

THE INFANTS' MILK DEPOT: ITS HISTORY AND FUNCTION.

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SEVERAL causes have contributed to bring the problems of infantile mortality into greater prominence during recent years. The increased interest in child-study, the growth of humanitarian feeling, and the rapid decline of the English birth-rate during a period of Imperialist expansion have combined to set a higher value upon infant life. In this connection less is heard of the "survival of the fittest" and the "devastating torrent of babies"; the fear of over-population which induced many to regard a high rate of infantile mortality with complacency has faded before the danger of depopulation, and the so-called doctrines of Malthus have given place to the gospel of Fecundity. To those engaged in the work of preventive medicine the continuance of a high rate of infantile mortality in spite of the great improvements in public health administration of the last thirty years is a problem of special interest. The following table shows that although the general death-rate has steadily declined since the early seventies there has been no corresponding decline in infantile mortality, which in fact has increased during 1886-1901. The comparatively low rates in 1902-3 are explained by the exceptional meteorological conditions prevailing during the summer months:—

Years	Death-rate per 1000 population	Deaths under one year per 1000 births
1851-55	22·6	156
1856-60	21·8	151
1861-65	22·5	151
1866-70	22·4	156
1871-75	21·9	153
1876-80	20·8	144
1881-85	19·4	138
1886-90	18·8	145
1891-95	18·7	150
1896-1900	17·6	156
1901	16·9	151
1902	16·3	133
1903	15·4	132

It would appear that there is need for more specialized measures of disease-prevention than those hitherto adopted.

In France, where an unusually low birth-rate has compelled the question of infantile mortality to be regarded as one of national importance, efforts have lately been made to improve the defective methods of infant feeding, which are held to be the chief factor in infantile mortality, by the establishment of organizations having for their object the encouragement of breast-feeding wherever possible, and the supply of sterilized milk for those infants for whom breast-feeding is impracticable. These organizations are of two types, the "Consultation de Nourrissons" and the "Goutte de Lait." The former is the earlier institution, and may be said to date from the year 1890 when Professor Herrgott founded "L'Œuvre de la Maternité" at Nancy¹. The infants born in this institution were required to be brought up by their mothers for medical examination one month after birth, and if the child's progress had been satisfactory the mother received a gift of money². In the years 1890-1900, 2,052 women had passed through this institution and 23,382 francs had been distributed amongst them.

The Nancy maternity charity, however, as established in 1890 was a somewhat embryonic form of the Consultation de Nourrissons; the first fully developed example was founded by Budin at the Charité Hospital, Paris, in 1892³, and two others were afterwards established by him, one at the Maternité Hospital in 1895, the other at the Clinique d'Accouchement Tarnier in 1898. Similar consultations have since been organized by Maygrier, Porak, Boissard, and other accoucheurs in Paris. There are two kinds of Consultations de Nourrissons. Those of the type established by Budin are attached to the maternity hospitals, and are limited to the children born in the hospital. The women are admitted for confinement free of charge, and the children born in the hospital are kept under regular medical supervision for the first two years. Every effort is made to encourage breast-feeding, but where satisfactory evidence can be adduced that this is impracticable, the children are fed on sterilized milk supplied daily at the hospital. Each mother is required to bring her child once a week to the hospital, where it is examined by one of the medical staff. The weight is taken and periodically entered

¹ Variot, *La Goutte de Lait*, *La Clinique Infantile*, Nov. 1st, 1903.

² Herrgott, *Annales de la Société Obstétricale de France*, 1901.

³ Budin, *Rapport sur les règles à suivre dans l'alimentation du premier âge*, *Congrès d'hygiène de Bruxelles*, 1903. *Des moyens de combattre la mortalité infantile*, *Revue Philanthropique*, 1902.

with other particulars in a register. The sterilized milk for the hand-fed children is supplied daily in bottles, each bottle containing sufficient for one meal and no more, and the quantity in each bottle is prescribed by the medical man supervising the child and is regulated by the weight of the child. Hand-feeding is exceptional at the consultations of the accoucheurs¹. At the Clinique Tarnier during the years 1898–1902 no less than 448 of the 527 children who were under observation were fed at the breast.

There are also Consultations de Nourrissons which are not attached to maternity hospitals, but otherwise the work is conducted on much the same lines. The mothers are required to bring their infants regularly for medical examination, and breast-feeding is encouraged by gifts of food and money to those mothers who suckle their children.

The Goutte de Lait, which may be regarded as the precursor and to some extent the prototype of the Infants' Milk Depots in this country, is an offshoot of the Consultation de Nourrissons, and is practically a milk dispensary from which infants are fed under medical supervision upon sterilized milk, with or without modification, supplied at the institution. Breast-feeding is encouraged but usually the great majority of the infants are hand-fed. The Goutte de Lait in fact is mainly intended to succour those infants for whom breast-feeding is practically impossible². The first Goutte de Lait was established by Variot in connection with the Belleville dispensary in 1892, shortly after Budin had organized his Consultation de Nourrissons at the Charité, and according to Variot there are now over 25 of these institutions in Paris.

The first provincial Goutte de Lait, and the first to exist as a separate institution, was established in Fécamp in 1894 by Dr Léon Dufour, who was the first to give the name of Goutte de Lait to these organizations. Since 1894, largely owing to the influence of Dufour and Variot, these institutions have multiplied in France, and there are now over 60 towns provided with one or more Gouttes de Lait. The majority are conducted by philanthropic societies, but in some towns, *e.g.* Nantes and Elbeuf, the Goutte de Lait is a municipal institution. Most of the French

¹ Maygrier, *Les Consultations de Nourrissons*, Paris, 1903.

² Some writers draw a sharp distinction between the Consultation de Nourrissons and the Goutte de Lait. Variot, however, applies the latter term to both organizations; but he lays stress on the difference in type between the consultations at the maternity hospitals where the infants are under medical supervision from birth, and the ordinary Goutte de Lait where most of the children are in a state of ill-health when they are first brought to the institution.

Gouttes de Lait are conducted on the methods laid down by Dufour at Fécamp which are best described in his own words.

Le but de l'œuvre, dès sa fondation, a été celui-ci : lutter contre la mortalité des enfants en bas-âge.

(a) En donnant aux mères de famille tous les conseils et encouragements possibles pour les engager à nourrir elles-mêmes leur enfant au sein.

(b) Toutes les fois que l'allaitement maternel ne peut être fait complètement et réclame le secours de moyens artificiels, l'œuvre fournit du lait de façon que l'enfant reçoive une alimentation mixte.

(c) Quand il est bien avéré que la mère est dans l'impossibilité physique, morale ou sociale, de nourrir son enfant, l'œuvre se charge de préparer elle-même le lait qui est destiné à ce dernier, afin d'éviter les fautes commises, trop souvent, dans cette préparation, et aussi afin d'assurer à l'enfant un lait de bonne qualité dans l'élevage artificiel.

Tous les enfants du premier âge de la ville de Fécamp sont admis à bénéficier de l'œuvre de la Goutte de Lait, sur la demande de leurs parents, de leurs tuteurs ou des personnes ayant la direction et la responsabilité de leur élevage.

Toutefois, son action est principalement dirigée sur la classe pauvre, celle où les difficultés de l'alimentation artificielle sont les plus grandes.

Les enfants sont repartis en trois catégories :

(a) Section gratuite, la première, la base de l'opération.

(b) Section demi-payante.

(c) Section payante.

Les enfants de ces trois sections reçoivent le même lait, préparé de la même manière, et distribué dans un matériel semblable¹.

Chaque enfant a un service de paniers et de biberons double et immatriculé.

Chaque mère de famille reçoit tous les jours, pendant un an, ou plus si besoin est, un panier contenant autant de biberons que l'enfant prend de repas dans un jour de 24 heures (neuf). Ces biberons renferment du lait, en quantité proportionnelle à l'âge de l'enfant.

La remise en est faite contre le dépôt d'un jeton de 0 fr. 10 centimes dans la section des pauvres ; ou d'autres de 0 fr. 30 centimes pour les ouvriers, 0 fr. 50, 0 fr. 75, ou 1 fr. dans la section payante, suivant la situation sociale des parents.

Le lendemain, contre la remise du panier et des biberons vides, un autre service, numéroté également au matricule de l'enfant, est remis contre un jeton de la valeur indiquée ci-dessus.

Une fois chaque semaine, les mères, en venant chercher leur lait, doivent amener leurs enfants à peser, de façon à permettre de contrôler l'évolution de leur accroissement et les soins généraux qui leur sont donnés.

L'œuvre est administrée par :

1. UN COMITÉ DE DIRECTION, composé de : Un Président, médecin, chargé de la surveillance générale, du contrôle de la préparation de lait, de celui du nettoyage des biberons, de la qualité du lait, des pesées, etc.

Une Dame patronnesse, trésorière.

¹ *La Goutte de Lait à Fécamp*, Rouen, 1900.

Trois autres Dames patronnesses.

Ces Dames ont la charge morale de la gestion des fonds octroyés à la Goutte de Lait¹.

