illness.

50. As has been shown in Section I, the investigation into infant morbidity disclosed the somewhat unexpected fact that no difference in sickness rates between the social classes existed. The importance of this, when related to the demonstrated mortality gradient, lies in the fact that it indicates the kind of risk experienced by the young infant in relatively adverse circumstances. It seems to show that adverse circumstances within the limits of variability of a community like Luton, do not increase the

infant's chances of being ill, but do imply that an infant who has become ill is less likely to recover.

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Note: Since the foregoing analysis was made, the Registrar General's analysis of neo-natal mortality in England and Wales according to Social Class for the year 1939 has been published.[5] This has been possible because since 1939 the occupation of the father is recorded at birth registration under the Population (Statistics Act), 1939. The results are set out in the following table.

England & Wales	Class I	Class II	Class III	Class IV	Class V	All Classes
Neo-natal mortality	18.9	23.4	25.4	27.7	30.1	27.1

SECTION III.

Case Studies.

51. Two significant facts have been demonstrated in earlier sections:(1) infant mortality (in Luton) still has a social gradient, and (2) infant morbidity, by contrast, is apparently independent of social class. The second of these facts - a somewhat unexpected disclosure - needs to be examined and if possible explained.

52. It was stated earlier (Page 12) that almost half the non-fatal illness among infants in Luton was experienced by a relatively small group. In this 'high incidence' group there were 97 infants who experienced 6,140 days of illness during the first year of life, or an average of 63 days per infant. The total number of days of illness recorded during the first year of life among the 1,498 infants was 12,732, or an average of 8.5 days per infant. Thus, the infants in the 'high incidence' group had seven times as many days of illness as the whole observed group and fourteen times as much illness (in days) as the remaining 1,401 infants. The existence of 'high incidence' and 'no illness' groups reflects undoubted differences between groups of infants in respect of their sickness experience, and these differences cannot be explained in terms of social class or referred to circumstances of which social class is an index. What then, we have to ask, are the factors which

decide whether infants shall be ailing or well during the first year of life. What agencies, independent of social class and of whatever it signifies, agencies of a kind that operate evenly through the social classes, determine the composition of the 'high incidence' and 'no illness' groups?

55. This section is mainly an attempt to answer these questions by means of case studies based on 90 infants in the 'high incidence' group* and a control group of 90 infants who had no recorded illness. The main object of the case studies was to identify factors which could account for a high incidence of sickness in one group and not in another, a difference which must reside in factors independent of social class and whatever it connotes. The method employed was described earlier (Page 12), when it was stated that a control group was constituted of infants who had no illness and who were matched, case for case, as regards social class, family size and feeding history with the 'high incidence' group. The two groups will first be examined in relation to the characteristics for which they were matched.

54. Table VI shows the distribution of incomes in the two groups according to social class.

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* Of the 97 infants which comprised the high incidence group, 7 left the area and so were lost to the enquiry.

TABLE VI.

Economic Circumstances According to Social Class.

(Weekly income per head).

Social Classes ø	HIGH INCIDENCE GROUP (90)			CONTROL GROUP (90)			COMBINED GROUPS (180)		
	Under 15/-	15/- to £2.10.0	Over £2.10.0	Under 15/-	15/- to £2.10.0	Over £2.10.0	Under 15/-	15/- to £2.10.0	Over £2.10.0
II	-	5	4	-	9	2	-	14	6
III	2	43	9	3	33	8	5	76	17
IV	2	12	2	2	19	4	4	31	6
V	-	5	-	-	8	-	-	13	-
Unclass.	2	4	-	2	-	-	4	4	-
All	6 (7%)	69 (77%)	15 (16%)	7 (8%)	69 (77%)	14 (15%)	13 (7%)	138 (77%)	29 (16%)

ø No Social Class I cases appeared.

54. The immediate significance of the table is that it shows the similarity of social class distribution in the two groups. From a study of the table it also emerges, as might be expected, that there is a close correspondence between social class and economic circumstances. Broadly speaking, about 7% of the families in both groups have weekly incomes of less than 15/- per head, and about 16% have over £2.10.0d. per head. The small proportion of families with weekly incomes of less than 15/- per head is noteworthy; and it is also of some interest that 6 families

among the 54 in classes IV and V had weekly incomes of more than £2. 10. 0d. per head.

56. There is evidently some gradation of income level as between the social classes, but equally clearly the amount of overlap is such that a particular income level cannot be assumed from the fact of social class in individual cases (see also Appendix III Page 66). The numbers are too small to justify conclusions about the meaning of social class in terms of economic circumstances, but even without the use of such a device as a poverty line, it is obvious that few families in any social class were under serious economic stress. The classification according to income is indeed consistent with a general impression that there is little or no serious poverty in the Borough. The point is important because it suggests that poverty, which undoubtedly has aetiological significance in certain localities, is unlikely to be a material influence in the population to which this study relates.

