INFANT MORTALITY IN THE CITY OF BELFAST.

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(*Read on Friday, 17th December*, 1943.)

Within recent years attention in the North has been drawn to the high mortality rate in Belfast and, as a result, considerable interest is now being shown in the matter of child health. The subject is being discussed constantly, either in the press or on public platforms, and attempts are being made to educate the people into the realities and difficulties of the problem How serious is the situation can be appreciated from the fact that in Belfast each year, for every thousand children born, any number between 85 and 120 will die. The extreme danger of being a baby in this city is evident when it is realised that, in some years, one baby in every eight dies during the first year of life.

Judging by standards existing elsewhere, 70 per cent. of these deaths are preventable and, consequently, at least five hundred children in Belfast lose their lives unnecessarily each year. Apart from the senseless waste of life due to these deaths, the sorrow and misery, the sadness and broken hopes following the loss of these children, demand consideration as a great cause of human suffering.

To tackle such a problem, and it is being tackled, facts concerning every feature of the matter are required, and it is in this connection that we wish to present our study to the Society.

So many factors have been suggested, at one time or another, as causing the deaths of these children, that considerable confusion has arisen. Apart from this, without actual study, it is impossible to determine the influence of such features as social levels, medical care, or housing. It was thought that an independent survey, using the approach to the subject we have employed, would be the best means of placing facts, already apparent, in their proper relationship and revealing features of importance not previously discerned.

It was, therefore, decided to study the deaths of legitimate infants occurring from June, 1941 to June, 1942. The ultimate form of our investigation was affected by many circumstances but, in general, we followed our original scheme which was to undertake a personal, anonymous and private survey of each child death occurring in one year, and by determining the main features associated with the individual death, to collect data which would reveal, by statistical treatment, the facts of the problem. Later, the value of a control group of living children became apparent and the scope of the survey was extended to include such children

The particulars given on the death (or birth) certificate in the case of each child were obtained and a card questionnaire drawn up listing details of the required information—*vide* Appendix. In the control group of living children a similar questionnaire was asked

During the period September, 1942 to February, 194 3, the homes of the children were visited (by E T.M) and the material collected. In the mortality group the visiting was completed by mid-December, 1942. The investigator was careful to avoid leading questions and where

inaccuracies or untruthfulness were suspected or detected, the cases were not considered. Also, deaths were excluded where the fatal illness was due to hardships resulting from previous air raids, and where families had moved from the city or could not be followed up

The control group was established by selecting every fifth child (excluding illegitimate children) born during the first six months of the period studied We arranged to obtain a control sample comparable in size to that of the children who died—the mortality group—and the number of completed questionnaires eventually secured was 477. The total legitimate Belfast births for the period is 7,778 and of these 3,359 were born during the first six months The mortality group consists of 554 cases, or 84 per cent of the total deaths of legitimate infants for the period studied. The death rate, including illegitimates, for Belfast in 1941 was 90·5

It is pointed out that the total number of cases in the samples, from the statistical view-point, is small. But in a survey of this nature requiring information in detail which should be secured by a personal visit from one investigator, the difficulty and time which would be involved in obtaining larger samples is evident

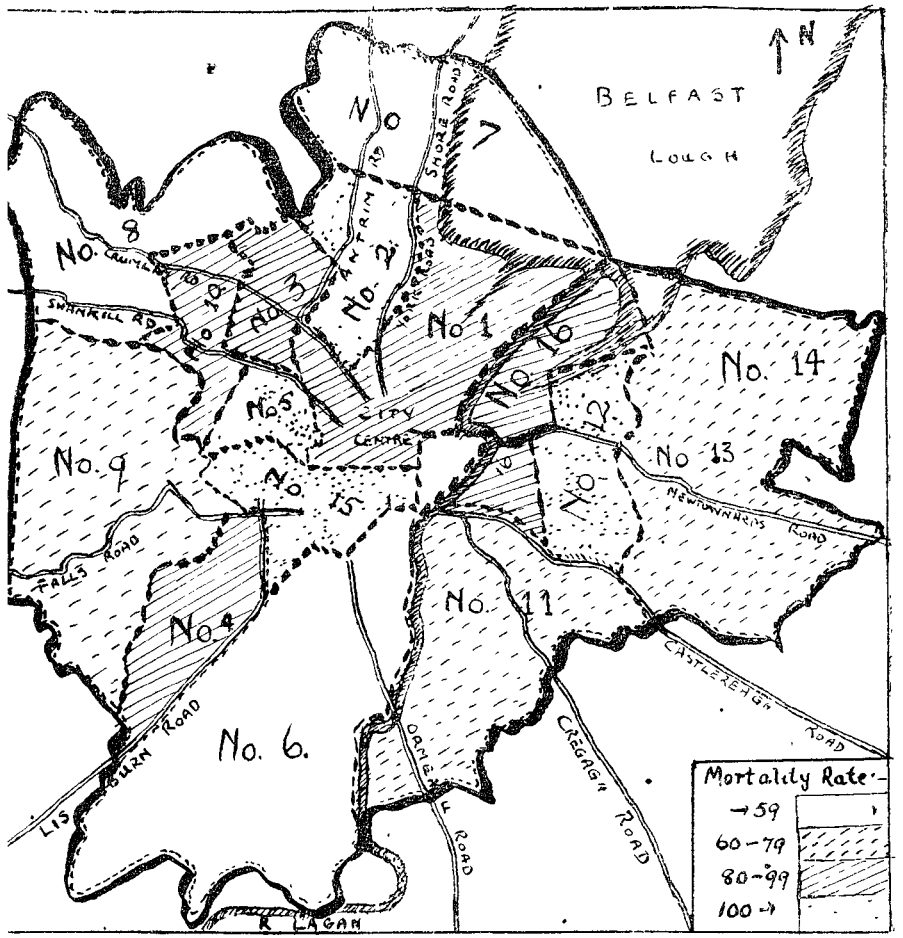
Information was collected (Appendix A) concerning the size of the family, including previous infant deaths, income, housing, domestic hygiene, the care and feeding of the child, the ante-natal and obstetric attention, the medical, nursing, hospital and other features relating to the fatal illness. In the control group similar data were recorded. In this group, incidence of respiratory and intestinal infections was determined and the care of the children during these illnesses considered.

On completing the visitations a system of coding of various factors (see Appendix A) was drawn up to enable the data to be transferred to machine cards, so that by machine "sorting" the general results in the two groups could be collected and subsequently examined. Significance was gauged in all cases by reference to the Karl Pearson (1900) χ^2 test When the number of degrees of freedom was 1, the Yates (1934) correction was applied. The results of the primary "sort" are given in Appendix A. We give these figures entirely, so that those interested may examine the primary results or use them for further study.

