INFANTILE MORTALITY: ITS CAUSES AND PREVENTION.

Presidential Address, read at Eston Hospital on September 28th, 1904.

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THE failure of sanitary efforts to reduce infantile mortality is the most unfavourable fact in the history of our sanitary efforts in Great Britain in the last twenty years.

It is not altogether unreasonable to expect that public health administration would have a very great influence in reducing infantile mortality to what may, under present conditions, be regarded as a normal standard—namely, 1 death under 1 year of age out of every 10 born.

Reference to the returns of the Registrar-General shows that the mortality of infants—that is, of children under 1 year of age—is absolutely appalling, and that it does not decrease with the progress of civilization in the same way as the mortality from other preventable diseases. During the ten years 1891-1900 a yearly average of 160 out of every 1,000 children born in London died under the age of 1 year.

In 1902 Glasgow had ...	128 per 1,000.
Edinburgh had ...	123 " "
Dundee had ...	143 " "
Aberdeen had ...	137 " "
London had ...	141 " "
Liverpool had ...	163 " "
Manchester had ...	152 " "
Birmingham had ...	157 " "
Middlesbrough had ...	182 " "
Eston had ...	171 " "

These figures show that throughout the country, and markedly in Middlesbrough and Eston, we are having a mighty slaughter of the innocents and sacrifice of human life. Dr. Hope of Liverpool, in the course of an inquiry into infantile mortality, took 1,082 families in which the death of an infant had occurred; these were taken consecutively and certain particulars were ascertained. The total number of children born in these families had been 4,574, but out of that number 2,229 had died, practically all in infancy, representing 487 deaths out of every 1,000 born—a waste of life nearly five times as great as the standard alluded to; but the most excessive fatality occurred in twelve families, in which the large total of 117 infants had been born and no fewer than 98 had perished in infancy.

These excessive examples, it must be remembered, are occurring in families in which, so far as municipal sanitation is concerned, there is very little to choose between them and many of the families that rear all or nearly all their children; nor can it be shown or inferred that there was any inherent weakness in the offspring, since those who have survived are of fair physique, not as a class suffering under any inherited condition likely to terminate their lives; but it is in the personal and domestic circumstances that the contrasts are most marked. Some of the causes of infantile mortality are common to every locality, such as:

1. Prematurity of birth and congenital defects.
2. Hereditary tendencies.
3. Inexperience and neglect of mother.
4. Industrial conditions.
5. Social position.
6. Improper food and method of feeding.
7. Death from accidental and homicidal violence.
8. Age of parents.
9. Illegitimacy.
10. Insurance.
11. Relation between birth-rate and infantile mortality.
12. Density of population.

1. PREMATURE BIRTH AND CONGENITAL DEFECTS.

The two factors requiring persistent attention are the inherent weakness of vitality and the comparative inability to maintain animal heat. The infant should not be bathed, but should be anointed over the whole body with oil, and then swathed in cotton-wool that has been previously warmed. Both as regards fat and proteids the digestion is extremely weak, and consequently the milk mixture needs to be extremely dilute. The feeding requires to be frequent, and the amount at each feed should not exceed one drachm.

2. HEREDITARY TENDENCIES.

such as the inheritance of syphilis, occasionally tuberculosis and other infectious diseases, have been conveyed directly

from the mother to the child. In cases where no distinct disease is transmitted, children may inherit from parents constitutional tendencies or a diathesis which may manifest itself in infancy, or in some cases not till later childhood. Under this head we may place the influence of rheumatism, gout, the various neuroses, and possibly alcoholism and insanity. In consequence of these conditions in parents, the child may inherit no definite disease, but simply a vitiated constitution. Some check on the marriage of unsuitable people has been suggested, securing the greatest good of the greatest number, and in Dr. Farr's words, rendering growth more perfect, decay less rapid, life more vigorous, and death more remote.

3. THE INEXPERIENCE AND NEGLECT OF MOTHERS.

This, especially among the industrial classes, is a most important factor in infantile mortality; as regards inexperience, it has been suggested that the deaths of first-born children should be separated from the general infantile mortality; such returns would undoubtedly show that first-born children die at a higher rate than children of a later birth, but some of the excess would be attributable to greater difficulty in parturition as well as to parental inexperience.