57. It will be noted also that social class distribution in the control group is virtually the same as in the primary survey group, as shown in Appendix I , i.e. 61% social classes I, II and III and 39% social classes IV and V and unclassified, as against 60.5% and 39.4% respectively. Indeed, had social class been the only

factor in respect of which standardisation was needed, 90 infants taken at random from the main survey group would have served as a control. As however, it was thought worth while to match the control group with the 'high incidence' group for family size and feeding history in addition to social class, 90 infants taken at random would not have met all three requirements. A comparison of individual case record cards in the groups had, therefore, to be made.

58. Family size is examined in Table VII below. The match for all infants in the 'high incidence' group with all infants in the control group is obviously a good one. There is not an equally close correspondence between the groups within the social classes, but the matching is not invalidated, for as has already been shown, morbidity experience is independent of social class.

TABLE VII.

Position in Family according to Social Class.

Social Class	HIGH INCIDENCE GROUP			CONTROL GROUP		
	Position in Family			Position in Family		
	1st child	2nd child	3rd and subs. child.	1st child	2nd child	3rd and subs. child.
II	6	2	1	2	6	3
III	9	23	22	16	14	14
IV	6	5	5	6	9	10
V	1	2	2	3	1	4
Unclass.	4	2	-	-	2	-
All	26	34	30	27	32	31

59. An analysis of the two groups as regards ages of siblings was also made (see Appendix II), which shows that there was no real difference between the two groups.

60. The third characteristic for which the groups were matched was feeding history (Table VIII below). It is apparent that an exact match was not achieved. During the first three months of life, 59 'high incidence' group infants were weaned as against 44 infants of the control group, but otherwise the two groups are not widely dissimilar.

TABLE VIII.

Age at Weaning.

Weaned at	HIGH INCIDENCE GROUP		CONTROL GROUP	
	No. weaned		No. weaned	
0-1 month	32	(35%)	32	(35%)
1-2 months	14	(16%)	7	(8%)
2-3 "	13	(14%)	5	(6%)
3-5 "	7	(8%)	16	(18%)
5-7 "	12	(13%)	13	(14%)
7 months and over.	12	(13%)	17	(20%)
All	90		90	

61. By and large it can be said that the two groups are reasonably well matched for social class, family size

and feeding history. The match is not perfect - and indeed it was virtually impossible to make it so - but in respect of the three named characteristics it is nearly enough complete for the purpose of providing a control. Two other characteristics for which the groups were not deliberately matched can now be examined; namely, room density and maternal age.

62. In respect of room density, family circumstances were classed as Good, Fair or Bad.* In the 'high incidence' group 76 families were graded as good, 6 fair and 8 bad. The corresponding numbers for the control group were 75, 7 and 8 respectively. It appears that in this respect the two groups are similar, a result that might have been expected to follow the deliberate matching for social class and family size.

63. The age distribution of mothers in the two groups was also examined, with results shown in Table IX below. It appears from the table that the bulk of mothers in the two groups are between 25 and 35 years of age, with a somewhat swollen proportion of women over 35 years in the

* The standard used was related to the definition of overcrowding contained in the Housing Act, 1936. Overcrowded families are called bad; borderline, fair; and others, good.

control group. The unusually high proportion of child bearing women in both groups at age 35 years and over will be noted. It is accounted for by the fact that the 'high incidence' group contained a disproportionate number of large families, so that the mother was often getting on in years; and the same applies to the control group as it was matched with the 'high incidence' group for family size.

TABLE IX.

Age of Mother at Childbirth.

Age of mother	All	High Incidence Group	Control Group
Under 25	23	14	9
25-35	108	57	51
35+	49	19	30
All	180	90	90

64. This is, perhaps, a good point to take stock of the position we have reached. The two groups - 'high incidence' and 'control' - have been matched for social class, family size and breast feeding history, and they are also similar in respect of room density and maternal age. Yet, unless the contrasting sickness experience of infants in the two groups is to be attributed to the

vagaries of chance, there must be some important differences between the groups to account for a high incidence of sickness in one and not in the other. It can now be asked in what possible ways they could differ; and this question is particularised by reviewing the entire range of factors which combine to determine the physical state of an infant. In broad terms they are as follows:-

I. Constitution at birth - attributable to an hereditary component and ante-natal environment.

II. Post-natal factors.

(1) Physical environment, of which social class, income level and housing circumstances are indices.

(2) Other environmental factors such as family size, feeding and standard of infant care.

65. These factors are not, of course, either sharply separated from or independent of each other and they could doubtless be classified in other ways. The fact remains, however, that we are virtually left with only two broad factors - infant care and infant constitution - to account for the differences in sickness experience we are seeking to explain. These factors can, therefore, be examined now to the extent that such an examination is possible.

Infant Care.