The primary "sort" is mainly a comparison between the collected results of the two groups of infants, and an inspection shows that some features are more closely related to infant mortality than others. In order to study further relationships of these factors, "secondary sorts" were obtained. Such features as income, dispensary area, and feeding for both the mortality and control groups were considered—also cause of death, age at death, etc., in the mortality group. In this way, a great mass of material has become available. However, in a communication such as this, it is quite impossible to deal with all the relationships, no matter how interesting. Also, in "secondary sorts" the numbers in the samples limit the possibilities of sub-classification and statistical treatment. Since we have a practical object in view, only matter relative to our purpose will be given. Genetic, academic or abstract investigations cannot be attempted. We are recording without comment certain statistics, without apparent value at present, but which may be found to be of use when collated with similar inquiries elsewhere. In this respect we would point out the value of data from other city areas with high infant mortality experience, such as Dublin or Glasgow.

Let us now consider the most important results from the statistical treatment of our figures.

Diagram 1.



Mortality Experience by Area.

The infants of the mortality and control groups were apportioned to their respective districts of residence. The units of area employed were the dispensary districts, as these, to a large extent, correspond to social status The entire legitimate births occurring in the city during the period studied were also thus apportioned. This treatment was necessary as births and deaths are registered and recorded according to the place of birth and death respectively. Using these figures, the actual infant death rates were calculated.

This enabled us to differentiate the dispensary areas with high and low rates The diagram of Belfast given shows the dispensary areas and the infant mortality experienced in them. See also Table II It is apparent that there is a very striking difference in the rates for the various areas, some rates being almost three times as large as others—ranging from 119 to 41.

The infants in the two groups were classified according to the income available to the mother for household purposes, less rent, per head,

per week. Three income levels were selected and are used throughout this study, *videlicet,* under 10/- per week, 10/- and under 15/- per week, and over 15/-

Consideration of area and income shows that where there is a high mortality rate, a larger proportion of infants belong to the poorer income groups (Table III).

A complete " secondary sort " relating areas of high and low mortality to all other features of the investigation was carried out. The results are either statistically insignificant, are of insufficient importance, or introduce features alien to our purpose.

Randomness of Mortality and Control Samples

At this stage it is opportune to discuss the random nature of both mortality and control samples. The actual numbers of births and deaths occurring in each dispensary area were compared with figures for the two samples calculated on a pro rata basis (Table III). In the mortality the actual and pro rata figures correspond very well. The agreement in the control is satisfactory except for the severely " blitzed " areas and one or two others whose population, in consequence, was raised. The mortality rate calculated for the pro rata groups compares with the actual rate.

Age at Death

We present a dual purpose table (IV), giving age at death in relation to cause of death to illustrate our observations on this feature. It can be seen that 40 per cent. of the deaths occur in the first month of life —neo-natal deaths. There is a steady and definite decline in the numbers dying as age increases. Apart from the preponderance of prematurity, birth injuries and congenital features in the deaths occurring in the first months of life, there are no other features of interest in this sort.

Relating the age at death to income (Table V), the figures, although not statistically significant, tend to show that in the highest income groups the rate is highest during the neo-natal period and then declines. The rate for the middle income class remains more or less stationary and that for the lowest income group seems probably increased compared with the total rate.

Sex

The preponderance of male over female deaths in the mortality group and, to a lesser extent, male over female births in the control group is to be noted. This is statistically significant. The ratios of female to male births and infant deaths in Northern Ireland in 1941 are 1/1·09 and 1/1.40 respectively, and the ratios are 1/1·12 and 1/1·43 for the control and mortality groups.

Cause of Death

The classification of cause of death used was that adopted by the Registrar-General. (Manual of the International List of Causes of Death.) The cause given on the death certificate as responsible was used. Three main diseases which are: respiratory infections, gastro-enteritis and prematurity, are responsible for two-thirds of all deaths. On further investigation of these results for dispensary areas we found that variations may occur in the distribution of the different diseases as regards area. In the poorer districts there may be a preponderance of gastro-

intestinal infections—preventable deaths. However, grouping the figures according to three mortality rate levels (Table VI), such observations cannot be considered statistically valid. "Secondary sorts" for cause of death against such factors as sex and housing (Table VII) were of doubtful relationship, while cause of death was related to income and age at death (Tables VIII and IV).

Income

Income was considered as the amount, less rent, available to the mother for household purposes per head (including the child in question), per week. In the mortality group the amount reckoned was the weekly average for the month preceding the fatal illness. A similar average, when the children were six months old, was taken for the control. Income grades of under 10/- per week, 10/- and under 15/- per week and over 15/-, were used. In the mortality group more than 42 per cent. of the children belong to the poorest income class (under 10/-), while in the control only 23 per cent. were in this class. In the mortality group 31 per cent. were in the richest grade, with a figure of 43 per cent. for the control. These figures show the very marked significant relationship of a factor or factors represented by income to mortality.

"Secondary sorts" for income show important relationships. For instance, there was a larger proportion of the poorer income levels in areas with high infant mortality rates in both groups (Table III). The greater number of the poorer income grades in the mortality group than in the control holds for all areas. Relating income to cause of death (Table VIII), it was found that there was a raised incidence of diarrhœa and enteritis among the poorest. Increased deaths due to prematurity and congenital malformations were found in the richest. Order of birth and income (Table IX) showed that for the richest class, first births were in the vast majority in both groups. For the middle income level, children were fairly evenly divided between one, two and three-child families. The poorest class showed that the majority of the deaths were occurring in the large families (Table IX) In the control group the same was found save that the numbers in the poorest class were much smaller.

The number of infants from families in which previous deaths had occurred were greatest in the poorest level and least in the richest.

Similarly, housing density (Table X) was greatest in the poorest section in both mortality and control groups. This is statistically significant —the higher the density the lower the income. For mortality and income the very high degree of relationship has been given above—the lower the income the higher the mortality. Now housing density is, of course, closely related to income, and the question arises, is the relationship between mortality and housing simply due to income as a common factor? The answer is in the affirmative: statistical treatment (Table X) shows that for income constant, there is no discernible relationship between housing density and mortality; whereas, considering housing fixed; a definitely significant relationship is established for income and mortality. The importance of this conclusion, that a factor or factors represented by income is the overriding social factor related to mortality, can hardly be stressed too strongly.

As regards domestic hygiene (Table XI), the poorest income section had the largest number of dirty or C grade houses and the richest the least.