4. INDUSTRIAL CONDITIONS.

Dr. G. Reid has drawn attention to the influence thus exerted in connexion with employment of married women in factories in Staffordshire; he found that the infantile mortality in three groups of towns followed the order in which the groups were arranged. From the point of view of number of women engaged in work away from home, it has been suggested that the observed coincidence is really due to the operation of other factors, inasmuch as populations can be selected from other parts of the country in which high infantile mortality exists in association with comparative little employment of women in factories—for example, here in Middlesbrough and district. The question raised in connexion with the Staffordshire figures is, however, one to which importance must be attached.

5. SOCIAL POSITION.

This is closely related to industrial conditions, in its influence on infantile mortality; this is abundantly apparent in looking at the mortality amongst the professional and the lower classes, lower and middle classes of society.

6. IMPROPER FOOD AND METHOD OF FEEDING.

Newsholme comments upon the striking statement that during the sufferings and starvation connected with the siege of Paris in 1870-71, while the general mortality was double, that of infants was said to have been reduced by about 40 per cent., owing to mothers being obliged to suckle their infants. The same increase of adult and diminution of infantile mortality was seen during the Lancashire cotton famine, when, Newsholme notes, mothers were not at the mills. The question whether a child will be strong and robust or a weakling is often decided by its food during the first three months of life; the largest part of the immense mortality of the first year is traceable directly to disorders of nutrition. The child must be fed so as to avoid not only the immediate dangers of acute indigestion, but rickets, scurvy, and general malnutrition, with all its various manifestations, since these conditions are the most important predisposing causes of acute disease in infants.

One of the difficulties has always been that temporary success may mean ultimate failure. If the injurious effects of improper feeding were immediately manifested there would be much less of it than exists at the present time.

It is because many things are valuable as temporary foods, which, when used permanently, are injurious. No better illustration is seen than in the too exclusive use of carbohydrates, like most of the proprietary foods; infants so fed grow very fat, and for the time appear to be properly nourished. The absence from the food of some of those elements which are of vital importance, may not be evident for months, hence the mistake is often made by the laity, and even by the profession, that those children are thriving. There are certain rules regarding the requirements of the growing organism which cannot be ignored without serious consequences, which will sooner or later be evident. Another common mistake is in the prolonged use of predigested foods; these are sometimes continued until, as in a case recorded, a healthy child at 2½ years was totally unable to digest the casein of cow's milk. A great stumbling-block to many is the fact that there are some infants of robust

constitution who, in good surroundings, have thriven exceptionally well in spite of very bad method of feeding. But it should not be forgotten that there are a very much larger number of perfectly healthy infants whose lives are sacrificed every year, both directly and indirectly, as a result of improper feeding; a method of feeding is to be judged not by the few exceptional cases which may do well, but by the results obtained in the majority of cases. Let no one think that he can secure the best results in infant feeding without devoting time and study to the problem. Close attention to details is necessary and indispensable to success in this as in all branches of medicine, but in none can more satisfactory results be obtained.

A woman's milk is the ideal infant's food. A thorough knowledge of its character, exact composition and variations is indispensable, for upon this knowledge are based all our rules for the preparation of foods used as substitutes for mother's milk when this cannot be obtained.

Breast Feeding.—Although it is admitted universally that the best method of rearing infants is to bring them up at the breast, it is often found that infants so reared do not thrive well, and by comparison with others brought up on the bottle appear small and ill-nourished. Such infants are more irritable, restless, and sleepless, and require more care than ordinary babies. It might at first sight be thought that the cause of this difference is in the method of feeding adopted and that artificial feeding is better than breast feeding. In truth, the fault lies not in the method but in the subject. It must clearly be understood that not every mother is fitted to suckle her child. Unfitness for the performance of this function may depend upon one or more of several causes, such as various conditions of ill-health or malnutrition, affections of the breast or nipples, insufficient supply of milk, mode of life, mental and moral characteristics; some of these conditions can be remedied if the mother is anxious to nurse her child, and is willing to devote her life for the time being to this duty, but if the mother is more anxious to devote her life to her own pleasures and amusements and regard the infant as a secondary consideration the case is a hopeless one, and partial weaning will have to be adopted as a lesser evil.