66. The difficulties of defining standards of infant care have already been referred to (Page 13). A poor standard of motherhood conveys the idea of a neglected, dirty child, and there is a natural tendency to associate maternal solicitude and infant wellbeing. Both may be assumptions without foundation. What is good care for one infant may not be good for another; what is essential for infant wellbeing in one environment may be unnecessary or even harmful in another; and excepting only the frankly bad or negligent by any grading, a range of standards of care which is neutral so far as the occurrence of infant sickness is concerned, might have to be re-examined in relation to the chance an already sick infant has of recovering. Standards of infant care commensurable with infant wellbeing have not yet been defined. If an infant thrives and has no sickness it would be nonsensical to say that his care was inadequate, however negligent the mother may appear to be; if on the other hand, the infant wilts and is sickly, though according to convention the standard of care may be high, it is not necessarily the right kind of care in the particular circumstances.

67. The subject bristles with difficulties, and it is far from easy when attempting to grade infant care to say what is being assessed. To take a practical point of view, however, it is clear that, according to the Health Visitors' assessment, standards of infant care in the two groups are not dissimilar. Table X shows the distribution of A, B and C standards* in the 'high incidence' and control groups to be 54, 31, 5; and 59, 25, 6 respectively.

TABLE X.

Relationship between Standard of Infant Care and Position in Family.

Position in family	HIGH INCIDENCE GROUP Standard of Infant Care			CONTROL GROUP Standard of Infant Care		
	A	B	C	A	B	C
1st child	18	7	1	19	7	1
2nd child	21	13	-	25	6	1
3rd child or over	15	11	4	15	12	4
Total	54	31	5	59	25	6

68. The falling standard of infant care with increasing family size is evidenced by the smaller percentage of 'A' assessments and the greater percentage of 'C's in the

* A means good; B, fair; C, poor.

larger families (Table XI).

TABLE XI.

Combined High Incidence and Control Groups.

Position in family	Standard of Infant Care			ALL
	A	B	C	
1st child	37 (70%)	14 (26%)	2 (4%)	53
2nd child	46 (70%)	19 (28%)	1 (2%)	66
3rd child & over.	30 (50%)	23 (37%)	8 (13%)	61
Total	113 (63%)	56 (31%)	11 (6%)	180

69. The presence of other children in the family need not necessarily imply that the young infant wants for lack of maternal care, but it is obvious that the difficulties confronting the mother of a family of several young children are greater. The facts disclosed in Tables X and XI, if they do nothing else, tend to increase confidence in the health visitors' assessments. Since, however, there is some doubt about what the health visitor is measuring, it is worth while to examine her assessments by such independent criteria as are available.

70. The relation between standard of infant care and social class shown in Table XII, is, therefore, of some significance. The table shows that there is on the whole a relation between social class and assessed standard of care.

TABLE XII.

Relationship between Social Class and Standard Of Infant Care.

Social Classes	Standard of Infant Care			ALL
	A	B	C	
I, II, III	84 (71%)	29 (24%)	5 (4%)	118
IV, V	26 (47%)	23 (42%)	5 (10%)	54
Unclass.	3	4	1	8
All Classes	113	56	11	180

71. An analysis of attendance at infant welfare centres, shown to be independent of social class in Appendix II , is probably a fair index of maternal diligence. Regularity of attendance at a welfare centre is not evidence that an individual woman is a good mother, nor can it be said that women who do not attend infant welfare centres with their infants are indifferent or neglectful mothers. It is, however, probable that among the women who do not make use of centres there is a higher proportion of indifferent mothers than among those who do attend regularly. Mothers of infants in the 'high incidence' and control groups were, therefore, classified as attenders or non-attenders at welfare centres - attenders meaning those who made consistent use of the centres, and non-attenders meaning those who had never attended or had

Attended on not more than two occasions. Table XIII shows unmistakably that the proportion of attenders is the same for the 'high incidence' and control groups; and especially important here, for what it is worth, is the fact that attendance falls with lower standards of infant care as assessed by the health visitor independently of this particular criterion.

TABLE XIII.

Attendance by Infant Care.

Infant care	High Incidence Group		Control Group		Combined Groups	
	Attenders	Non-Attenders	Attenders	Non-Attenders	Attenders	Non-Attenders
A	30	24	34	25	64 (60%)	49 (40%)
B	16	15	14	11	30 (54%)	26 (46%)
C	1	4	2	4	3 (30%)	8 (70%)
Total	47	43	50	40	97	83

72. In spite of its indefinite nature it is, therefore, probably justifiable to assume, both on grounds of common knowledge and of independent facts, that the health visitors' assessments were sound. Assuming, then, that the standard of infant care as assessed by the health visitor is meaning-

ful, it must be concluded that the difference between the two groups - 'high incidence' and 'control' - cannot be accounted for in terms of a care factor. And, indeed, such a conclusion is no more than a confirmation of facts already known. For, other things being equal, as infant care has been shown to vary with social class, it follows that if morbidity varied with infant care it also would vary with social class. But this has been shown not to be the case, from which it follows that morbidity incidence is not dependent on the standard of maternal care within the operative range of this factor in relation to the infants studied.

The Constitutional Factor.