Income did not influence, significantly, the extent or duration of breast-feeding in either the mortality or control groups (Tables XIII

and XIV). Income did not appreciably affect ante-natal examination. The nature of attention at the confinement was only affected, in so far as the numbers of persons both in the control and mortality groups who were confined in the Jubilee Hospital (Poor Law) and who were attended by maternity nurses only, were greatest in the poorest section. With regard to the care given to children during the fatal illness, income would appear to have little significance. We have analysed such features as when medical aid was summoned, the adequacy of medical and nursing attendance, hospitalisation, etc., and from our data income appears to have little or no influence on medical or nursing care during fatal illness.

Order of Birth

A comparison of the distribution of the children in the mortality and control groups, according to position in family, shows that there are somewhat more children of larger families in the mortality than in the control group. This difference, however, cannot be regarded as statistically significant owing to the small numbers in the sample.

Previous Deaths

In an attempt to discover whether any mothers could be considered as "killing mothers," the number of previous infant deaths for each case was sought. In the mortality group the figures may show a more frequent occurrence of previous deaths, but the figures are not statistically significant.

Housing

Although "sorts" for the number of persons occupying and the number of rooms in the homes of the children are available, it is more satisfactory to consider the housing density. The largest individual sections in both groups live with a density of one person but less than one and a half persons per room. In general, however, the housing density is very significantly worse in the mortality group than in the control. The figures are illuminating, as regards housing in Belfast, and show, from the control, that almost one-fifth of all families with young children are so short of living space that they exist at a density of two or more persons per living room. In the mortality group the position is worse—the number of persons so accommodated reaches nearly one-third When one considers the small rooms of the Belfast artisan dwellings, this overcrowding can be appreciated. As pointed out before, housing is related to mortality as an effect of the influence of income.

Domestic Hygiene

The assessment of this factor was based on a personal judgment of the condition of the home. While somewhat less than half the homes in both groups were spotlessly clean and showing maternal efficiency; 15 per cent. or one in seven in the mortality group, and 11 per cent. or one in nine in the control, were filthy and showed maternal inefficiency. This result is unexpected and the fact that nearly half the homes were classed as spotlessly clean, shows that the standards set were not unduly high. While there was plenty of filth to be found, it was surprising that no significant connection between dirty homes and mortality could be demonstrated.

Infant Feeding in Belfast

This was considered under three headings :—

(1) Principal foods given to control children for the first six months of life.

(2) Food given for the second six months, and
(3) Foods, the infants who died, received prior to their fatal illness.

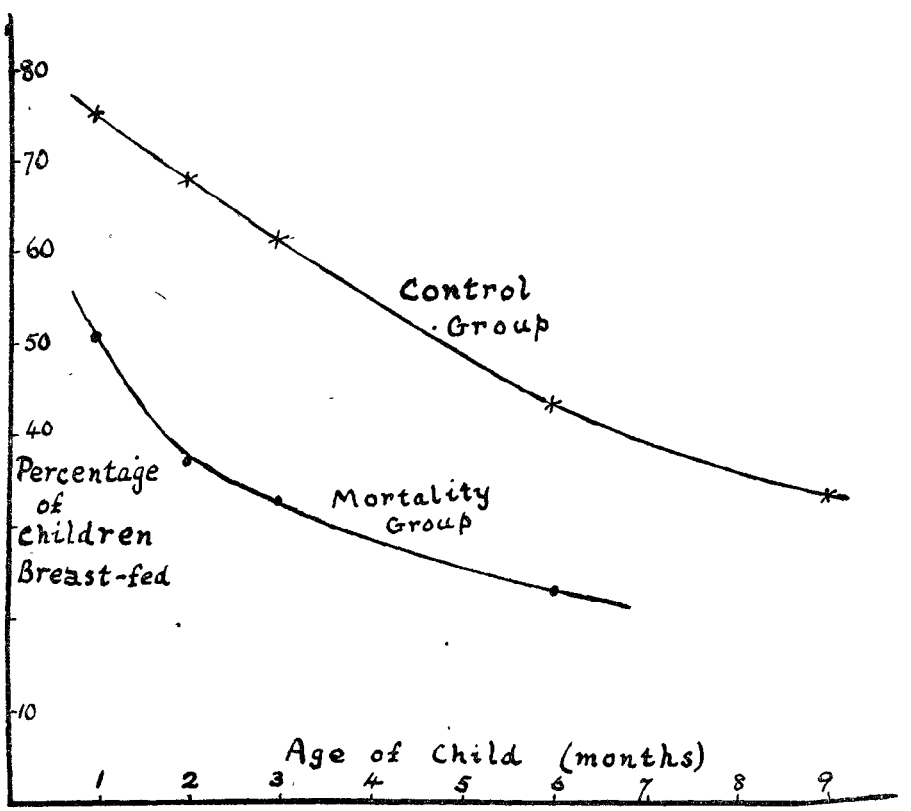
(1) During the first six months almost three-quarters of the infants received breast-milk, with or without a supplement, as the principal food Of the remainder a slightly larger proportion were fed on cow's milk, than on cereals, or dried proprietary milk.

(2) During the second six months breast-feeding decreased, so that one-third were thus fed, another third were given "mixed feeding" and cow's milk, and the remainder given various diets

(3) Feeding in the mortality group, prior to the fatal illness, followed the trends in the control group Breast-feeding diminished as age increased, with an increased use of other foodstuffs

From the aspects of feeding considered above it is apparent that in the mortality group a smaller proportion of infants were breast-fed for a shorter time than in the control This striking difference in the incidence of breast-feedng is better demonstrated by an analysis of the proportion of children in both groups breast-fed at various ages. In the mortality group this is based on the number of infants alive at these ages and is found by relating the duration of breast-feeding to the age of death.

Diagram 2.



It should be noted that when assessing the duration of breast-feeding the infant was classified as breast-fed if the major part of its diet was breast-milk We considered the use of this definition advisable as, nowadays, so many babies receive supplements.

The table (XII) and graph (Diagram 2) give the very significant results obtained At the age of one month, three quarters of the children in the control were breast-fed, while in the mortality group, of the children alive half were breast-fed at this age Further, the proportion breast-fed in this group is considerably less at each succeeding month of age than in the control group

The influence of the social factors of income, housing and domestic hygiene on the extent of breast-feeding was considered, and no significant relationship can be demonstrated in either the mortality or control groups. Similarly for rank of birth and cause of death, the differences shown are not statistically significant (See Tables XIII and XIV)

Care in Fatal Illness

The features considered in the care of the infants during the fatal illness were :—

(1) Health Visitation.
(2) Medical Attendance
(3) Nursing
(4) Hospitals
(5) The incidence of respiratory and intestinal diseases, in the control group, of sufficient severity to require medical attention was considered and analysed in relation to health services, as in the mortality group

(1) *Health Visitation* was satisfactory. Approximately nine-tenths of the cases had been visited before or shortly after the child's death.