Cow's Milk.—The only one of the lower animals whose milk is practically available for infant feeding is the cow. Cow's milk being our main reliance in artificial feeding of infants and the staple food of nearly all young children, it follows that everything relating to its production and handling is important: it should be fresh, not over twenty-four hours old, and should contain no preservative. It should be from healthy animals, free from tuberculosis or other taint. It should be clean; it should not be skimmed or otherwise falsified; it should contain no pathological organisms; the number of other organisms should not be excessive; the percentage of fat should be known, and the milk should be as nearly uniform as possible from day to day and at different seasons of the year. It should be mixed milk (not one cow's milk), since it is subject to fewer variations, and from healthy, hardy cows—for example, shorthorns. Can we not do something by educating the public to appreciate, and dealers to produce, a better and cleaner milk, by giving the health authorities of municipal and urban districts greater power than heretofore in the matter of milk inspection, and by urging co-operation in the way of establishing big dairy farms, where the animals are subjected to a regular inspection by a competent veterinary surgeon, a chemist and bacteriologist to be employed to see that the milk is kept up to a certain standard, both as regards composition and purity, and the authorities could certify this milk? This milk could be sold at a slightly higher price, and I am certain it would prove eminently successful from a medical and commercial standpoint.

Milk Sterilization.—The term "sterilization" is widely and rather loosely used to signify the heating of milk for the destruction of germs. It, however, should be borne in mind that none of the methods commonly employed render milk sterile in the bacteriological sense of the word, although this can be done by heating on two or three successive days as in preparing culture media—what is accomplished by the means commonly employed is the destruction of such pathological germs as may be present, and a large number of the other bacteria, so as to retard for several days the ordinary fermentative changes. The practice of heating milk used for infant feeding is generally adopted all over the world, but heating changes the taste of the milk, makes it constipating, the colour is changed, the casein is rendered less coagulable by rennet, and other chemical changes occur which are still

imperfectly understood, and it may cause scurvy or scurvy rickets.

Pasteurizing Milk.—To obviate the disadvantages above referred to, the practice has come largely into use in America of employing much lower temperatures for milk sterilization; 150° to 155° F. (65° to 68° C.) are the temperatures which have now the sanction of the highest authorities, although by some 140° F. (60° C.) is deemed adequate. These temperatures are maintained from twenty to thirty minutes; spores are not destroyed by this method, and such milk requires special handling; after sterilizing, it should always be rapidly cooled. Amongst the poor of our large towns, in summer heating to 212° F. for an hour is to be advised as the most satisfactory—and indeed the only efficient—method of sterilization. It should be remembered that the use of such milk as a sole diet for a long time is attended with a certain amount of risk, and we should always be on the watch for soreness of the legs and the spongy gums that indicate the beginning of scurvy, as well as for the more general symptoms of malnutrition.

Clean Milk.—It is quite possible to produce milk for cities which does not need sterilization. There are special dairies supplying such milk, and their number may be greatly increased if the medical profession will use its influence in that direction. It is towards this end we should work, to secure for every town a milk sufficiently clean, pure, and fresh to render heating unnecessary. My personal preference is strongly for such milk, believing, as I do, that the heating of milk, sufficient to kill bacteria, does impair to some extent its nutritive properties, and to a degree directly proportionate to the height of the temperature employed and the length of time it is continued. In the country, where milk is obtained fresh and used before it is twenty-four hours old, sterilization is unnecessary, provided the cows are healthy and the milk is handled with reasonable care, the most important feature of which is that it be quickly and properly cooled as soon as it is drawn.

Peptonized Milk is a valuable resource in chronic cases where there is feeble casein digestion, and during an attack of acute indigestion in infancy, and then we should use completely peptonized milk. It is not advisable to continue its use indefinitely, for in this case the stomach gradually becomes less and less able to do its work. It should not be used longer than a month or two at most.