73. It would be scientifically foolhardy, without qualification, to attribute a high incidence of infant sickness in a population to constitution solely by a process of exclusion - even in a population with the apparently neutral environment of a community where social class, family size, housing, infant care and feeding are without influence on sickness risk. Yet, it is apparent that we are thrown back on just such a possible explanation of the group differences studied, and any facts

which tend to confirm or disprove it have to be examined carefully.

74. In the first place, it is well to be clear exactly what constitutional proneness - if it exists - should be taken to imply. This is necessary because it is far too readily assumed that constitution at birth implies something which is genetically determined. This, of course, is not the case. Constitution might be genetic in origin (or it might have a genetic component), but the influence of ante-natal environment cannot be ruled out.

75. It is impossible to draw a firm conclusion from the limited facts available, but an examination of the proportionate distribution of different groups of sickness is highly suggestive. It will be seen from Table XIV that whilst there is no excess of gastro-intestinal disorders and the infectious fevers in the 'high incidence' group, there is a disproportionately high incidence of respiratory disorders and diseases of the skin in this group.

TABLE XIV.

Proportionate Distribution of Disease Incidents.

Disease	Disease Incidents in the 'High Incidence' Group		Recorded Incidents in the remaining Infants.	
	No.	%	No.	%
Respiratory	101	57	177	45
Skin	10	6	7	2
Gastro-intestinal	22	12	47	12
Infectious Fevers	29	17	89	23
Other	14	8	68	18

76. Respiratory disorders and diseases of the skin, much more than other disorders, are immediately attributable to environmental conditions which affect infants more or less evenly. Unlike gastro-intestinal infections and the infectious fevers, they are probably little dependent on accidents of contact and other infective hazards, e.g. exposure to measles and food borne infections. The distribution of respiratory and skin disorders is, indeed, consistent with the view that some infants are more susceptible than others to these conditions - a view to which most clinicians would probably subscribe.

77. Without giving too much weight to an argument based on somewhat slender positive facts, it seems justifiable

to conclude that a constitutional factor is probably important in explaining the difference between the proportionate distribution of illnesses of different kinds in the 'high incidence' group and among infants generally.

78. If such a constitutional factor in infancy was determined by the ante-natal environment, it would not be unreasonable to expect other observable differences at birth. It might be expected, for instance, that the distribution of birth-weights - a matter on which information is available - would differ from the 'high incidence' to the 'control' group. But no such difference was disclosed; and, moreover, the distribution of birth weights in the high incidence group was virtually the same as for Luton births generally (Table XV).

TABLE XV.

Birth Weights.

Birth Weight lbs.	High Incidence Group No.	%	All Births 1945-47* No.	%
0-3½	-	-	34	-
3½-5½	4	5	202	3
5½-7	23	25	1794	27
7+	63	70	4532	70
ALL	90	100	6562	100

79. The proportion of premature births - presumably an index of ante-natal influences - was a little higher in the high incidence group than for births generally, but the numbers are so small that the difference is without significance.

80. The extent to which a constitutional component of infant sickness is inborn cannot, of course, be decided by evidence of a nature afforded by the present study, and this question is left open. It is, however, almost impossible when all the facts are taken into account, to explain the composition of the high incidence group otherwise than in terms of constitution - whether inborn or determined by antecedent environment during the pre-natal and early post-natal periods.

* Note: The birth weights for 1945-47 are taken from an investigation conducted in the Borough during these years. They relate to all live births, domiciliary and institutional.

DISCUSSION.

81. The studies described in Section III and earlier sections afford factual information on a variety of subjects of importance to pædiatricians, medical officers of health, sociologists, and in a lesser degree to general clinicians. The facts, it is true, relate to a relatively small group of infants in a prosperous industrial town situated in the climatically favoured South Eastern area of England; and there is no justification for assuming that what is true of Luton is true of towns and cities in other parts of the country and much less of rural areas. This limitation is obvious; and unless the contrary is stated, can be taken as understood in what follows. Nevertheless, it may be likely that many of the findings, though quantitatively different in other areas, are qualitatively true of England and Wales as a whole.

82. Thus, for instance, the assessment of infant care by health visitors - for which it was impossible to establish a standard according to definable criteria - was shown to be apparently well founded. The assessment of what is good infant care would probably vary according to the type of community the health visitor works in, but

the correspondence between their assessments and the ratings according to family size, social class and attendance at infant welfare centres in Luton is evidence of the dependability of the health visitors' judgments.

83. In another connection it is particularly noteworthy that infants attending infant welfare centres enjoy, on the whole, higher standards of care than non-attenders, and the fact is important because it underlines the limitations of surveys restricted to groups of infants selected from welfare centres. It demonstrates that such selected groups cannot be used without risk of serious error in drawing conclusions about infants in general.

84. The investigation also disclosed that a particular social class is no longer synonymous with a particular income level - a not unexpected finding. It will be seen from Appendix III , and from Table VI on page 32, that there is a considerable overlapping of income level as between the social classes. The intermixing of the classes in respect of income has, indeed, apparently gone so far that it is doubtful if the class gradient for infant mortality can be attributed to

differences dependent on family income. The absence of overt poverty in any class reinforces this conclusion.