(2) *Medical Attendance* included :—

(*a*) When was medical aid summoned ? In 80 per cent. of the cases the doctor was summoned on the first or second day of the fatal illness. For the respiratory or digestive diseases in the control, medical aid was called in somewhat later.

(*b*) Nature of medical aid sought. For much more than half the children, especially in cases of " preventable " illness, the medical aid summoned was the family doctor.

(*c*) Adequacy of medical aid was determined by a consideration of the number of times the child was seen by a doctor and the nature and duration of the disease. Due regard was paid to the fact that these were cases of fatal illness. In 68 per cent of the cases reviewed the attendance was regarded as satisfactory.

(3) *Nursing* The figures for this feature are of special importance In the mortality group 352 children required nursing in their homes, and only 31 or 8·8 per cent. of these were nursed by trained nurses. In 42 cases it was unsatisfactory, and in 279 out of the 352, there was a complete absence of all skilled nursing.

(4) *Hospitals* —Of the cases, 134 infants were born in hospital and remained there till death. The admissions to hospital numbered 176, and of these 152 died in hospital. Only 8 out of the 477 control children were admitted to hospital for

gastro-enteritis or respiratory infections. Hospital admissions for the major causes of death are fairly evenly distritributed. We feel that conclusions drawn from the data relating to the length of time in hospital, etc., are too much affected by extraneous factors to be reliable.

" Secondary sorts," relating income to these factors, show that infants in the lowest income class received medical aid as promptly as those better off, and that nursing or hospital care did not vary with income. The figures (Table XV) suggest that a greater number of infants in the poorest income group may have had inadequate medical attention, but this conclusion is not statistically valid.

Comment

It might be profitable at this stage to recapitulate, as briefly as possible, the main points elicited from the statistical analysis of our results We found that certain dispensary areas in Belfast show an unduly heavy mortality rate and that it is associated with a larger number of people with smaller incomes and an increased housing density. As regards the relationship of social considerations to infant mortality, the predominant influence of a factor or factors represented by income, has been demonstrated. The cleanliness of the home was surprisingly not a significant factor associated with mortality. The main causes of death are respiratory infections, gastro-intestinal disorders, premature birth and a miscellaneous group. Feeding, judging by the standards considered, is satisfactory in the control group, but in the mortality breast-feeding incidence is very much lower. Social factors do not significantly influence the extent of breast-feeding in either of the groups of children studied. Respiratory and digestive diseases have a low incidence in the control group and such diseases largely occur at teething time and doctors are not called in as soon as in the mortality group. In the fatal illness medical attendance is reasonably adequate, doctors are summoned in the early stages and the adequacy of medical care does not appear to be affected by income. Trained nursing is almost completely absent in the cases of children who die at home.

In this survey the age of the mother was not sought, as it was considered that, supposing sufficiently accurate information could be obtained, the numbers in the samples would be insufficient to give a satisfactory analysis for the necessary age groups (Campbell, 1929 ; Burns, 1942). As very few of the mothers were engaged in industry this factor was neglected, and any attempt to establish vocational grades, based on the occupation of the father, failed owing to the number in the Forces.

It remains to relate these features to the problem of infant mortality in Belfast.

Infant deaths occur mostly in certain parts of the city, for instance, in some districts, during the year studied, the rate was over 100, while in others it was very little above 40. The investigation of the incidence of respiratory and digestive diseases in the control group shows that there is a low incidence of these diseases among ordinary children in the city and that a very small number are admitted to hospital suffering from these diseases. Consequently it would seem that the mortality rate does not reflect the morbidity, as apart from the mortality group few serious cases of the diseases, which cause 40 per cent. of the total deaths, appear among the population. It can be concluded, therefore, that serious illness, at least as far as these two conditions are concerned,

affects almost exclusively a comparatively small group of unfortunate children

We are not able from an analysis of the characteristics of the mortality group, to give an accurate forecast of the type of child likely to die but it is possible to say that deaths are mainly confined to certain districts; that children who die are in the lower income groups, that they exist in smaller and more crowded houses, and that they are not so well breast-fed. We can state that illnesses, which look serious from the commencement, occurring in children under the age of six months, are not only likely to be serious but very probably will end fatally. Also, it is plain that the poorer the child the more likely it is to contract serious illness and, therefore, more likely to die.

Several other features are apparent, such as the greater recourse to the family doctor, the complete lack of trained home nursing, and the dominating effect of income over all other social factors influencing infant mortality. Since our study has a practical purpose, which is to advance proposals likely to help in reducing infant mortality, we would suggest that even though medical care is, in the main, adequate and the diseases prevalent are curable or preventable, the gap in the medical services caused by the absence of trained nursing in the children's homes is a large factor in causing child deaths The relatively small amount of serious illness present, apart from the mortality group, and the limited areas in which such illness exists, would render it possible to institute a service of trained nurses who could attend cases of serious illness amongst children in their homes

For such a service to function successfully the co-operation of the family doctor and mother is essential In fact, it should be possible, in view of the changes likely to take place in the medical services in the North, to integrate the family doctors into a complete maternity and child welfare service. Further, in view of the importance of the family doctor, he should be aided by a consultant pædiatric service and might even be encouraged, or assisted financially, to take short post-graduate courses or diplomas in child health.

With regard to the feeding of children it is apparent that the divergence of feeding practices represents divergent views. We would suggest that a standard method of infant feeding should be established and that this method be taught everywhere in the city and made widely known. It is better to understand one method of feeding well than many badly. Education on the value of breast-feeding and, what is better, assistance to breast-feed by an expansion of the present "meals-for-expectant-mothers" scheme is wanted. We would suggest that this will also have a considerable effect in lowering the prematurity rate Finally, in this respect it is suggested—though not from any experience obtained in this survey—that improved post partum gynæcological supervision of the mothers by family doctors or welfare clinics and an increased number of "repair" operations would have an improving effect on maternal and, later, on child health

It has frequently been pointed out during the course of this study that low income is the dominant social factor associated with infant mortality. It is interesting to pursue this relationship further. It is understood, of course, that income is only considered as it applies to an industrial community in which all necessities must be purchased as opposed to rural wages which may include, or give opportunity to produce, foodstuffs. At first sight, the significance of income as a deciding

factor influencing infant mortality would seem clear. Poverty or the inability to purchase the necessities of life or to obtain medical or other care necessary for the child's survival may be the cause of its death.