The first of these institutions out of France was established in New York City in the spring of 1893 by a well-known philanthropist, the Hon. Nathan Straus.

"This milk depot was located on a pier at the foot of East Third Street, that situation being accessible to a very large tenement-house population. Awnings and seats were put up on the pier so that the babies and their mothers could remain there and inhale the fresh air from the river.

"The building which was erected was, owing to the character of the site, of necessity long and narrow; it was placed several feet from the edge of the pier, so that an outside passage-way connecting the rooms was reserved. The building was divided into four rooms. The first room is used for sterilizing the bottles, stoppers, and nipples, and preparing and pasteurizing the milk. The second room is occupied by large water-baths of iced water for keeping the pasteurized milk until it is delivered. The third room contains ice-boxes for the cans of raw milk. The fourth room, which is nearest the end of the pier, is devoted to the business of selling the milk²."

In the Straus Milk Charity the milk is pasteurized, not sterilized, as in the French depots. It is heated in stoppered bottles to 167° F. (this temperature is reached in about 10 minutes) and remains at that temperature for 20 minutes.

"At first two sorts of milk were furnished: (1) Pure milk pasteurized in eight-ounce bottles; (2) A milk especially prepared for feeding infants, a one-half dilution with water, sugar of milk, and lime-water as follows:

Sugar of milk 12 oz.	Lime-water 8 oz.
Milk 1 gal.	Water 1 gal.

thus producing about what we now speak of as 2.2.7, that is 2% fat, 2% proteids, and 7% sugar. This formula was not considered ideal, but was easily prepared and seemed to answer well. It was dispensed in eight-ounce bottles.

"Later, on the advice of Dr A. Jacobi, there was added a one-half dilution of milk with barley-water which was sweetened with cane-sugar according to the following formula:

Table-salt $\frac{1}{4}$ oz.	White cane-sugar 10 oz.
Milk 1 gal.	Barley-water 1 gal.

This was dispensed in six-ounce bottles.

"The six-ounce bottles of both the prepared milks were sold at one cent each. The eight-ounce bottles of pure milk were sold at one and a half cents each³."

¹ Dufour, *Comment on crée une Goutte de Lait*, Fécamp, 1902.

² Rowland G. Freeman, *The Straus Milk Charity*, New York, 1895.

³ Freeman, *Milk Pasteurization*, New York, 1897.

Mr Straus endeavours to obtain as pure a milk supply as possible, the milk is certified by the New York Milk Commission and the farms and cows from which it is derived are inspected by the Veterinarian of the New York Board of Health. In 1902 the Straus Milk Charity had 14 depots at work in New York, and 1,200,000 bottles of milk were supplied¹.

Similar depots have since been opened in Yonkers, N.Y., Chicago, and Rochester, N.Y. In all these depots the milk was pasteurized at first, but in the Rochester depots, which are municipal institutions, it has been found possible by the observance of strict cleanliness in milking and storage to dispense with any process of sterilization and pasteurization and the milk is supplied raw. A fuller account of the Rochester methods, which are of the greatest interest, is given later.

The first British depot was opened on August 8th, 1899, by the St Helens Corporation on the initiative of Dr F. Drew Harris, the Medical Officer of Health². Depots were opened by Liverpool, Ashton-under-Lyne, and Dukinfield in 1901, Battersea in 1902, and Leith and Bradford in 1903. All these are municipal institutions, but the first private depot in this country was established in York in 1903 by the York Health and Housing Association at the instance of Mr Seebohm Rowntree. In Liverpool the work is conducted on a large scale. There are two sterilizing stations, and during the two and a half years ending December 31st, 1903, no less than 6295 children had been fed on the milk.

As the English milk depots differ in some respects from the French Gouttes de Lait and from the American depots it may be useful to describe the working of one of the former institutions in some detail, and for this purpose the writer has selected the Battersea depot as being the one with which he is most familiar. It may be taken as a fairly typical Infants' Milk Depot. The following description applies to the methods adopted at the present time, which are the results of nearly two years' experience.

One of the most important considerations to be borne in mind in establishing a Milk Depot is the control of the source of the milk supply. It is most important that the milk should arrive at the depot as free as possible from bacterial contamination, otherwise considerable difficulty

¹ Freeman, *The Reduction in the Infantile Mortality in the City of New York*, *Medical News*, New York, Sept. 5th, 1903.

² *The British Medical Journal* of August 18th, 1900, contains an interesting article by Dr Drew Harris on the St Helens Depot.

will be experienced during the hot weather and the best results will not be secured. The farm from which the milk is supplied to the Battersea depot was selected by the Medical Officer of Health from a number of farms offered by the contractor for selection. The cows are milked in the open air and never enter a shed except during a few weeks in winter. The milk is cooled down to 40° F. shortly after it is drawn from the cow and travels to the depot in sealed churns. The following is a list of the conditions accepted by the contractor.

1. The Contractor shall supply milk which must contain not less than 3.25 per cent. of butter fat and 8.75 per cent. solids not fat, and cream which must contain not less than 50 per cent. of butter fat; and the milk and cream must be free from chemical preservatives or colouring matter and be drawn from healthy cows only.

2. The Contractor shall deliver the milk and cream in sealed churns or cans to the Council's Depot, No. 28 York Road, before 8 a.m. every morning, Sunday excepted.

3. The Contractor must be prepared to increase or diminish the supply within reasonable limits, at one day's notice from the Medical Officer of Health.

4. A warranty ticket must be attached to every churn and can guaranteeing its contents to be in accordance with the specification.

5. No charge is to be made for the use of churns or cans, which when empty are to be removed by the Contractor from the Council's Depot free of charge.

6. All pails, strainers, railway churns, refrigerators, fittings and other vessels and implements brought into contact with the milk shall be thoroughly inspected before being used, be properly cleansed, scalded and dried immediately after being used, and exposed to the air in a clean place, without lids or covers.

7. The farms, water supply, drainage system, farm buildings, dairy and cattle shall be open at any reasonable time to the inspection of the Council's Medical Officer of Health, or any person duly authorised by him, and no milk or cream shall be supplied from any farm which has been certified by the said Medical Officer of Health to be in an insanitary condition.

8. The cows shall be subject, if required, to a periodical veterinary inspection by a Veterinary Surgeon duly appointed by the Council, and the Contractor shall undertake not to supply milk or cream from any cow which is diseased, newly calved or under physic.

9. The cows shall during summer be pastured, and during winter so fed that no taint is imparted to the milk. The Contractor undertakes to use no brewer's grains (wet or dry), turnip-tops or vetches.

10. The udders of the cows shall be carefully cleansed before milking, and the utmost possible cleanliness observed at every point connected with the cows, cowhouse, utensils and attendants.

11. The milk shall be carefully strained and cooled to at least 56 degrees F., immediately after milking, over a Lawrence, or other cooler of approved design, and shall be delivered at the Council's Milk Depot at a temperature not higher than 56° F.

12. The Contractor shall undertake that the refrigerators and the in-flow and

out-flow pipes, &c., are examined daily in order to see that everything is in thorough repair, and that there is no leakage.

13. No milk or cream shall be supplied from any farm on which there is a case of infectious disease.

14. The Council shall have the right to take samples of the milk or cream at any time, either at the farm or at any point in course of delivery.

15. From June to September inclusive, the Contractor when required by the Medical Officer of Health, shall pasteurise the milk before delivery.

16. Should any breach of any one or more of these clauses be at any time proved, the Contractor shall pay to the Council the sum of twenty pounds, or any lesser sum the Council may think fit, as and for liquidated damages, for each and every time such breach of any clause shall have been committed, and the Council shall deduct the same from any amount which may be due to the Contractor.

The Battersea depot is a three-storied building which was adapted for the work. The two upper stories are occupied as a residence by the manageress and some of the staff, and the work is carried on in four rooms on the ground-floor. The front room is used as a shop, in the next room the babies are weighed, the third is the bottle-washing room, and in the fourth the processes of modifying, bottling and sterilizing are carried out. The appliances in use are as follows:

- 1 One H.P. boiler.
- 1 Sterilizing chamber with trolley, as shown in the illustration.
- 2 Bottle-filling machines.
- 1 Cold storage chamber.
- 1 Cooling tank.
- 1 Electric motor to which are attached two revolving brushes for bottle-washing.
- 3 Soak tanks for dirty bottles.
- 3 Sets of rinsing jets.
- 1 Milk strainer.
- Drawing racks, churns, cans, measures, wire baskets, graduated 7 oz. bottles, etc.

The amount expended in alterations to premises and in appliances since the depot was opened in June, 1902, is about £700. The milk arrives at the depot before 6 a.m., and is at once modified by the addition of water, cream, lactose and a little salt.

The following table gives the dilutions and the amounts, given at different ages¹.

¹ The dilutions and amounts are based on the table in the leaflet, *How to bring up Children*, issued by the Medical Committee of the Hospital for Sick Children, Great Ormond Street.