85. The survey disclosed, moreover, a remarkable concentration of illness in a small fraction of the infant population. It is a matter of common experience that a great deal of adult sickness is concentrated in a small fraction of the population, but it was somewhat astonishing to discover such a high degree of concentration during the first year of life, i.e. more than half the total amount of sickness concentrated in less than 7% of infants. And when it is recalled that the infants constituting the 7% were proportionately distributed throughout the social classes, the question is inevitably raised whether inborn proneness to sickness is a factor of moment.

The Main Facts.

86. All the foregoing points are important, but taking the survey as a whole they are subordinate matters. Outweighing in importance all other findings are two facts:

1. That there is a class gradient for infant mortality.

2. That there is not a class gradient for

infant morbidity.

These facts raise many questions with a bearing on epidemiological theory and practical issues.

Infant Morbidity.

87. As no class morbidity gradient exists, it must be concluded that environmental differences associated with social class play no part in determining whether an infant is sick or well during the first year of life. In other words, it follows that the volume of infant sickness would not be reduced by raising the standard of living of the less well-to-do sections of the community to the level enjoyed by the well-to-do, or by changing the way of living of the one so that it approximates to that of the other. It is, of course, conceivable - and indeed even likely - that in congested areas with great occupational diversity, or in parts of the country where the climate is more severe there would be a stratification of infant sickness according to social class, but this is not so at all events in Luton, and the detailed case studies in Section III virtually leave no alternative to the conclusion that the concentration of infant sickness in a small fraction of the infant population is mainly accounted for by a constitutional component.

88. One other factor, however, needs further examination. It will be recalled that the 'high incidence' group contained a higher proportion of bigger families than the general survey group,* and since it was shown that an only child suffers less sickness than an infant with brothers and sisters, the possible effect of family size on morbidity cannot be excluded from consideration. There is, however, no need to employ elaborate methods of statistical analysis. The amount of sickness in the 'high incidence' group was seven times as great as in the general survey group, and the only infant had but a small advantage over second and later infants. It is obvious, indeed, that the higher proportion of larger families in the 'high incidence' group could not account for more than a fraction of the difference between this group and the remainder.

89. It is significant also that the only factor shown to operate unevenly as between the social classes - the standard of infant care, which diminishes progressively from Class I to Class V - is apparently without influence

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	High Incidence Group		General Survey	
	No.	%	No.	%
Only child	53	29	600	40
Second child	66	37	508	33
Third & over	61	34	390	27

on the risk of infant sickness. This does not mean, of course, that with greatly improved standards of infant care there would be no diminution in infant sickness, but it does signify that, by and large, the effective standard of care is no better in one social group than in another.

90. The explanation that the high sickness rate in a small group of infants is an expression of consitutional proneness rather than environmental hazard, though mainly dependent upon the processof excluding other possible explanations, is also supported to some extent by positive facts. The disproportionate amount of respiratory disease and disorders of the skin, the first of which accounts for almost half the sickness incidents recorded, is difficult to explain except as due to a constitutional factor. If this explanation is adopted, it follows that climatic factors and infective agents, (or in the case of skin conditions infective agents, chemical and physical irritants and substancesproducing allergic reactions), which are common to the environment of most infants, cause <u>disease</u> only among the unusually susceptible. It raises, in other words, the question whether in a favourable environment, the immediate physical causesof these groups of disorders have less ætiological

significance than is commonly attributed to them. It is arguable at all events, that there are many noxious agents to which infants generally are exposed, but that only a few infants react to them with a violence amounting to disease.

91. In less favourable climates than Luton enjoys and in places where serious poverty and overcrowding exist it is likely, of course, that lesser degrees of constitutional susceptibility might be significant in determining disease reactions among the worse off; and if this is so, there would presumably be a social morbidity gradient in such places. That is to say, although the Luton study suggests that little reduction of infant sickness would result from environmental improvements of a practical order, the same may not be true of less favoured areas. The question can be settled only by morbidity studies in a number of places differing in respect of climate, urbanisation, industry, material prosperity, and other factors which combine to determine standards of living and amenity. In places where there is a social morbidity gradient, if the circumstances of the less favoured groups could be raised to the level of the favoured infant sickness would be reduced in amount. In places where no gradient exists, it would not.

Infant Mortality.

92. The demonstration of a mortality gradient where

there is no morbidity gradient tends to confirm the value of the infant mortality rate as an index of standards of living in the widest sense of the word. It suggests also that differences between the social classes which are apparently without effect on sickness incidence play a material part in determining the risk of an infant dying. Broadly speaking, two explanations of this fact are admissible. Either the resistance of infants to established disease in poorer circumstances is lower than in more favourable circumstances, or alternatively, the sick infant, to give him the best chance of recovery, needs a standard of care which is brought to bear in some social groups, but not in others. The first explanation though not inconsistent with the fact of a sickness rate evenly distributed among the social classes, is unlikely. Its adoption would imply a social gradient for degrees of proneness sufficient to endanger life, but not for lesser degrees which determine only sickness. The second alternative namely, that the care an infant requires <u>when it is sick</u> is forthcoming in some circumstances but not in others, is more acceptable.