Recent opinion expressed by authorities in social medicine shows that many have adopted this view—in a recent work, Titmuss (1943) states that there is no evidence that the poorest section of the community are dysgenic.* He shows that at one month of age the infant mortality rates of a high social class and that of a low one are almost equal, but that for the age period 6-12 months, the difference rises to almost 500 per cent. He ascribed this inequality in the infant mortality rates in the social classes to increasingly adverse economic conditions and environment. Titmuss and those who agree with his views stress the influence of poverty rather than heredity or any other factors and suggest that improvement in social conditions would reduce the infant mortality rate to levels as low as in Holland and other countries. Before proceeding from this, we would point out that our results show a similar divergent effect in mortality rates in the different income groups comparable to that demonstrated by Titmuss. We think, too, that our figures show a trend, which with a larger sample might attain significance, to the effect that luxury or "civilisation" makes childbirth more difficult for the rich and therefore tends to raise the neo-natal figures unduly for this class.

It is plain that malnutrition and other social features directly due to poverty are potent factors in producing mortality, but there is another side to this problem. A man's income is not only decided by economic circumstances but to a certain extent, in fact to a large extent, by his own efforts. It represents the use of his brains and his brawn, his aggressiveness, initiative and vitality. It shows his ability to survive and to secure for himself and his family the environment most suitable for their health, happiness and security. So close is the relationship between income and infant mortality, that it could nearly be said that the measure of a man's ability to secure a living in an industrial community would indicate his ability to rear a family successfully. Relative to any given standard of living, in an industrialised society, the highest infant mortality will for such reasons be found in the lowest income group. While the average man's income may, to some extent, be governed by circumstances over which he has no control, this will not hold as much in a large population group. In many countries, some of them relatively poor, the gradual improvement in the standard of living by the insistent demands of the people for something better and their willingness to work for it, has led to an improvement in environmental conditions with, *inter alia*, a fall in the infant mortality rate. We would suggest that, fundamentally, the level of infant mortality in any group is largely determined by the biological strength of the human material in the population concerned.

While, in this study, income has been shown to be closely related to infant mortality, a further feature must be considered. With the levelling up of incomes the amount per head per week is not a true index unless the occupation of the individual is taken into account. Neither do total family incomes give an accurate guide to the amount available for the upkeep of the family, without the numbers and the information necessary to divide the cases into social groups. Income, in this respect, is best shown by the amount available to the mother for household purposes, per head of the family, each week.

We admit the possibility that the relationship of income to mortality

may be through an aggregation of many small effects, so small that sampling errors may conceal them. We would suggest that the true position of the relationship between income and infant mortality is an intermediate one, in the sense that while we agree with Ryle (1943), Titmuss and those who say that poverty and the resulting bad environment are the real factors underlying infant mortality, we would qualify this by insisting that man's ability to change or affect his environment for the better should also be considered.

We are grateful to the Medical Research Council of Ireland for assistance The machine compilation of our material was effected by the Statistics Branch of the Department of Industry and Commerce by kind permission of the Director and the willing co-operation of the Staff, not only in the routine calculations but also with technical advice and guidance.

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APPENDIX A

RESULTS OF PRIMARY "SORT"	NUMBER OF CASES	
TOTAL		
Mortality Group ("M") 554	"M"	"C"
Control Group ("C") 477	Group	Group
(1) The sixteen Dispensary Areas —		
Areas 1 and 2	64	30
Area 3	59	57
Area 4	63	53
Areas 5 and 15	77	46
Area 6	16	31
Areas 7 and 8	17	34
Area 9	60	53
,, 10	63	42
,, 11	48	61
Areas 12 and 16	61	41
,, 13 and 14	26	29
(2) Age at Death — (CONTROL Cards Age at which Typical Illness Occurred). —		
Under 1 day	67	—
1—7 days	69	—
1—4 weeks	85	8
4 weeks— 2 months	62	10
2 months	57	10
3 ,, ,,	108	38
6 ,, ,, ,,	106	61
No Illness in "C"	—	350
(3) Sex —		
Male	326	252
Female	228	225
(4) Cause of Death —		
Diarrhœa and Enteritis	101	—
Pneumonia, Bronchitis, Congestion	131	—
Premature Birth, Injury at Birth	131	—
Congenital Malformations	48	—
Congenital Debility	57	—
Convulsions	33	—
Common Infectious Diseases	6	—
Tuberculous Diseases	8	—
Other Causes	39	—

	"M" Group	"C" Group
(5) Household Income per Head, per week (including Child in question) —		
Under 5/-	13	2
5/- and under 10/-	151	68
10/- ,, ,, 15/-	166	136
15/- ,, ,, 20/-	96	105
20/- and over	128	166
(6) Household Income less RENT, per Head, per week (including Child) —		
Under 5/-	36	9
5/- and under 10/-	195	102
10/- ,, ,, 15/-	152	158
15/- ,, ,, 20/-	126	137
20/- and over	45	71
(7) Order of Birth (Multiple pregnancy counted as one birth) —		
First Child	182	183
Second ,,	94	97
Third ,,	98	62
Fourth ,,	57	45
Fifth ,,	23	26
Sixth ,, ,,	28	18
Seventh ,,	30	17
Eighth ,,	13	12
Other Children	29	17
(8) Number of Previous Deaths under 1 year (twins counted separately) —		
None	447	402
1	76	63
2	18	10
3	7	1
4	3	—
5 or more	3	1

	"M" Group	"C" Group
(9) Previous Deaths as a Percentage of Previous Births		
If no previous Deaths	447	402
Over 0% and under 20%	24	19
,, 20% ,, ,, 40%	45	29
,, 40% ,, ,, 60%	20	12
,, 60% ,, ,, 80%	3	3
,, 80% ,, ,, 100%	13	12
,, 100%	2	—
(10) Last Preceding Birth —		
If First Birth	182	183
If Lived one year	326	266
Died under one year	46	28

HOUSE

(11) Number of Rooms in House (or Apartment) —		
1	24	10
2	59	25
3	125	59
4	240	252
5	81	95
6	22	28
7 or more	3	8
(12) Number of Persons living in House (includes Child in question) —		
1	—	—
2	6	11
3	139	139
4	100	102
5	106	86
6	87	45
7	44	41
8	31	20
9	23	15
10 or more	18	18
(13) Housing Density—persons per room (including Child in question) —		
Less than 1	98	128
1 but less than 1½	205	206
1½ ,, ,, ,, 2	95	55
2	39	32
More than 2 but less than 3	65	36
3 but less than 4	36	15
4 or more	16	5
(14) Domestic Hygiene —		
A Spotlessly clean and showing maternal efficiency	241	216
B Intermediate Conditions	229	209
C Dirty or showing maternal inefficiency	84	52