Condensed Milk.—The reasons both for the success and failure of condensed milk as an infant food are apparent from a study of its composition; as it is ordinarily used as a temporary food it is often useful, first because it has been sterilized, but chiefly because the casein of the cow's milk has been reduced by the usual dilution to such a point (0.6 per cent.), and that an infant with a very weak digestion can manage it, whilst it furnishes an abundance of sugar, the easiest thing for an infant to digest. During the first few months of life it is often apparently very successful for these reasons, but it cannot be continued indefinitely without hazard. I have seen many infants reared exclusively upon it, but rarely one who did not show on careful examination more or less evidence of rickets. Condensed milk fails as a permanent food, partly because it consists too largely of carbohydrates, but chiefly because it is lacking in fat.

Whey is especially valuable for infants in cases of acute indigestion, or in chronic cases where there is much difficulty in the digestion of casein, it may be made the basis of a milk modification.

Beef Preparations (extracts) are not to be considered in any sense as foods. Kemmericks has shown that animals receiving nothing else died of starvation, and sooner even than when everything was withheld; they are stimulants, and as such are often useful.

Barley, Rice, and Oatmeal Waters.—These are useful as additions to milk for healthy infants who have reached the age of seven or eight months.

Milk Food.—Nestlé's and other milk foods, malted milk, cereal milk, and Carnick's food, and even some of the farinaceous foods, like imperial granna, are advertised as substitutes for breast feeding, and recommended for use alone; others such as Mellin's, Liebig's, and Eskay's foods are intended to be prepared with milk. The use of any of the commercial foods alone is admissible only for short periods during derangement of digestion, when we wish to withhold for the time all fat and milk proteids. Their prolonged use almost invariably produces some grave disorder of nutrition, most frequently scurvy.

The modification of cow's milk for infant feeding, or the

laboratory method—Rotch's American method—is certainly the most scientific, and may be the method of the future; but at present it is expensive, the process now followed of separating and recombining the milk elements impairs its nutritive properties, the mother or nurse cannot use it without the advice and direction of the physician. I cannot go into the details of this process, but may say that the milk laboratory is only an instrument or agency in the physician's hands for carrying out his own idea in infant feeding, and the results will be good or bad according to the use he makes of it. I am convinced of its scientific value and its practical utility; it is placed by Holt next to maternal nursing. Success in infant feeding is largely a question of close observation and careful attention to details; without these, the proportion of failures by any method will be very large.

7. ACCIDENTAL OR HOMICIDAL VIOLENCE.

Infants may succumb during the first few days of life from malformations of heart, lungs, kidneys, stomach or intestines, and sometimes from diaphragmatic or umbilical hernia or internal haemorrhage, but the most fertile source is asphyxia from overlying: 1,000 infants die every year from this cause in the city of London, and usually due to intoxication on the part of the mother.

8. INFLUENCE OF AGE OF PARENTS ON VITALITY OF THEIR CHILDREN.

Dr. Matthews Duncan showed that the vitality of infants in a maternity hospital was greatest when the age of the mother was about 24 years, and with the youngest mother the number of weakly children is greatest. On the father's side, the youngest parents also appear to disadvantage—girls should not marry before the age of 20 years, and old men should not marry young women.

9. EFFECT OF ILLEGITIMACY ON INFANTILE MORTALITY.

An illegitimate child has less than one half the prospect of reaching the end of the first year of life which is enjoyed by a child born in wedlock. Who can doubt that their life is much harder and more difficult? Illegitimacy is in itself an evil to a man, and the State should seek to diminish the number of these births, and carefully inquire to what circumstances any increase is to be ascribed. The necessity for regulations respecting illegitimate infants is indicated by the significant fact that, according to Dr. Lancaster's evidence in 1871, the inquiries requiring to be held on illegitimate children under 1 year of age amounted to 31 per cent. of all the inquiries held on infants, although such children formed less than 5 per cent. of the total number of births—such facts led to the passing of the Infant Life Protection Act of 1892.