93. This explanation is supported, moreover, by an

examination of the causes of infant deaths. Appendix IV , Table IV , shows that of the infants born in Luton in 1945, 12 died from respiratory, and 7 from gastro-intestinal infections before attaining the age of one year. When these deaths are related to the incidence of respiratory and gastro-intestinal conditions, they yield fatality rates of 4.1% and 10% respectively. Together, these groups of conditions account for 36% of infant deaths; and there is little doubt that many deaths due to these causes were preventable.

94. There are undoubtedly some mothers in every social class who fail to appreciate the possible gravity of an illness in the early stages and who consequently postpone calling in a doctor. In the lower income groups, failure to summon medical aid may hitherto have been attributable partly to a desire to avoid unnecessary expense; and this factor doubtless operated more frequently in the lower income groups than in the higher. In circumstances of relative affluence, where there is no such deterrent, the sick child is more likely to have had immediate medical attention. Lack of parental solicitude, or poor judgment are consequently likely to have had more serious effects

for the sick child in the lower income groups.

95. In the high income groups where the expense of medical attention is not a deterrent to seeking medical aid, the well-to-do parent doubtless transfers part of the responsibility for the care of the sick child to the doctor and is able toprovide the requisite care and surroundings. The sick child of a poor but careful and observant mother is probably adequately protected against avoidable fatality; but in the poor household, the child's safety depends a great deal more on maternal capacity than it does in circumstances of relative affluence. In other words, a relatively poor standard of infant care is likely to have more serious consequences among the poor than among the well-to-do. And it will be recalled that standards of infant care were shown to be lower in the lower income groups.

96. Poverty, then, or at any rate some degree of financial stress, may well have been a factor which determined whether the sick infant received the medical and nursing care and attention he required; and it is interesting to speculate on the effect the National Health Service Act, 1946 will have on infant mortality. Now that medical and nursing services are available equally to every-

one irrespective of means it is not unlikely that adequate medical and nursing care are secured for the sick child in the poor household with an expedition sometimes lacking in the past. It is also interesting to ask if the low infant mortality rates which obtain in the cities of New York and Chicago - cities by no means free from environmental circumstances as bad as any in this country, cities in which a proportion of the population is certainly no better in standards of infant care than our worst - can be attributed mainly to the high degree of organisation of welfare services one of whose main objects is to secure the immediate and effective treatment of the sick infant.

97. Whatever the answers to these questions may be, the mortality gradient on the one hand, and the uniformly distributed infant morbidity on the other - at first sight not apparently consistent with each other - are seen to be reconcilable.

CONCLUSION.

98. It has been shown that the concentration of sickness in a small fraction of the infant population and its uniform distribution in different environmental circumstances, of which many indices have been used,

suggests that a constitutional factor is important in determining whether an infant is sick or well during the first year of life.

99. In less favoured towns this factor would, in all likelihood, be less apparent than in Luton because illness attributable to it in greater or less degree would probably be submerged in a mass of sickness due to adverse environmental factors. In the relatively favourable environment to which the survey is related, however, it is apparently a main determinant of infant sickness, and it follows that in such an environment no substantial reduction of infant sickness can be expected from general measures which call within the scope of public health and social medicine. This is a conclusion of great practical significance inasmuch as it suggests the point at which infant care should be concentrated, and particularly because it contrasts sharply with what has been disclosed in relation to infant mortality.

100. The persistent social gradient of infant mortality points to the fact that even in the relatively favoured environment of a town like Luton practical measures can be taken to bring about a substantial reduction of the infant death rate. But it does not appear that the infant

death rate would automatically be reduced to new low levels merely by raising the income and economic status of the lowest social groups. It seems rather that this result will be achieved by ensuring that sick infants in the lower social groups are afforded a higher standard of medical and nursing care than some of them have hitherto enjoyed. In the long term, these results will be brought about by improved education in the widest sense of the word, and by better standards of living and by the provision of domestic aids which often relieve the mother of burdens she cannot carry without stress. In the short term, however, it would seem that infant mortality will be further reduced by encouraging mothers in every social group to seek medical advice whenever an infant is sick; and by ensuring at the same time that home nursing or hospital services are speedily made available where home circumstances are adverse.

101. This policy should be adopted not only in the case of obviously serious illness, but also in the case of apparently trivial disorders - particularly respiratory and gastro-intestinal disorders - which are likely to become serious in unfavourable circumstances.

APPENDIX I.

General Morbidity Survey.

Investigation Card.

Health Visitor's Name .....

Serial No. .....*(Birth Register).*

Name..... *Date of Birth*.....

Address..... *1st change*.....

..... *2nd change*.....

(Note if family have left Luton).

Husband's occupation..... *Social Class*.....