Age of child	Modification	No. of bottles per day	Amount per bottle	Amount per day
During 1st fortnight	Milk 1 part, water 2 parts	9	1½ oz.	13½ oz.
„ 2nd „	„ „	9	2½ „	22½ „
„ 2nd month	„ „	9	2½ „	22½ „
„ 3rd „	Milk 1 part, water 1 part	9	3 „	27 „
„ 4th „	„ „	8	4 „	32 „
„ 5th „	„ „	7	5 „	35 „
„ 6th „	Milk 2 parts, water 1 part	7	5 „	35 „
„ 7th „	„ „	6	6 „	36 „
„ 8th „	Milk practically unmodified	6	6 „	36 „
Over 8 months	„ „	6	7 „	42 „

Cream and sugar are added so as to bring the proportion of fat and sugar to about 3·2 and 6% respectively. The milk is varied to suit individual cases upon the request of a medical man. After modification the milk is bottled and is then, the stoppers being closed, placed in the sterilizing chamber. Steam is injected and the temperature raised to 212° F., where it remains for about 10 minutes. The bottles are then taken out of the sterilizer and rapidly cooled in the cooling-tank.

The bottles are supplied in wire baskets, each basket holding from 6 to 9 bottles and containing a 24 hours' supply. The next day the basket of empty bottles is returned and a fresh supply obtained. When a child is entered at the depot the mother is instructed by the manageress as to the proper method of using the milk and she receives the following printed leaflet.

Instructions for the use of Humanised Milk.

1. The charge for the full weekly supply of Humanised Milk for infants under six months is 1s. 6d., payable in advance. If a day's supply only is taken, the charge is 3d. The charge for the full weekly supply for infants aged from six to twelve months is 2s., or 4d. per day. Children above one year old will be charged 2s. 6d. per week, or 5d. per day. The scale of charges for children living outside the Borough is as follows:—

Under six months	2s. 3d. per week, or 4d. per day.
Six months to twelve months	2s. 9d. „ 5d. „
Over one year old	3s. 3d. „ 6d. „

2. The Depot is open from 11 a.m. to 6 p.m. on week-days, and is closed on Sundays.

3. The milk will be supplied in bottles in a basket, each bottle containing sufficient milk for one meal, the amount varying with the age of the child. Infants under two months receive nine bottles per day; older children receive fewer bottles, as they should be fed less frequently.

4. If children are sent for the milk, they must be warned not to tamper with the stoppers of the bottles. On no account must a bottle be opened until the infant is ready to be fed.

5. Just before using, each bottle should be placed unopened in a basin, or jug of hot water, and warmed to the proper temperature. The bottle should then be opened and the teat put on. The child should be fed at regular intervals, and fed from these bottles only. On no account should any other feeding-bottle be used. The teat should be kept scrupulously clean.

6. When all the milk in one bottle is not used, the remainder must not be warmed up again, but a fresh bottle opened for the next meal. Where there are other children this milk need not be wasted.

7. On no account should any other food be given unless ordered by a doctor.

8. After using, the bottles should be thoroughly rinsed in cold water.

9. Breakages will be charged for at the rate of 1*d.* per bottle, and damage to baskets must be made good. All bottles, baskets, and rubber rings not returned to the Depot will be charged full value.

10. It is important that the child should be brought once a week to be weighed. The Depot is open for this purpose on Tuesdays and Wednesdays from 2.30 to 4 p.m.

11. The presence of Infectious Disease in a house must be at once notified to the Medical Officer of Health.

N.B.—The milk should never be used in preference to mothers' milk, which is the best of all foods for young infants.

It will be seen that this method of infant feeding is a very simple matter as far as the mother is concerned. When feeding time arrives all she has to do is to place the bottle, unopened, in a basin of warm water until it reaches body temperature, to open the bottle, put on a rubber teat supplied at the depot and feed the baby from the sterilized bottle direct. There is no need for a "feeding bottle," which alone is a great advantage.

The homes of the children fed on the milk are visited by the lady sanitary inspectors, who endeavour to secure that the instructions are properly carried out. If the child does not appear to be progressing favourably the mothers are strongly advised to seek medical advice, and if the child has been using the milk for more than two or three weeks and is not under medical supervision the mother is advised to give a little gravy or raw meat juice in addition to the milk, and written instructions for the preparation of raw meat juice are given to her. Mothers are urged to bring the children once a week to be weighed, but it has been found impossible to insist on this. There appears to be a prejudice against baby-weighing, at all events the number of children who are brought to the depot for this purpose is small.

Arrangements have been made with the Board of Guardians by

which the relieving officers are empowered to issue orders on the depot in lieu of giving money in outdoor relief. Similar arrangements have been made with various local charitable organizations.

There are several points of difference in the administration of the depots in England and America and on the Continent. One point is the treatment of the milk. In many of the French depots the milk is sterilized, but not modified, except for very young infants, and the process of sterilization consists of keeping the milk at 102° C. for from 45 to 60 minutes. At Fécamp, however, the milk is diluted with water in the proportion of one part to two parts of milk, and the same modification is adopted at St Helens, where the milk is sterilized by the French method. In the American depots the milk is pasteurized, with or without modification, except at Rochester, where it is supplied modified, but raw. The preparations and quantities at Bradford and York are similar to those at Battersea, which have already been given, and the milk is kept at 212° F. for from 10 to 20 minutes.

In the depot at Earle Road, Liverpool, which is the most complete in this country, the milk is kept at a temperature of 210° F. for from 20 to 30 minutes, and the preparations are as given below¹.

Age	Quantity of pure milk for 24 hours in ounces	Water in ounces
1—2 weeks	6 $\frac{3}{4}$	6 $\frac{3}{4}$
2—8 "	13 $\frac{1}{2}$	13 $\frac{1}{2}$
2—3 months	20 $\frac{3}{4}$	10 $\frac{1}{2}$
3—5 "	30	15
5—7 "	36	12
Over 7 months	36	12

2 $\frac{1}{2}$ ounces of cream, 1 $\frac{1}{2}$ ounces of sugar, and $\frac{1}{8}$ ounce of salt, to be added to each gallon of mixture.

The most important difference, however, between the English and American depots and the French Gouttes de Lait is in the supervision of the children. In most of the French institutions the supply is stopped if the child is not brought to the depot regularly to be weighed and examined by a medical man, but in the English and American depots there is no hard and fast rule of this kind, and such supervision as is exercised by the officers of the depot is carried out by nurses or lady inspectors acting under the instructions of the medical director of the institution, who in England is the Medical Officer of Health.

¹ Mussen, Supply of Sterilized Humanized Milk for Infants, *Journal of State Medicine*, Oct. 1903.

As a matter of fact most of the children come to the depot on the advice of a doctor and begin the milk under medical supervision, and should the progress of the child at any time be unsatisfactory, a fact which the parents are by no means reluctant to bring to the notice of the management, the mother is strongly advised to take the advice of her own doctor. In the English depots the object is to secure as far as possible the supervision of the regular medical attendant rather than to appoint a municipal doctor to give gratuitous advice. It is questionable whether the latter plan would meet with the approval of the medical profession in this country, as it is easy to see that it might lead to an objectionable form of "hospital abuse."

Objects of the Infants' Milk Depot.

So much having been said on the history and practical working of the Infants' Milk Depot it may now be asked upon what grounds can the existence of these institutions be justified? For what object were they established, and is there any evidence that the object has been attained? The object of the Infants' Milk Depot is, as stated by Dufour, "lutter contre l'excessive mortalité des enfants de la ville élevés artificiellement, surtout dans la classe pauvre¹," and it may be well to consider in some detail the grounds on which it is held that the depot is capable of achieving this object. Although much yet remains to be said on the subject of infantile mortality there can be no doubt that the most important condition giving rise to the deplorable waste of infant life which year by year recurs in our urban centres is defective infant feeding. It is unnecessary to recapitulate the evidence for this statement: it will hardly be disputed, but it may be pointed out that the mortality due to defective feeding cannot be fully estimated from the deaths from the diarrhoeal and digestive diseases. The impaired nutrition resulting from defective feeding must render the child specially liable to succumb to acute disease and to the various forms of tuberculosis.

Breast-feeding.

Breast-feeding is undoubtedly the best method of infant feeding, but there is reason to think that breast-feeding is becoming increasingly difficult to secure. The writer is not in possession of

¹ Dufour, *Comment on crée une Goutte de Lait.*

any statistics which support this view, but he knows no practitioner of long experience who does not agree to it. There is a tendency to assume that hand-feeding is a phenomenon entirely or almost entirely due to social and economic conditions and to neglect possible physiological factors. This is another point on which statistical evidence is lacking, but the writer inclines to the opinion, which is based on his own experience and that of more experienced practitioners, that a considerable number of mothers who wish to suckle their children are unable from lack of milk to do so. But whatever the causes of hand-feeding may be, and whether it is or is not increasing, there can be no doubt that the practice is deeply rooted in our social life. Doubtless breast-feeding could be increased by the growth of a more healthy public opinion on this question, by special factory legislation, and by the establishment of Consultations de Nourrissons on Budin's methods, but it is to be feared that in the absence of something like a revolution in our social and economic organization hand-feeding will continue to be so prevalent as to make the difference between good and bad hand-feeding a matter of immense importance.