CARE OF CHILD

(15) Who minded Child —		
Mother	327	465
Grandmother	14	10
Female Relation	4	2
Other Person not a Relation	3	—
Maternity Nurse in Child's Home	63	—
In Hospital or Other Institution	143	—
(16) Welfare Clinic Supervision —		
When Child in Hospital from birth or Supervision otherwise Impossible (e g , evacuated, etc)	240	13
Adequate Supervision (1 visit per mth. or more)	192	318
Doubtful Supervision (less than 1 per month or less than 5 visits)	49	68
Absence of Supervision (No Nurse or one visit only and No Attendance at Clinic)	73	78
(17) Feeding Prior to the Fatal Illness —		
CONTROL Cards —Feeding (Diet of major importance) for First 6 months		
Congenital and Premature Cases not Affected by Feeding	183	—
Breast only	102	191
,, and Cow's Milk	11	81
,, ,, Dried Milk	6	25

	"M" Group	"C" Group
(17)—*continued*		
Breast and Cereal Food	3	39
,, ,, "Mixed Feeding"	4	1
Cow's Milk	131	61
Cereal Food	38	39
Dried Proprietary Milk	74	40
Cereals and "Mixed Feeding"	1	—
"Mixed Feeding"	1	—
(18) CONTROL Cards —		
Feeding for 6—12 month period (Diet of major importance) —		
Mortality Cards	554	—
Breast only	—	142
,, and Cow's Milk	—	28
,, ,, Dried Milk	—	20
,, ,, Cereal Food	—	3
,, ,, "Mixed Feeding"	—	26
Cow's Milk	—	80
Cereal Food	—	33
Dried Proprietary Milk	—	58
Cereals and "Mixed Feeding"	—	19
"Mixed Feeding"	—	68
(19) Length of Breast-feeding —		
If Breast-fed till Death	121	—
Not Breast- fed	142	30
Breast-fed for		
Less than 1 month (feeding definitely established)	81	74
1—2 months	45	35
2—3 ,,	14	35
3—4 ,,	15	46
4—5 ,,	6	20
5—6 ,,	6	17
6—9 ,,	3	50
9 months or over	11	156
Died before Breast-feeding could be established	95	—
Unsuccessful attempt to establish Breast-feeding	25	14
(20) Why was Breast-feeding Discontinued —		
Mortality Cards	554	—
CONTROL Cards —		
Unsuccessful attempt to establish Breast-feeding	—	14
Child not Breast-fed	—	30
,, Breast-fed for 9 months	—	156
Stopped due to Failure of Supply (without Illness of Mother)	—	139
,, ,, ,, Disagreeing with Child or Child not thriving	—	18
,, ,, ,, Illness of Mother	—	79
,, ,, ,, Illness of Child	—	14
,, ,, ,, Other Causes	—	27
(21) Were Foods, where Sterilisation necessary, Sterilised —		
Child Breast-fed only	103	19
Sterilised	335	343
Not Sterilised	2	8
Otherwise	114	107

BIRTH

(22) Antenatal Examination —		
If Adequate Examination	426	425
Inadequate ,,	72	26
Absence of ,,	56	26

Adequate Four or more examinations by Doctor, Clinic or Nurse in cases of first-born. Two to four examinations for other children—depending on circumstances of the case

Inadequate Below standard of Adequate

(23) Who Attended Confinement —		
In Jubilee Maternity Hospital	168	104
,, Royal Maternity Hospital	87	88
,, Other Institution	32	38
,, House with Nurse and Doctor	101	101
,, ,, ,, Nurse(s) only	159	138
No Medical Supervision	7	8

(If Nurse or Doctor arrived after the birth, coding is for their absence.)

	"M" Group	"C" Group
(24) Difficulty at Confinement —		
Normal, No Difficulty	418	409
Slight Difficulty	55	48
Serious ,,	81	20
25) Whether Child Premature —		
Not Premature	386	445
Premature	168	32
FATAL OR TYPICAL ILLNESS		
(26) MORTALITY Cards Place of Death —		
51 Lisburn Road (J M H or Ava)	190	—
Royal Maternity Hospital	42	—
Children's Hospital	38	—
Other Institution	16	—
Private House	268	—
CONTROL Cards Incidence of Serious Digestive or Respiratory Infections —		
No Serious Illness	—	350
Digestive ,,	—	32
Respiratory ,,	—	75
Both Digestive and Respiratory	—	20
(27) MORTALITY Cards Health Visitors —		
Did not Visit	58	—
Visited before Death	73	—
,, after Death	132	—
,, both before and after Death	171	—
Doubtful Information	120	—
CONTROL Cards Typical Illness Selected		
No Serious Illness	—	350
Digestive Illness Selected	—	46
Respiratory Illness Selected	—	81
(28) Duration of Illness (Fatal or Selected) —		
Less than 1 day	101	1
1—3 days	76	2
3 dy—1 wk	108	15
1—2 wks	89	19
2—4 ,,	80	44
4 wks or over	100	46
No Serious Illness in "C"	—	350
(29) Length of Time before Doctor Called —		
Child in Hosp from Birth	134	—
Dead before Doctor Came	27	—
Doctor not Summoned	8	352
,, Called 1st day	219	27
,, ,, 2nd ,,	88	43
,, ,, 3rd ,,	37	31
,, ,, From 3rd day to 1 wk	13	13
,, ,, After 1 week	28	11
(30) Was Medical Attendance at Illness (Fatal or Selected) Satisfactory —		
If Child in Hosp from Birth	134	—
Satisfactory Attendance	286	87
Fairly Satisfactory Attendance	59	29
Unsatisfactory Attendance	75	11
CONTROL Cards No Illness	—	350