Husband's occupation..... } *Health Visitor to complete if not entered, or different from above.*

Place of work.....*Date*..... }

HOUSING CIRCUMSTANCES

Y. Code District	Council / Other: Owner/Occupier Buying / Tenant	Rooms in House	Persons in House	Persons per Room	Children under 16 years in House	Families in House	Mark 'U.F.' if unfit

Family circumstances (first visit), 1946. *Sibship.*

.....

.....

Breast Feeding ceased.....*months.*

ILLNESSES—ACCIDENTS

(Necessitating treatment in bed for at least 48 hours or for which doctor called, or leaving disability).

Nature of illness		Date of onset: Month	Date of onset: Year	Duration in days	Remarks *	H.V.'s initial and date
First Visit 0—1 years	1					
	2					
	3					
	4					
	5					

* Enter 'D' for Death with certified causes and 'N' if attend nursery or nursery school.

APPENDIX I (continued)

Enquiry card used for individual case studies.

Reference No. ..... Serial No. .....

Name ..... Date of Birth .....

Address .....

Birth Weight ..... Breast Fed: Yes. No.

Age: Father ..... Mother .....

Age: Other Children .....

Father's Occupation .....

Housing Circumstances .....

Economic Circumstances .....

Illness etc. First Year .....

Standard of Maternal Care: A. B. C.

Regularity of Attendance at Welfare Clinic:

Non Attender.

One or two attendances only.

Frequent attender.

Notes: .....

.....

.....

APPENDIX I (continued)

Comparison of circumstances of observed and unobserved groups in the morbidity survey.

Table I.

	Observed Group (1498)	Unobserved Group (350)*	Infant Deaths (49)
Legitimate...	1423 (95.0%)	278 (83.9%)	40 (81.6%)
Illegitimate	75 (5.0%)	53 (16.1%)	9 (18.4%)
Infants in fit houses ...	1440 (96.2%)	323 (97.6%)	42 (85.8%)
Infants in unfit houses	58 (3.8%)	8 (2.4%)	7 (14.3%)
Social Classes I, II & III	906 (60.5%)	84 (25.4%)	16 (32.7%)
Social Classes IV & V ...	435 (29.0%)	46 (13.9%)	11 (22.4%)
Unclassified	157 (10.4%)	201 (60.8%)	22 (44.9%)
Family Size			
1 child	572 (38.2%)	173 (52.3%)	16 (32.7%)
2 children	508 (33.9%)	82 (24.8%)	12 (24.5%)
3 children	230 (15.3%)	32 (9.7%)	10 (20.4%)
4 or more children ...	168 (11.2%)	26 (7.9%)	7 (4.3%)
Not stated	20 (1.3%)	18 (5.4%)	4 (8.2%)
All	1498	331	49

* No information available in respect of 19 infants.

APPENDIX II

Case Studies.

TABLE I

Position in Family and Ages of Siblings.

Position in Family	No. of Children	High Incidence Group				No. of Children	Control Group			
		Age of Siblings					Age of Siblings			
		0-5	5-10	10-15	15+		0-5	5-10	10-15	15+
1st Child	26	-	-	-	-	27	-	-	-	-
2nd Child	34	18*	15ø	3	-	32	20	12	-	-
3rd Child	15	10	14	1	5	16	11	14	2	5
4th Child and over	15	14	23	16	7	15	15	18	18	8

* includes one twin.
ø includes one adopted child.

TABLE II

Attendances at Welfare Centres according to Social Class.

Class	High Incidence Group		Control Group		Combined Groups			
	Attenders	Non-Attenders	Attenders	Non-Attenders	Attenders		Non-Attenders	
II	6	3	8	3	14	53%	6	47%
III	27	27	22	22	49		49	
IV	8	8	14	11	22	55%	19	45%
V	3	2	5	3	8		5	
Unclass.	3	3	1	1	4		4	
Total	47	43	50	40	97		83	

APPENDIX III.

Principal occupational groups in Luton and their social class distribution, according to the Registrar-General's classification, showing average weekly wage earning capacity.

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Occupations	Weekly earnings
Class I	
Army, Commissioned Officers (effective)	£8 to £12
Royal Air Force, Commissioned Officers (effective)	£8 to £12
Royal Navy, Commissioned Officers (effective)	£8 to £12
Clerk in Holy Orders	£10 to £20
Physicians, Surgeons, Registered Medical Practitioners	£35
Incorporated Accountant	£30
Student	?
Class II	
Engineer's Manager	£20
Master Plumber	£15
Master Baker	£15
School Master (Burnham scale for teachers £550 to £1450)	
Draughtsman	£9.16.0 to £14
School Teacher (Burnham scale for teachers £300 to £550)	
Engineer, time study	£10.16.0 to £14
Managers (shop)	£7.2.6 to £14
Class III	
Electrician	£6.10.0
Fitter	£8.10.0
Carpenter	£6.10.0
Bricklayer	£6.10.0
Clerk	£5.17.0 to £7.16.0
Toolmaker	£8.10.0
Truck Driver	£5 to £5.10.0

APPENDIX III (continued)