The problem of finding a satisfactory substitute for mother's milk is one of great difficulty, and it may be questioned whether it will ever be completely solved. In the meantime thousands of mothers have to feed their children as best they can, and while our knowledge of artificial infant feeding is so defective that physicians of the highest eminence hold the most diverse opinions on such subjects as the relation of sterilized milk to infantile scurvy and the desirability of modifying cows' milk for infants, it is not surprising that the ordinary housewife should fail to achieve satisfactory results. Amongst the poor the grossest mistakes are made: young infants are not infrequently given such articles as hard-boiled eggs, cheese, carrots, beer, and even spirits, and other items of the comprehensive dietary known as "what we have ourselves." Assuming, however, that the mother has sufficient intelligence to avoid such lethal dietetic errors she has three classes of food from which to select a substitute for human milk, viz., proprietary foods, condensed milk, and cows' milk more or less modified and artificialized.

In seeking for a substitute for mother's milk it should be borne in mind, as Chapin points out, that "anything aside from breast-milk that is put into an infant's stomach is a foreign substance that may cause digestive disturbance¹," and the aim should be to obtain a food

¹ Chapin, *The Theory and Practice of Infant Feeding*, 1902.

resembling as closely as possible human milk. Tried by this standard proprietary foods are at once put out of court. Milk is a purely animal product, while proprietary foods are largely vegetable in composition as nearly all contain wheat flour or other matter of vegetable origin, and many contain unaltered starch, a substance the young infant is quite unable to digest. Generally speaking these foods are deficient in fat, too rich in carbohydrate, and contain no anti-scorbutic element. They are not now in favour with the profession, and few will dispute Still's opinion that "There are few cases in which any of these proprietary foods should be allowed to become the principal article of diet."

Condensed Milk.

Condensed milk is a popular infant food. It appears to be cheap, is easy to prepare, and is not infrequently recommended by medical men as being "safer" than cows' milk in hot weather.

In nutritive properties condensed milk is seriously deficient. Apart from the separated condensed milks which are destitute of fat it may be said that most of the brands of condensed milk upon the market are deficient in fat, and contain an excessive amount of cane-sugar, while all lack the anti-scorbutic elements. There is abundant clinical evidence to associate condensed milk and rickets as cause and effect.

The popular idea that condensed milk is a comparatively "safe" food during the diarrhoea season is not in accord with fact. Newsholme found that in 191 cases of fatal diarrhoea in Brighton in the three years 1900-02¹ the method of feeding was as follows:—

Breast	9·4%
Cows' milk	46·6 „
Condensed milk	44 „

Meredith Richards² investigated 183 deaths from diarrhoea in infants under six months in Croydon during the same years, and found the method of feeding to be as follows:—

Breast	14%
Cows' milk	48 „
Condensed milk	33 „

¹ *Annual Report on the Health of Brighton, 1902.*

² *This Journal, 1903.*

Of course, these figures cannot be taken as showing the relative incidence or fatality of diarrhoea in infants fed on cows' milk and condensed milk respectively, as the number of infants comprised in each of these two classes is not stated, but it is improbable that more than 44% of the total infants in Brighton were fed on condensed milk. There is, therefore, no reason to think that the infants fed on condensed milk are more secure from diarrhoea than those fed on cows' milk. Nor is this surprising. When the tin is opened condensed milk is as liable to contamination as cows' milk, especially as the tin contains sufficient material to last two or three days. Moreover, condensed milk is not necessarily sterile. During the years 1900-02 75 samples of condensed milk were examined by the Bacteriologist of the Liverpool Health Department, and the majority were found to be not sterile. Dr Hope says, "Bacteria are usually present, and the milk which was originally condensed might have contained various products of the decomposition of bacteria. These products are masked subsequently by the large quantity of sugar present, but their irritant properties are not destroyed¹."

Methods of feeding are, however, of importance in connection with diseases other than diarrhoea. There is need for more knowledge on this subject. What is wanted is an investigation, clinical, pathological and bacteriological, into the various methods of artificial feeding and their influence on nutrition. We want to know more of the influence of various foods on the child's powers of resistance to disease in general and to certain diseases in particular. It is probable that fuller knowledge would reveal further serious disadvantages to the use of patent foods and condensed milks. Park and Holt have lately conducted an enquiry somewhat on these lines in the tenement-houses of New York City, and it is interesting to note that the results with condensed milk in the summer observations were particularly unsatisfactory. "These children were often apparently in good condition until attacked with acute disease, when they offered but little resistance and seemed to succumb more quickly than any other class of patients²."

Niven³ has compiled the following interesting table in connection

¹ *Annual Report on the Health of Liverpool*, 1902.

² Park and Holt, Report upon the results with different kinds of pure and impure milk in infant feeding in tenement-houses and institutions of New York City, *Medical News*, New York, Dec. 5, 1903.

³ Quoted by T. D. Lister, *Infant Feeding and Milk Supply*, 1903.

with the question of the relation of condensed milk to infantile mortality.

Two Districts of Manchester, showing the Comparative Feeding of 533 Children.

Method of feeding	Ancoats (433)	Chorlton-upon-Medlock (100)
Breast-fed	85·9	81·0
Artificially fed	14·1	19·0
	100·0	100·0
Of the artificially fed :		
Cows' milk	62·0	89·0
Condensed milks	38·0	11·0
	100·0	100·0
Infantile mortality	234	184

This table shows that although rather more children were breast-fed in Ancoats than in Chorlton-upon-Medlock, the use of condensed milk was very much more common in the former district and was associated with a far higher rate of infantile mortality. It is not, of course, claimed that these figures are conclusive, but they are certainly suggestive and indicate a line of enquiry which might usefully be followed further.

Cows' Milk.

We now come to the consideration of cows' milk, which is generally agreed by the profession to be the best substitute for human milk generally available. But though cows' milk resembles human milk much more closely than patent foods or condensed milk, there are important points of difference apart from the question of contamination bacterial or otherwise. Cows' milk has a hard curd, and is adapted for the digestion of an animal with four stomachs. The human infant has but one stomach, and that is adapted for the reception of a milk with a soft curd.

The chemical differences are as great as the mechanical. The importance of these differences is, however, a matter of dispute. Budin and the French physicians give sterilized milk unmodified,

even to very young infants. In the Havre Goutte de Lait the milk is entirely unmodified. Some writers, *e.g.* Variot, affirm that it is modification and not sterilization that gives rise to infantile scurvy. On the other hand, Rotch and the Americans, who have done much to place infant feeding on a more scientific basis, insist on the importance, of that individualized modification,—percentage feeding. The weight of opinion in this country seems to be with the American rather than the French physicians, and in the present state of our knowledge it would appear to be safer to employ some form of modification, although the American refinements are perhaps unnecessary for babies on this side the Atlantic.

The most important point of difference, however, between human milk and cows' milk is that whereas the former passes from the secreting gland direct to the baby's mouth and is practically sterile, cows' milk in making the journey between these two points is seriously exposed to contamination. Contamination by chemical preservatives, though not so frequent as formerly, is still far too common, but it is almost insignificant compared with the importance of bacterial contamination.

Bacterial Contamination.

The process of milking as carried on in this country has been happily described by Dr Leslie Mackenzie as a "process of unscientific inoculation of a pure or almost pure medium with unknown quantities of unspecified germs¹." From the time it is drawn from the ungroomed filthy cows until by means of the long-tubed bottle it reaches the mouth of the baby, cows' milk is continually exposed to serious pollution, and gross bacterial fouling is so common as to be almost universal. The influence of bacteria-polluted milk on health is far from being fully understood, but it may be assumed that clean milk is preferable to dirty milk. We know, however, that milk has often acted as a carrier of the infections of enteric fever, scarlet fever, diphtheria, cholera and tuberculosis, although its influence on the latter disease has possibly been exaggerated, and there is now a mass of evidence that certain forms of sore-throat are closely associated with the consumption of milk from diseased cows. It is most probable that our list of milk-borne diseases is far from complete, and that fuller knowledge will add to the dangers we now know to exist in the present state of the milk supply.

¹ Mackenzie, *Edinburgh Journal of Medicine*, 1899.

The question of the chief place of contamination is important. In the case of the diseases already mentioned it is usually the farm, but in diarrhoea, the most fatal of the milk-borne diseases, contamination probably takes place chiefly in the home of the consumer. This view, however, is disputed by Delépine, who, from the examination of a large number of milk samples during an investigation extending over seven years, has arrived at the conclusion that there is a distinct relationship between epidemic diarrhoea and food poisoning, that both are due to the infection of the food by members of the colon group of bacilli derived from faecal contamination, and that the contamination is chiefly derived from the farm.

“My results do not exclude infection at the home of the consumer, or during transit from the farm, but they indicate that infection at the farm, or through vessels infected at the farm and used by the farmer for the storage and carriage of milk must be of paramount importance. None of the milk I have examined had been exposed to any influence attributable to a consumer's home. It will be noticed that a large proportion of the samples of milk obtained from cans at railway stations or at the farms is already infectious before it reaches the consumer; also the degree of noxiousness acquired through infection is proportional to the length of time the milk has been kept, and the temperature which it has been exposed to, before it reaches the consumer¹.”