10. INSURANCE OF INFANTS IN RELATION TO INFANTILE MORTALITY.

It appears fairly evident that, after free allowance for selection of insured lives and for the fallacies connected with the extremely high mortality soon after birth, there is no trustworthy statistical evidence of the ill-effect on the life prospects of children from life insurance. There is no proof that neglect and crime have been greater in their incidence upon insured children, and it can scarcely be held that the prospective receipt of insurance money has been the incentive to child neglect and child murder in more than a small number of cases (Newsholme).

11. RELATIONS BETWEEN BIRTH-RATE AND INFANTILE MORTALITY.

Alterations in the birth-rate, by affecting the age constitution of a population, affects the death-rate; thus, a high birth-rate, other things being equal in a particular year, by causing immediate increase in the number of young children whose rate of mortality is high, might be expected to increase the death-rate for a year or two. On the other hand, however, if the birth-rate continues high, after a few years the population comes to possess an unusual proportion of persons who have weathered the storms of infancy and whose rate of mortality is now low. Thus, a high birth-rate continued for a number of years, might be expected to produce a low death-rate. As a matter of fact, in many instances in which high birth-rates occur, other conditions which affect death-rates, more than the birth-rate itself, does also obtain, and hence the influence of birth-rate *per se* is often obscured. Thus, in crowded urban districts occupied by poor people high birth-rates and high death-rates often co-exist. The high death-rate in such cases obtains, notwithstanding the favourable age-distribution

of the population produced by the high birth-rate, and is probably due to insanitary conditions. It has been pointed out that low birth-rates continued for a number of years have been observed to be associated with low death-rates. In France, however, a low birth-rate co-exists with a somewhat high death-rate. In that country the low birth-rate has been very long continued, and the proportion of persons at advanced ages (attended by high mortality) is in such marked excess of the normal proportion as to adversely influence the death-rate.

12. DENSITY OF POPULATION AND INFANTILE MORTALITY.

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

CONCLUSION.

Fully aware of the many imperfections in this paper, I hope I have not attempted too much, but have aroused some interest in this most important subject, full of interest, but sadly neglected, and that each one of us may strive so far as he can to stir up public opinion in this matter—that district and municipal authorities will carry out fully the power they possess relating to cows, cowsheds and milkshops, so that we may at least have clean milk; that printed instructions be handed to parents when the birth of the child is registered, containing advice on simple methods of rearing infants, great stress being placed on breast-feeding; and by appointing lady inspectors or visitors in every town.

And, lastly, by teaching hygiene in our schools. Educate the future mothers of England to a keener sense of their duty to their own children and the State than exists at the present time. Mothers should be mothers, and not gay society puppets, who want a life of change and excitement, with the rest of their time spent in how they can get rigged up to attract and make a display.

Infantile feeding is undoubtedly the most fertile source of our deteriorated national physique.

To dream of making strong men and women out of damaged children is impossible.

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MEMORANDA:

MEDICAL, SURGICAL, OBSTETRICAL, THERAPEUTICAL, PATHOLOGICAL, ETC.

SUPERIOR STRABISMUS.

T. W., a retired farmer, aged 70, had an accident while getting into his dogcart, resulting in his head and face being dragged through the branches of an old tree. His lower eyelid was torn away at both canthi, and hung over the cheek by a narrow tag of skin in the centre, a quantity of the loose cellular tissue also being dragged out and hanging by a slight attachment; a point of a branch also penetrated deeply under the eyeball, impinged on the position of the inferior rectus, and left a piece of rotten wood at the bottom of the wound. The sight was unaffected, and the pupil reacted normally to the light. The wounds, naturally, did not heal readily, and the eye had to be dressed twice daily for a month. At the end of that period, when trying the sight of the eye, he was alarmed to find that he saw double, one image being on the top of the other, and, the eyes being inspected at some little distance, the pupil of the injured one was seen to be elevated about an eighth of an inch above the plane of the other. This state of matters continued for about a month, when the inferior rectus began to reassert its power,