Occupations	Weekly earnings
Class III (continued)	
Welder	£5. 5. 0.
Roundsman	£5. 2. 6.
Shop Assistant	£5. 5. 0.
Progress Chaser	£9. 0. 0
Millwright	£8. 10. 0
Turner	£8. 10. 0
Class IV	
Gardener	£5 to £7. 10. 0
Works Fireman	£6 to £7. 10. 0
Police Sergeant	£7. 10. 0 to £8. 5. 0.
Police Constable	£5. 5. 0 to £6. 12. 0.
Commissionaire	£5. 18. 0
Machinist (engineering)	£7 to £8
Stoker	£7
Class V	
Labourer, Engineer's	£5. 15. 0.
Labourer, Building	£5. 6. 0.
Labourer, general	£5
Storekeeper	£6. 12. 6 to £7. 5. 0.

Note: (i) The weekly earnings shown in Classes III, IV and V are, in the case of engineering operatives, calculated on basic hourly rates of pay. Production workers can implement these rates by as much as 60% by virtue of a special production bonus.

Class I	Income per week	£8 to £35
Class II	Income per week	£7. 2. 6 to £20
Class III	Income per week	£5 to £9
Class IV	Income per week	£5. 5. 0 to £8. 5. 0
Class V	Income per week	£5 to £7. 5. 0.

(ii) The information as to social classes and the wage earning capacity of these groups was obtained from (a) departmental records; (b) personal inquiries; (c) trade union rates of pay; (d) information supplied by individual employers.

APPENDIX IV.

Mortality Tables

Table I

Causes of death at 0-1 years, Luton 1945-47.

	Social Class*					
	I	II	III	IV	V	Total
Prematurity	1	9	40	16	3	69
Congenital malformation	2	8	15	9	3	37
Erythroblastosis	-	1	3	1	-	5
Intussusception	-	-	1	-	1	2
Atelectasis	-	-	1	-	-	1
Spina bifida	-	1	2	1	-	4
Birth trauma	-	-	5	2	-	7
Concealed haemorrhage of mother	-	-	1	-	-	1
Toxaemia of mother	-	-	3	-	-	3
Pneumonia	1	4	14	7	6	32
Pleural effusion	-	-	1	-	-	1
Coryza	-	-	1	-	-	1
Bronchitis	-	-	2	4	-	6
Whooping cough	-	-	3	1	-	4
Measles	-	-	-	1	-	1
Jaundice	-	1	-	-	-	1
Hepatic degeneration	-	-	-	1	-	1
Enteritis	-	-	9	7	6	22
Cerebro spinal fever	-	-	-	1	-	1
B. coli meningitis	-	-	1	-	-	1
Pneumococcal meningitis	-	-	-	1	-	1
Septicaemia and mongolism	-	-	1	-	-	1
Miliary tuberculosis	-	-	-	1	-	1
Inhalation of vomit	-	1	3	1	-	5
Asphyxia	-	2	3	2	-	7
Accidental burns	-	-	1	-	-	1
Convulsions	-	-	1	-	-	1
All Causes	4	27	111	56	19	217

* According to occupation of father.

APPENDIX IV (continued)

Registered legitimate live births, Luton 1945-47*

Class	Number	Per cent.
All classes	6000	100
I	240	4
II	720	12
III	3600	60
IV	1080	18
V	360	6

* On basis of ascertained distribution for 1946.

Table II

Infant Mortality by Social Class of Father
Luton 1945-47.

Social Class	Legitimate live births		Deaths		Death rate per 1,000 legitimate live births		Per cent. of rate for all classes.	
All Classes	6000		217		36		100	
I	240	960	4	31	17	32	47	89
II	720		27		37		103	
III	3600		111		31		86	
IV	1080	1440	56	75	52	52	144	144
V	360		19		53		147	

Table III

Infant Mortality by Social Class of Father* (England and Wales)

Social Class	Death rate per 1,000 legitimate live births			Per cent. of rate for all classes.		
	1911	1921-3	1930-2	1911	1921-3	1930-2
All Classes	125	79	62	100	100	100
Class I	76	38	33	61	48	53
Class II	106	55	45	85	70	73
Class III	113	77	58	90	97	94
Class IV	122	89	67	98	113	108
Class V	153	97	77	122	123	125

*(From "Birth, Poverty and Wealth")

Table IV.

Infants born in Luton in 1945 who died before reaching the age of 1 year (by social class of father).

0 - 1 year.

Cause of Death	Class I	II	III	IV	V	Total
Prematurity	1	2	10	1	1	15
Asphyxia	-	1	-	1	-	2
Congenital malformation	-	2	3	3	1	9
Hepatic degeneration	-	1	-	1	-	2
Erythroblastosis	-	-	1	-	-	1
Birth trauma	-	-	-	2	-	2
Enteritis	-	1	3	2	1	7
Whooping cough	-	-	-	1	-	1
Pneumonia	-	1	4	2	-	7
Accidental burns	-	-	1	-	-	1
Bronchitis	-	-	2	3	-	5
All causes	1	8	24	16	3	52

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