Newsholme² does not accept this view. He does not deny that serious epidemics of diarrhoea occur which are due to the contamination of a single milk supply, and that such epidemics are analogous to milk outbreaks of enteric fever, but he holds that “the ordinary sporadic cases of diarrhoea are due to domestic infection of milk or other foods, or to the direct swallowing of infectious dust.” From an investigation of the different supplies of milk among the families in Brighton invaded by diarrhoea in the years 1900—02 he found no evidence of special incidence on single milk supplies. In the 89 fatal cases of diarrhoea fed on cows' milk there were no less than 41 sources of milk supply, and he concludes that “Unless we assume that a very large proportion of non-fatal cases occurred, we must infer, in view of the diffusibility of milk, that most of these milk supplies were non-infective before they reached the home of the individual patient.” Moreover 9·4%

¹ This *Journal*, 1903.

² The importance of the home contamination of food in the causation of diarrhoea was first pointed out by Newsholme in his Presidential Address to the Incorporated Society of Medical Officers of Health, 1899. See *Public Health*, December 1899.

of Newsholme's total 181 cases were breast-fed, and 44% fed on condensed milk¹.

Further evidence in support of Newsholme's view has been brought forward by Meredith Richards². The latter writer examined the records of 22 cases of food poisoning, excluding cases due to tinned food, and found a striking difference between the seasonal incidence of these outbreaks and that of fatal diarrhoea. He also points out that Chesterfield with a diarrhoeal rate of 54.4 per 1000 births during the years 1896—99, derived 98% of its whole milk supply from cow-sheds situated within the borough or within a radius of five miles, and that out of 253 fatal cases of diarrhoea occurring in infants in Croydon over 12% were breast-fed, while only a little more than half received fresh cows' milk³. The investigations of Park and Holt in New York lend no support to Delépine's view. The ten physicians engaged in this enquiry were agreed that the most important factor was intelligent care, while "most of the physicians stated that, leaving out the very worst store milk in summer, the results were very much less affected by the character of the milk than they had anticipated, and distinctly less than by the sort of care the infants received."

On the whole, it may be said that weight of evidence is distinctly in favour of the view that in fatal diarrhoea contamination of the food takes place chiefly in the home of the consumer.

From the foregoing considerations we may conclude that cows' milk is the best substitute for human milk generally available, that it is probably better to modify it for the use of young infants, and that it is most important to protect it against contamination, especially against contamination within the home of the consumer.

But even the purest cows' milk of the most nicely adjusted percentage composition may be a source of danger in the hands of a

¹ Newsholme, Remarks on the Causation of Epidemic Diarrhoea, *Transactions of the Epidemiological Society*, Vol. xxii. N. S. p. 34. See also *Annual Report on the Health of Brighton*, 1902.

² This *Journal*, 1903.

³ The relation of condensed milk to diarrhoea requires further investigation. Delépine and Hope have shown that condensed milk is frequently non-sterile, and it does not follow that condensed milk which is sterile, *i.e.* containing no living bacteria, is necessarily non-toxic. Moreover, further information is required as to the relation of attack-rate to death-rate in infants fed on condensed milk and other foods. The case mortality in infants whose nutrition has been impaired by a condensed milk diet may be exceptionally heavy, as would appear from the enquiries of Park and Holt, see p. 344. If this be so, a comparatively small number of tins of condensed milk containing infective material may give rise to a disproportionately large number of deaths.

careless or ignorant mother. The question of quantity as well as quality has to be borne in mind. The child may be over-fed, either by being fed too frequently or by being given an excessive amount at each meal. Both forms of over-feeding are common and give rise to serious consequences. Budin attaches great importance to "suralimentation" as a factor in the production of gastro-intestinal disorders, and he lays stress on the advantages of supplying the day's milk in separate bottles, each bottle containing the proper quantity for one meal¹. By this method of supply, which is employed in most of the French Gouttes de Lait and in all the British Milk Depots, the danger of over-feeding is considerably lessened, as both the number of meals and the proper quantity at each meal are clearly indicated. The Infants' Milk Depot, however, has other important advantages. The milk supplied is free from chemical preservatives—this alone is an important consideration—and, as in many depots, if not in all, care is taken to supply milk produced under clean conditions, the original bacterial content is probably much less than that of the milk generally supplied in the district. By the process of sterilization the initial pollution is wholly, or almost wholly, neutralized², and as each meal is supplied in a separate bottle the possibilities of home contamination are reduced to a minimum. Moreover, the milk is supplied at a price which is not beyond the reach of the poor. If then the work of the depot is under the supervision of a medical man and care be taken not to discourage breast-feeding, it would appear that from the general principles of preventive medicine there is ample justification for the existence of these institutions.

Results.

We may now examine the results of these institutions so far as they can be ascertained at the present time. A considerable amount of statistical matter has been issued in respect of the various depots in Europe and America, but after a careful consideration of the numerous documents he has been able to consult, the writer has arrived at the conclusion that it is doubtful whether the value of these institutions can be expressed in figures. But the Infants' Milk Depot is not the only preventive measure of which this can be said. There

¹ Budin, *Le Nourrisson*, Paris, 1903.

² Sterilization is not an essential part of the work of an Infants' Milk Depot. In the depots at Rochester, U. S. A., it has been found possible by the employment of aseptic methods to supply the milk raw. This is of course the ideal method.

are indeed few measures of public health administration whose beneficial effect can be demonstrated inductively by statistics, as can be done in the case of vaccination. The conditions determining the prevalence and fatality of a particular disease or group of diseases are so exceedingly numerous and interdependent that it is almost impossible to trace the effects of any one cause. For instance, the precise effect of hospital isolation on the prevalence and fatality of any of the chief infectious diseases is still a matter of controversy, although a considerable mass of material is available for analysis. To trace the effect of a milk depot is a much more difficult problem. From the statistical standpoint a depot is analogous to a hospital for sick children. It would be an extremely difficult task to estimate in figures the influence on child mortality of the various children's hospitals in London; and in the case of the milk depot the difficulty is even greater, as the few depots which exist at the present time have been but recently established, and in every case the operations have been conducted on a comparatively small scale. In this, as in most medical questions, clinical testimony is of far greater value than statistics, and this testimony is almost uniformly favourable to the depots. In Battersea this is certainly the case. In February, 1904, the writer addressed a circular letter to the medical practitioners in the district and to the visiting physicians of certain children's hospitals to which Battersea children are taken, asking for an expression of opinion as to the value of the milk. Replies were received from 44 practitioners, three of whom refrained from expressing any opinion on the ground that they had not had sufficient data. The remaining replies, with one exception, were favourable, in most cases highly so; only one practitioner expressed himself as disappointed with the results obtained from the use of the milk. The testimony in favour of the Straus depots of the observers who conducted what was probably the most methodical and extensive investigation into infant feeding yet made is quoted on page 361.

Statistical Evidence.

The statistical evidence it must be confessed is uncertain. All the methods which have yet been employed are beset with fallacies, which in no case appear to have been successfully avoided.

The method usually adopted is to compare the death-rate amongst the children fed from the institution with the infantile mortality in the

town. Budin recently presented a report to the Académie de Médecine, Paris, on the work of his Consultation de Nourrissons at the Clinique Tarnier. From the account of this report in the *British Medical Journal* of February 20th, 1904, it appears that since March, 1898, 712 children have attended the Consultation from birth for periods varying from less than one month to two years, and that 26 died; a proportion of 36·5 per 1000. As the average period of attendance was nine and a half months, the annual mortality rate is estimated at 46 per 1000. For comparative purposes it is stated that in Paris during 1898, 1899, 1900 there were 20,282 deaths in 113,805 infants under one year, deducting the infants sent to nurse outside the city, or a proportion of 178 per 1000—a figure which compares most unfavourably with the mortality rate at the Clinique. But these figures are not really comparable, for while the rate in the city is a death-rate of infants under one year, no less than 243 of the 712 children at the Clinique attended during their second year—a period when the mortality rate is distinctly lower than in the first year. It would be better to either exclude these 243 children or compare the rate 46 per 1000 with the death-rate in Paris of children under *two* years¹.

In the comparative figures calculated for the St Helens Depot by Drew Harris this error appears to have been avoided, and the results calculated in the number of children under one year. The figures are as follows²:

Year	No. of children on books	Death-rate per 1000 among children at depot	Infantile death-rate borough of St Helens
1899	232	103	157
1900	332	102	188
1901	282	106	175
1902	200	82	167

In the first three years of this table the children fed on the milk for less than one week were deducted, as in these cases the milk was not given a fair trial; in 1902 the children fed for less than 14 days were deducted.

¹ The difference between the two rates, however, is too great to be explained by the difference in age-periods. There can be no doubt that the children at the Clinique had a much better chance of survival than children living under average conditions in Paris, although this cannot be expressed numerically from the data given. The 712 children were all born in the institution and all were under highly skilled medical supervision.