	"M" Group	"C" Group
(31) Home Nursing at Illness —		
Child in Hosp (from Birth) or under Control of the Maternity Nurse	202	—
Nursing regarded as Satisfactory	31	7
,, ,, ,, Unsatisfactory	42	34
Absence of Nursing	279	86
CONTROL Cards No Illness	—	350
(32) Nature of Medical Attention (excluding Nurse) called —		
Child in Hosp from Birth	134	—
Absence of Medical Care	35	2
1 Private Doctor only	221	82
2 ,, Doctors only	40	13
3 ,, ,, or more	15	—
Dispensary Doctor only	30	16
,, ,, and Other(s)	31	7
Hospital Extern	28	2
,, ,, and Other(s)	20	5
CONTROL Cards No Illness	—	350
(33) Was Child admitted to Hospital —		
Child in Hosp from Birth	134	—
Admitted to Hospital	138	7
Not Admitted	244	119
Discharged from Hosp before Death or Discharged and Readmitted for same Illness	38	1
CONTROL Cards No Illness	—	350
(34) How long Ill before Admission to Hospital —		
Child in Hosp from Birth	134	—
Ill less than one day	19	—
,, 1 day but less than 3 days	41	2
,, 3 days ,, ,, ,, 1 week	40	3
,, 1 wk ,, ,, ,, 2 weeks	26	1
,, 2 wks ,, ,, ,, 4 ,,	20	2
,, 4 wks or over	30	—
Child not Admitted to Hospital	244	119
CONTROL Cards No Illness	—	350
(35) How long Child lived after Admission or How long kept in Hospital —		
Child in Hosp from Birth	134	—
Child not Admitted to Hosp	244	119
In Hosp less than 1 day	13	—
,, ,, 1—3 days	38	—
,, ,, 3 days—1 week	30	—
,, ,, 1—2 weeks	32	4
,, ,, 2—4 ,,	29	2
,, ,, 4 weeks or over	34	2
CONTROL Cards No Illness	—	350
(36) Did Illness (Fatal or Selected) occur at Dentition Time —		
At Dentition Time	96	53
Not at Dentition Time	458	74
CONTROL Cards No Illness	—	350
(37) Rent per Week —		
Under 5/-	114	64
5/- and under 10/-	282	218
10/- ,, ,, 15/-	124	134
15/- ,, ,, 20/-	21	31
20/- and over	13	30

APPENDIX B.

TABULATED RESULTS

TABLE I — *Values of χ^2 for Some Factors in Relation to Mortality (from the "primary sort")*

Column on Coding Scheme	Factor Related to Mortality	χ^2	n	p
(1)	Dispensary Districts	36 3	10	·00
(3)	Sex	8 2	1	·00
(5)	Income, total	40 6	3	00
(6)	Income, less Rent	46 4	4	00
(7)	Order of Birth	8 9	4	> 05
(8)	Previous Deaths (excluding first births)	4 9	2	> 05
(9)	Percentage Previous Deaths (excluding first births)	3 6	4	> 30
(10)	Last Preceding Birth	0 0	1	> 98
(11)	Number of Rooms	41 1	4	·00
(12)	Number of Persons	15 4	8	>·05
(13)	Housing Density	32 2	5	·00
(14)	Domestic Hygiene	4 1	2	>·10
(22)	Antenatal Examination	26 9	2	·00
(24)	Difficulty at Confinement	31 8	2	·00

TABLE II —(a) *Births and Deaths of Legitimate Infants in Belfast, for June,* 1941 *to* 1942, *reapportioned to Area of Residence* (b) *Comparison of "pro rata" sampling figures with the actual "Blitzed" areas are marked with an asterisk*

NOTE —Actual deaths exclude —

Two, caused by "enemy action", in area 7. (Inquest.)

Two, with no addresses. Born in J M H.

One, with wrong address Born in J M H. Unknown at address (area 4).

One, of "wilful suffocation", in area 11. (Inquest)

Dispensary Area(s)	Number of Births (of legitimate infants only)		Number of Deaths (of legitimate infants only)		Percentage Mortality	
	Actual	Pro rata Control Group	Actual	Pro rata Mortality Group	Actual	Pro rata Groups
1* and 2*	751	489	84	76	11·2	15·5
3*	797	929	74	70	9·3	7 5
4	753	864	68	75	9 0	8 7
5 and 15	762	750	85	91	11 2	12 1
6	495	506	21	19	4 2	3 8
7 and 8	461	554	22	20	4 8	3·6
9	855	864	67	71	7·8	8 2
10*	760	685	70	75	9 2	10 9
11	799	995	56	57	7 0	5·7
12* and 16*	742	669	74	73	10 0	10 8
13 and 14	603	473	37	31	6·1	6 5
TOTALS	7,778	7,778	658	658	8 5	8·5

TABLE III.—*Income and Areas of different Mortality Rates Related for the Mortality and Control Groups*

For mortality group, $\chi^2=12\ 7$, with $n=4$. $0\ 02>P>0\ 01$.

Income less Rent per Head, per Week (including Child in question)	Dispensary Districts and Mortality Rate						Totals All Districts	
	—79 Areas 6, 7, 8, 9, 11, 13 and 14		80—99 Areas 3, 4 and 10		100— Areas 1, 2, 5, 12, 15 and 16			
	Mortality Group	Control Group	"M" Group	"C" Group	"M" Group	"C" Group	"M" Group	"C" Group
Under 10/– ..	57	36	80	33	94	42	231	111
10/– to 15/– ..	42	67	50	48	60	43	152	158
15/– and over	68	105	55	71	48	32	171	208
Totals.	167	208	185	152	202	117	554	477

TABLE IV —*Age at Death related to Cause of Death*

Cause of Death	Age at Death							Total
	Under 1 day	1—7 day	1—4 weeks	4 wks — 2 mths	2—3 months	3—6 months	6—12 months	
Diarrhœa and Enteritis ...	—	—	9	16	14	38	24	101
Respiratory Infections	1	5	11	10	17	40	47	131
Prematurity	54	40	30	6	1	—	—	131
Other Causes	12	24	35	30	25	30	35	191
All Causes	67	69	85	62	57	108	106	554

TABLE V —*Age at Death related to Income.*

For this table, $\chi^2=7{\cdot}7$ and $n=8$. $0{\cdot}5>P>0\ 3$

Income less Rent per Head, per Week (including Child in question	Age at Death					Total
	0—4 weeks	4 wk.— 2 mth	2—3 mth	3—6 mth	6—12 mth	
Under 10/– . . .	85	28	28	50	40	231
10/– and under 15/– ...	57	17	15	27	36	152
15/– and over	79	17	14	31	30	171
All Income Groups	221	62	57	108	106	554

TABLE VI —*Cause of Death and Areas of different Mortality Rates related*

For this table, $\chi^3 = 4\ 6$ and $n=6$ $\quad 0\ 7 > P > 0\ 5$

Cause of Death	Dispensary Districts and Mortality Rate			Total
	—79 Areas 6, 7, 8, 9, 11, 13 and 14	80—99 Areas 3, 4 & 10	100— Areas 1, 2, 5, 12, 15 and 16	
Diarrhœa and Enteritis	25	31	45	101
Respiratory Infections	38	44	49	131
Prematurity	41	46	44	131
Other Causes	63	64	64	191
All Causes	167	185	202	554

TABLE VII.—*Cause of Death related to Housing Density*

For this table, $\chi^2 = 18\ 1$ and $n=9$ $\quad 0\ 05 > P > 0\ 02$.