² *Annual Report on the Health of St Helens, 1902.*

Hope¹ has recently calculated the death-rate of the children attending the Liverpool depots. The total number of children on the books up to December 31st, 1903, was 6295, but in many cases it was found impossible to obtain sufficient information. In the 4453 cases kept under close observation there was a mortality rate of 78 per 1000—a rate which compares favourably with the infantile mortality rate in the city, which, in the three years under consideration, was as follows :

Year	Infantile mortality
1901	188
1902	163
1903	151
Average	<u>167·3</u>

Adopting the same method of comparison, the writer calculated the mortality rate in the infants attending the Battersea depot during the six months ending December 31st, 1902². During this period there were 466 children who were kept under observation. Deducting 72 children over one year there remained 394 infants under one year, of whom 39 died. This gives a mortality rate of 98·9 per 1000, the infantile mortality in the borough during the same period being 143 per 1000. In 14 of the 39 fatal cases the milk had been taken for less than one week, and when these cases were deducted and the deaths during the first week of life in the borough also deducted, the rates in the depot and borough respectively were 63·4 and 118·9. Similar rates have been calculated for several of the Gouttes de Lait, the results in all cases being highly favourable to the institution.

Further reflection has convinced the writer that it is most difficult to assess the value of the results obtained by the use of this comparative method. The method itself is so beset with fallacies that any conclusions based upon it must be received with caution. In the first place it is a mistake in this connection to treat the first year of life as one age-period. It is really a collection of age-periods, the earlier of which differ from the later in mortality rates far more than the whole first year does from any subsequent period. From the infantile life-tables in the 54th Annual Report of the Registrar-General it appears that "the mortality is highest in the first day of life, and then falls rapidly, though still high

¹ "Infantile Mortality and the supply of Humanised Sterilised Milk," a paper read before the Liverpool Medical Institution on March 17, and reported in the *British Medical Journal*, March 26th, 1904.

² *Annual Report on the Health of Battersea*, 1902.

in the remaining days of the first week. The mortality falls enormously in the second week, remains at nearly the same level through the third, and shows a considerable decline in the fourth week. In the second month the mortality is only a small fraction of that in the first month; it then falls more gradually to the end of the 7th or 8th month, after which but little change occurs¹." If, then, the depot children contain a greater or less proportion of infants in the first few weeks of life than the children in the town, the comparison is at once vitiated, for the age-periods are not the same. The real mortality rate can only be calculated from an infantile life-table. Moreover, a year is too long a period on which to base the mortality rate. The population attending the depot is most numerous during the season of greatest risk, namely the third quarter of the year, and the number of deaths, therefore, especially the deaths from diarrhoea, will be disproportionately high. It would be more satisfactory to calculate a separate rate for each quarter. Another difficulty arises from the varying periods during which the children remain on the milk. Many come to the depot upon medical advice while suffering from some disorder, and when recovery takes place the milk is discontinued. To include infants who have attended the depot for not more than a week or two in the depot population, in calculating the ordinary annual mortality rate per 1000, is distinctly unfair to the institution. A rate should be calculated on a group of children of the same age who have attended the depot during the whole period upon which the rate is based.

But assuming the technical statistical difficulties to be overcome, it is doubtful whether we are in a position to form a definite opinion from the results of this method. It may be urged that the mother who will take the trouble to send regularly every day for the milk may be assumed to be more than usually mindful of the welfare of her children, who would, therefore, in any case have had a better chance of survival. To some extent this is true, although the depot method of feeding saves so much labour that it might be expected to attract the less industrious housewives. But there are considerations on the other side. In comparing the institution infants with those in the town, we are comparing a class entirely hand-fed with one containing a very large number of breast-fed infants, and it is not contended that the depot milk is anything but an imperfect substitute for mother's milk. And while nearly all the depot children are drawn from the poorer classes

¹ Newsholme, *Vital Statistics*.

living in the least healthy districts, the town population includes the middle and upper classes amongst whom the infantile mortality is relatively low. More important still is the fact that many of the children begin to use the milk when they are already more or less seriously ill. No less than 50 per cent. of the children attending the Liverpool depots¹ were ill at the beginning of their attendance. The depot death-rate is therefore somewhat analogous to a dispensary death-rate, and the children cannot in this respect be compared with an ordinary child population. It may be that these opposing considerations neutralize each other. The writer's opinion is that the balance is distinctly in favour of the depots, and that the figures quoted above under-estimate rather than over-estimate the value of these institutions. But from a purely statistical standpoint this conclusion cannot be drawn from the figures as they stand. The only way of applying this method so that conclusive results might be expected, would be to calculate by an infantile life-table a death-rate in each quarter for children attending the depot during the whole period of observation, and for hand-fed children of the same class, living in the same district under similar conditions, and exposed to the same influences. It does not appear that such statistics have yet been published.

Another method is to compare the infantile mortality in the town before and after the opening of the depot. This method is employed by Dr Peyroux of Elbeuf in his attacks on the Gouttes de Lait². Taking the nine French towns in which the oldest and most important of these institutions have been established, he has ascertained the proportion of the deaths under one year to the deaths at all ages, and also the proportion per 1000 births, before and after the establishment of the Goutte de Lait. The method of estimating infantile mortality by the proportion of deaths under one year to total deaths is so fallacious that it is surprising that it should have been seriously put forward. Without considering results based on this method we may at once turn to those calculated on the proportion of deaths under one year per 1000 births. Dr Peyroux' figures, which are compiled from the official returns, may be arranged in tabular form as follows³:

¹ Hope, *op. cit.*

² Peyroux, Consultations de Nourrissons et Gouttes de Lait, *La Semaine Médicale*, Paris, December 24th, 1902.

³ In considering these figures it should be borne in mind that still-births are registered in France.

The Infants' Milk Depot

Town	Before the Goutte de Lait		After the Goutte de Lait	
	Years	Deaths under 1 year per 1000 births	Years	Deaths under 1 year per 1000 births
Fécamp	1881—94	214	1895—1900	194
Grenoble	1891—94	168	1895—1901	141
Bourg	1891—98	141	1899—1901	130
Elbeuf	1891—98	284	1899—1900	307
Havre	1891—98	207	1899—1900	219
Nantes	1891—98	182	1899—1901	140
Nancy	1891—99	183	1900—1901	177
Rouen	1891—1900	305	1901	262
Versailles	1891—1900	189	1901	180

From these figures Peyroux contends that “les résultats des Gouttes de Lait sont négatifs à Elbeuf, à Nancy, au Havre; ils sont médiocres à Bourg et à Versailles, un peu plus satisfaisants à Fécamp. Seules, les Gouttes de Lait de Rouen, de Grenoble et de Nantes paraissent avoir donné des résultats positifs.” He will not, however, allow that the results in the latter towns are really positive. He points out that at Grenoble, for instance, in 1891—1901 the mean number of births was 1357 per annum, while the yearly number of infants fed from the Goutte de Lait was only 72, most of whom were not fed from the institution more than three months, and he holds that the Goutte de Lait, therefore, could have had little effect in diminishing the infantile mortality. He concludes, therefore, that on the whole the results of the Gouttes de Lait have been mediocre, and for the reason that “très scientifiques en théorie, ces œuvres ne peuvent rien donner en pratique.”

Assuming for the moment that conclusions as to the value of the Gouttes de Lait can be drawn from these figures, it by no means follows that the results have been mediocre. If the Bourg Goutte de Lait with its small *clientèle* brought down the infantile mortality in Bourg from 141 to 130 per 1000 during three exceptionally hot summers the promoters of that institution have good cause for congratulation. It is, however, doubtful whether any conclusions can legitimately be drawn from these figures. In the first place, as Peyroux has himself indicated, the work of the institutions has been conducted on far too small a scale to produce an appreciable effect during the short period of observation. For instance, the total number of children fed from the Havre Goutte de Lait in 1899 was only 305 while the number of births in the town was 4082. In 1900 the corresponding figures were 304 and 3919¹. The same objection would

¹ Caron, *L'Œuvre des Gouttes de Lait*, Havre, 1903.

apply to any figures based on the movement of infantile mortality in Paris. According to Variot¹ the infantile population of Paris is about 40,000, the number of children attending the various Consultations is not more than about 800 or 900. It is obvious, as Bertillon points out², that the Gouttes de Lait in Paris are too small to produce an appreciable result.

A still more serious objection is that the period of observation is too short. To estimate the value of any measure for the protection of child life, even if conducted on a large scale, by the mortality occurring in the first few years after its adoption is obviously most untrustworthy, as infantile mortality is highly sensitive to varying meteorological conditions and to the epidemic prevalence of such diseases as whooping cough. As a matter of fact, all the Gouttes de Lait selected by Peyroux, except those at Fécamp and Grenoble, began their work either just before or during a period of exceptionally hot summers. The following table shows this clearly for the Goutte de Lait at Havre³:

Town of Havre.