Cause of Death	Housing Density				Total
	Less than 1 person per room	1 but less than 1½ persons per room	1½ but less than 2 persons per room	2 or more persons per room	
Diarrhœa and Enteritis	11	34	14	42	101
Respiratory Infections	18	52	26	35	131
Prematurity	32	44	23	32	131
Other Causes	37	75	32	47	191
All Causes	98	205	95	156	554

TABLE VIII —*Cause of Death related to Income.*

For this table, $\chi^2 = 15{\cdot}6$, and $n=6$ $\quad 0\ 02 > P > 0{\cdot}01$.

Cause of Death	Income, less Rent per Head, per Week			Total
	Under 10/-	10/- and under 15/-	15/- and over	
Diarrhœa and Enteritis	52	22	27	101
Respiratory Infections	50	50	31	131
Prematurity	50	35	46	131
Other Causes	79	45	67	191
All Causes	231	152	171	554

TABLE IX — *Income related to Order of Birth for both the Mortality and Control Groups*

Income less Rent per Head, per Week	Group	Order of Birth									Total
		1st	2nd	3rd	4th	5th	6th	7th	8th	9th and others	
Under 10/– ..	Mortality	26	27	31	41	17	24	28	13	24	231
	Control	9	6	12	20	15	5	11	10	13	111
10/– and under 15/–	"M"	40	35	52	12	4	4	2	—	3	152
	"C"	37	40	37	20	10	3	6	2	3	158
15/– and over	"M"	116	32	15	4	2	—	—	—	2	171
	"C"	137	51	13	5	1	—	—	—	—	208
All Incomes	"M"	182	94	98	57	23	28	30	13	2	554
	"C"	183	97	62	45	26	18	17	12	17	477

TABLE X.— *Income and Housing Density related for both the Mortality and Control Groups*

With income held constant, $\chi^2=6\,3$ for mortality and control groups and housing density $n=6$ $0{\cdot}5>P>0\,3$

With housing held constant, $\chi^2=21{\cdot}4$ for mortality and control groups and income $n=6$. $0\,01>P$

Income less Rent per Head, per Week	Housing Density										Totals	
	Less than 1 person per room		1 but less than 1½ persons per room		1 but less than 2 persons per room		2 but less than 3 persons per room		3 or more persons per room			
	Mortality Group	Control Group	"M" Group	"C" Group	"M" Group	"C" Group	"M" Group	"C" Group	"M" Group	"C" Group	"M" Group	"C" Group
Under 10/–	4	2	59	32	52	22	78	45	38	10	231	111
10/– to 15/–	19	23	79	92	27	19	16	16	11	8	152	158
15/– and over	75	103	67	82	16	14	10	7	3	2	171	208
All Incomes	98	128	205	206	95	55	104	68	52	20	554	477

TABLE XI — *Income and Domestic Hygiene related for both Mortality and Control Groups*

Considering the mortality group, $\chi^2=121$ for income and domestic hygiene $n=4$ $0\,01>P$.

Income less Rent per Head, per Week	Domestic Hygiene						Totals	
	Condition A		Condition B		Condition C			
	Mortality Group	Control Group	"M" Group	"C" Group	"M" Group	"C" Group	"M" Group	"C" Group
Under 10/–	48	18	116	66	67	27	231	111
10/– and under 15/–	73	51	68	87	11	20	152	158
15/– and over	120	147	45	56	6	5	171	208
All Incomes	241	216	229	209	84	52	554	447

TABLE XII.—*Incidence of Breast-feeding at various ages in the Mortality and Control Groups.*

Age of Child in Months	Number Living		Number Breast-fed		Percentage Breast-fed	
	Mortality Group	Control Group	"M" Group	"C" Group	"M" Group	"C" Group
1 . .	333	477	171	359	51	75
2 .	271	477	101	324	37	68
3 . . .	214	477	70	289	33	61
6 . .	106	477	24	206	23	43
9 . .	—	477	—	156	—	33

TABLE XIII.—*Incidence of Breast-feeding at ages of one and two months, respectively related to :—*

(a) Income,
(b) Housing,
(c) Domestic Hygiene,
(d) Order of Birth, and
(e) Cause of Death.

Breast-Feeding Incidence and		At Age One Month				At Age Two Months			
		Numbers Breast-fed		Percentages		Numbers Breast-fed		Percentages	
		Mortality Group	Control Group	"M" Group	"C" Group	"M" Group	"C" Group	"M" Group	"C" Group
(a) Income Less Rent per head per week	Under 10/-	75	85	51	77	51	74	43	67
	10/- and under 15/-	52	118	55	75	27	114	35	72
	15/- and over	44	156	48	75	23	136	31	65
(b) Housing No of persons per room (incl Child in question)	Less than 1	30	96	62	75	14	85	37	66
	1 but less than 1½	57	158	47	77	34	142	33	69
	1½ and incl 2	38	67	49	77	24	63	39	72
	More than 2	46	38	52	68	29	34	43	61
(c) Domestic Hygiene Condition	A	56	165	47	76	29	150	31	69
	B	86	157	55	75	51	140	41	67
	C	29	37	48	71	21	34	40	65
(d) Order of Birth	1st	55	133	56	73	33	118	43	64
	2nd	28	69	49	71	14	61	29	63
	3rd	30	51	48	82	16	46	30	74
	4th—5th	22	58	46	82	13	55	33	77
	6th or over	36	48	54	75	25	44	45	69
(e) Cause of Death	Intest. infect	44	—	48	—	25	—	33	—
	Resp. infect	63	—	55	—	41	—	39	—
	Other	64	—	50	—	35	—	38	—

TABLE XIV — *Application of χ^2 test for significance between Breast-feeding incidence at age 1 month and factors considered in Table XIII.*

Breast-feeding Incidence (at age of 1 month) related to	Mortality Group			Control Group		
	χ^2	n	$P>$	χ^2	n	$P>$
Income . . .	·9	2	·5	·2	2	·9
Housing .	3 8	3	2	2·1	3	5
Domestic Hygiene .	2 0	2	·3	·7	2	7
Order of Birth	2·1	4	·7	5·7	4	2
Cause of Death .	1 2	2	5	—	—	—

TABLE XV.— *Adequacy of Medical Aid in relation to Income.*
Considering the income levels (i) under 10/–, and (ii), 10/– or over, $\chi^2=4·62$ $n=2$ $0·1>P>0·05$.

Mortality Group Medical Aid	Income less Rent per Head, per Week			Total
	Under 10/–	10/– and under 15/–	15/– and over	
Satisfactory	121	84	81	286
Fairly Satisfactory . . .	25	17	17	59
Unsatisfactory . . .	42	15	18	75
Total .	188	116	116	420