Year	Deaths under 1 year per 1000 births	Deaths under 1 year from diarrhoea per 1000 births	Maximum temperature, June—September
1891	195	66	20·7° C.
1892	227	75	21·1
1893	220	117	21·4
1894	211	116	19·1
1895	215	128	22·9
1896	188	85	20·9
1897	191	115	21·9
1898	223	125	22·5
Goutte de Lait established January 1899.			
1899	212	136	24·1
1900	221	136	22·6
1901	175	94·8	24
1902	191	88·4	19

It is interesting to note that the infantile mortality was higher in 1902 than in the previous year, although the maximum temperature and the diarrhoea rate were comparatively low. This is explained by a very fatal epidemic of measles at the end of 1902.

Further evidence of the fallacies underlying the method we are now considering is afforded by the figures of some of the British milk depots

¹ Variot, *L'Avenir des Gouttes de Lait*, *Archives de Médecine des Enfants*, April 1903.

² Letter to the writer, March 1904.

³ Caron, *op. cit.*

which, unlike the Gouttes de Lait, began operations before or during a period of cold, wet summers. In Liverpool, for instance, the first depot was opened in May 1901, and in the following year a second depot was established and the work greatly extended. The infantile mortality figures of the city show a great and progressive reduction in 1902-3.

Years	Deaths under 1 year per 1000 births
1896-1900	188
1901	188
1902	163
1903	151

The Battersea depot opened in June 1902, and the infantile mortality figures are as follows:

Years	Deaths under 1 year per 1000 births
1897-1901	161.8
1902	136
1903	135

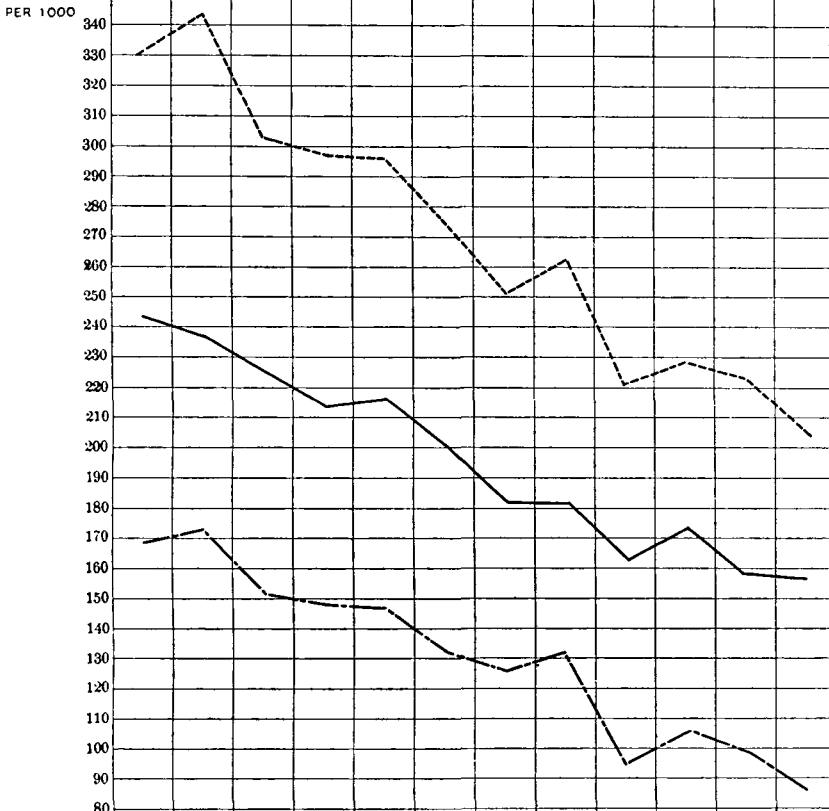
The summers of 1902-3 were exceptionally cold and wet and therefore favourable to the relatively low rates of mortality which prevailed in the country generally. How far the reduction in Liverpool and Battersea was due to the weather or to the depots it is impossible to say, but there is no reason to doubt that the former was the preponderating condition.

The fallacies which occur when too short a period of observation is taken are more serious than those arising from the small number of children fed from the depot, for though the number actually may be small, the educational influence of the depot, which some consider its most important effect, may not be inconsiderable if its operations extend over a fairly long period. It will be noted that at Fécamp and Grenoble, the two oldest of the institutions mentioned by Peyroux, there was an appreciable reduction in the mortality which appears to be independent of weather conditions. Would it not be possible, then, to draw reliable conclusions from the movement of infantile mortality provided that the depot had been at work for, say, a decennium though only working on a comparatively small scale? In this connection the New York figures are of interest. The Straus Milk Charity was established in 1893 and has since steadily increased its area of operations. Compared with the enormous population of New York the number of children fed from the 14 depots may be small, but its

THE DECLINE IN MORTALITY IN NEW YORK OF INFANTS UNDER 1 YEAR AND THE AGENCIES WHICH HAVE CONTRIBUTED TO IT.

— MORTALITY FROM ALL CAUSES FOR YEAR.
 - - - MORTALITY FROM ALL CAUSES FOR JUNE, JULY, AUGUST AND SEPT.
 — MORTALITY FROM DIARRHOEA FOR JUNE, JULY, AUGUST AND SEPT.

YEAR	1891	1892	1893	1894	1895	1896	1897	1898	1899	1900	1901	1902
MAX. TEM.	96°	97°	95°	96°	97°	98°	93°	100°	95°	97°	100°	90°
MEAN T. JULY, AUG.	74°	76.7°	73.5°	72.7°	74°	76.5°	74.5°	75.7°	75.6°	76.39°	75.6°	72.9°



	STRONG					VAN WYCK					LOW		
*	**	***	****	*****	****	****	****	****	****	****	****	****	CITY ADMINISTRATIONS.
*	**	***	****	*****	****	****	****	****	****	****	****	****	STERILIZATION OF MILK.
*	**	***	****	*****	****	****	****	****	****	****	****	****	MILK INSPECTION.
*	**	***	****	*****	****	****	****	****	****	****	****	****	STRAUS MILK CHARITY.
*	**	***	****	*****	****	****	****	****	****	****	****	****	ST. JOHN'S GUILD.
*	**	***	****	*****	****	****	****	****	****	****	****	****	OTHER FRESH AIR CHARITIES.
				***	***	***	***	***	***	***	***	***	STREET CLEANING.
				**	**	**	**	**	**	**	**	**	GARBAGE AND REFUSE REMOVAL.
		*	*	***	***	***	***	***	***	***	***	***	DIPHTHERIA ANTITOXIN.
	*	*	*	*	**	**	**	**	**	**	**	**	ASPHALT PAVEMENTS.
						*	*	*	*	*	*	*	RECREATION PIERS.
						*	*	*	*	*	*	*	SMALL PARKS.
*	*	*	*	*	*	*	*	*	*	*	*	****	IMPROVED TENEMENT CONDITIONS.

educational effect extending over 10 years has probably been not inconsiderable. To what extent then has the remarkable reduction in the New York infantile mortality in the last decennium been due to the Straus depots? The complexity of this problem is at once apparent from a consideration of the chart on p. 357, which was compiled by Dr Rowland G. Freeman, Mr Straus' chief medical adviser¹.

It appears that the Straus Milk Charity was not the only ameliorative influence which came into operation after 1893. Since that date the quality of the milk supplied in the city has improved, sterilization of milk has become general², many streets have been paved with asphalt, a better system of refuse removal has been introduced, open spaces have been provided, anti-toxin has come into use, the condition of the tenement-houses has been improved, and the St John's Guild and other similar organizations have been the means of providing sea-trips for many thousands of children in New York during the hot weather in July and August. How is it possible to isolate the Straus depots from these agencies and measure their influence on the decline in the infantile mortality? It would seem, then, that the method of comparing the mortality in the same town before and after the establishment of the milk depot may be unreliable even if a fairly long period of observation be taken unless a searching analysis be made of the local conditions.

The third, and perhaps the most promising, of the purely statistical methods is to compare the movement of infantile mortality in the district before and after the establishment of the depot with that in neighbouring districts containing no depot but in other respects similar. Paffenholz gives figures compiled on this method for the depot at Yonkers, N.Y., U.S.A., which was opened in 1895. The figures relate to Yonkers and three other suburbs of New York³.

¹ Freeman, *The Reduction in the Infantile Mortality in the City of New York, and the agencies which have been instrumental in bringing it about*, *Medical News*, New York, Sept. 5th, 1903.

² Sterilization of milk is now so generally practised in the tenements of New York that the investigators of the Rockefeller Institute, an account of whose work is given on pp. 359, 360, discovered that, "In the summer of 1902 especially it was rare to find an infant fed on raw milk." This perhaps has been the chief factor in the decline in the mortality.

³ Paffenholz, *Wichtige Aufgaben der öffentlichen und privaten Wohlfahrtspflege auf dem Gebiete des künstlichen Ernährung des Säuglings*, Bonn, 1902.

Period	Hoboken 55,000 pop.		Long Island City 40,000 pop.		Newburgh 26,000 pop.		Yonkers 38,000 pop.	
	Deaths		Deaths		Deaths		Deaths	
	Under 5 years	From diarrhoea	Under 5 years	From diarrhoea	Under 5 years	From diarrhoea	Under 5 years	From diarrhoea
June, July, August and September in each year								
1892—95	289	104	225	90	75	30	162	91
1896	352	110	257	115	72	43	135	48
Difference	+63	+6	+32	+25	-3	+13	-27	-43

The period of observation is, however, too short; it would be interesting to know what happened after 1896. And further information is needed as to the prevalence of epidemic disease in the various districts and other local conditions before any conclusions can be drawn from these figures.

It would appear, then, that each of these three statistical methods is beset with fallacies, but it does not follow that a purely statistical method is inapplicable. Where the work of the depot has been conducted on a sufficiently large scale and for a sufficient length of time, conditions which do not appear to have been fulfilled in the case of any existing institution, it may be possible to trace its influence on the mortality figures provided that the investigations are conducted by persons adequately acquainted with the local conditions.

The best method, however, is to institute an investigation—clinical, pathological and statistical—somewhat on the lines of the enquiry lately conducted by Park and Holt in New York¹. The objects of this enquiry were: “(1) To make a comparison of the results of infant feeding in tenements in winter and summer; (2) to determine how far such results were affected by the character of the milk used, especially its original bacterial content, its preparation, and whether it was fed after heating or raw; (3) to see to what extent results were modified by other factors such as the care the infants received and the surroundings in which they lived.” The clinical observations were made during the summers of 1901–02 and the intervening winter by ten physicians, each of whom had a group of about 50 children under observation for periods of about 10 weeks. The children were visited twice a week and their weights taken at regular intervals. No child was ill or suffering from marasmus when the observations began. The total number observed was 632;

¹ Park and Holt, *op. cit.*

340 were six months old or under, 265 from seven to twelve months and 47 a little over twelve months. Many of the infants received breast-feeding at night, and all of course were under regular medical supervision during the period of observation. The statistical results of this enquiry are tabulated below. It should be said that the store milk was in nearly all cases heated in the summer; usually it was raised to nearly boiling point. In the winter in about half the cases some method of partial sterilization was employed. The condensed milk was almost invariably prepared with boiled water.

	Summer observations		Winter observations	
	Good results	Bad results	Good results	Bad results
Store Milk	56 %	44 %	96 %	4 %
Bottled Milk	61	39	94	6
Condensed Milk	60	40	92	8
Milk from Central Distributing Stations	81	19	93	7

These figures are not intended to indicate strict numerical differences. There are obvious statistical objections; for instance, it is not stated whether the age-periods were the same in each group. The observers, however, regard them as comparable, and as indicating a real and marked difference between the results with the milk from the central stations, *i.e.* the Straus depots and similar institutions, and those obtained with the other forms of feeding. The difference is attributed to the fact that at the Milk Depots a certain amount of supervision was exercised over the infants¹, and some systematic attempt at milk modification was made. "Again, what contributed in no small degree to success with this plan of feeding was that this milk was supplied in separate bottles for each feeding, that the quantity for one feeding was suitable for the child, and that only a proper number of feedings for the 24 hours was dispensed at one time. There was not, therefore, the temptation to over-feeding and too frequent feeding which with other methods are so generally practised."

In addition to the statistical reports the physicians were asked to state their own conclusions as to the general problem of infant feeding in tenements. Their opinions founded on their clinical experience are, as Park and Holt say, most suggestive. The unanimous opinion was that the most important factor in securing good results is intelligent care; but as regards the various methods of feeding studied the physicians have no doubt as to the superior advantages of the milk

¹ But all the children in this investigation were under some supervision by the physicians making the observations.

depots. "Of the methods of feeding now in vogue, that by milk from central distributing stations unquestionably possesses the most advantages in that it secures some constant oversight of the child, and since it furnishes the food in such a form that it leaves the mother least to do it gives her the smallest opportunity for going wrong. This method of feeding is one which deserves to be much more extensively employed, and might, in the absence of private philanthropy, wisely be undertaken by municipalities, and continued for the four months from May 15th to September 15th."

This testimony of the New York clinicians is perhaps the best evidence in favour of the Infants' Milk Depot that has yet been published.

Objections.

It may now be useful to briefly consider some objections which have been brought against these institutions. In France they have chiefly been attacked on the ground that they encourage artificial feeding at the expense of breast-feeding. No evidence, however, has been brought forward to substantiate the charge. As a matter of fact, in all the milk depots of which the writer has any knowledge the mothers are distinctly given to understand that the milk should never be used in preference to mother's milk, which they are told is the proper infant food. But the charge of discouraging breast-feeding may be brought with equal justice against all measures which tend to improve artificial infant feeding. From this standpoint the promoters of the *Goutte de Lait* are no more blameworthy than those who seek to improve the condition of the milk supply, who invent appliances to simplify home modification, or educate mothers in the principles of artificial feeding; while the worst offenders are the American physicians, who have done so much to improve and systematize artificial infant feeding. Those who bring this charge against the milk depot must logically apply it to all improvements in artificial feeding, and thus place themselves in the position of the extreme temperance reformers, who regard anything short of the complete extirpation of alcoholic beverages as a mere parleying with vice more productive of harm than good¹. We must

¹ At the same time the writer warmly sympathises with the desire to encourage breast-feeding which animates those who bring this charge. There can be no doubt that the difference between breast-feeding and hand-feeding is very great and implies far more than questions of digestibility and contamination. Ehrlich's theory of immunity has given rise to lines of research the results of which show that profound differences exist between

realize that at the present time artificial feeding is in many cases a necessary evil; the only question is whether it shall be well or badly done—the latter alternative entailing an immense loss of life.

It has also been objected to the English milk depots “that for a municipality to furnish a sterilized milk supply raises special difficulties as to the function of a municipality, which surely should be to control the milk supply and insist upon its purity rather than to itself trade in a sterilized milk¹.”

It would seem that objections of this nature would apply equally to a municipal supply of water or to the municipal provision of slaughter-houses, both of which measures are wrong if the function of a municipality be merely to control private traders. And it is questionable whether it is profitable in this connection to consider very closely the difficulties which may arise as to the precise “function of a municipality.” In attempting to assess the value of any given administrative measure having for its object the saving of human life it is surely preferable to regard its effect on the public health as the all-important consideration. The question properly falls within the province of preventive medicine, and there appears to be no necessity to enter the region of political science in search of a determination of the “function of a municipality².”

But the controlling and supplying functions are not antagonistic. Liverpool “trades in a sterilized milk,” but Liverpool was one of the first municipalities to take action in the reform of the milk supply. The large towns, however, are at a disadvantage, as practically all their milk comes from the country and most of it is already contaminated before reaching the town. In the rural districts the regulations for the control of the milk supply are practically inoperative, and it cannot be the blood and other fluids of different species, and that these differences extend to milk. It is said that mother's milk contains anti-bodies—a fact which explains the immunity of sucklings from infectious disease, and there are probably other fundamental biological differences. It is highly improbable that the milk of another animal can ever adequately replace human milk. It is greatly to be deplored that there has been no organized effort to encourage breast-feeding in this country. Much might be done to imitate the example of the French in this respect. A “Consultation de Nourrissons” should be established in every town as complementary to the Milk Depot. The Factory Act might with advantage be modified so as to extend the period during which a woman is excluded from work after childbirth, provision being made to secure from pecuniary loss all women who could produce satisfactory evidence that they were suckling their infants.

¹ Swithinbank and Newman, *Milk Bacteriology*, p. 503, 1903.

² It will be noted that the New York physicians engaged in the investigation conducted by Park and Holt came to a different conclusion as to the functions of a municipality in relation to the prevention of infantile mortality. See p. 361.

said that there are indications of improvement in the near future. A reliable bacterial standard would remove many difficulties, but the authors of the standard English text-book think that "the time has probably not yet come for fixing a minimum standard of the number of organisms permissible, or for prosecution if that standard be passed¹." Clean milk is, of course, the desideratum, but the difficulties in the way of securing a clean milk supply have been greatly under-rated. It is not merely a question of clean well-constructed cow-sheds. The production of clean milk involves the careful grooming (at 4, or even 2 a.m.) of an excessively dirty animal, and the observance of strict cleanliness of person and utensils by the employees handling the milk. Any observant person who has watched the ordinary process of milking, and noted the standard of cleanliness of cows and milkers, must surely agree that if manure and other filth is to be kept out of milk it will be necessary either to effect something like a revolution in the personal habits of the employees in the milk trade, or to substitute persons of a higher social standing, who may be relied upon to maintain the necessary standard of cleanliness and observe a reasonable reticence in the matter of expectoration in the absence of external compulsion.

But assuming these difficulties in the way of clean milk production by private enterprise to be solved, at what price will the milk be sold? Chapin, who writes with authority on this subject, appears to regard a rise in price as inevitable and the attempt to improve "grocery milk," therefore, as "almost hopeless."

"Legislation cannot compel a farmer to produce his milk at a loss, and the population that consumes 'grocery milk' would vote out of office authorities that prohibited its sale or advanced its cost"..... "Farmers cannot be expected to take additional care of their milk without extra compensation. Higher prices to the farmer is the solution of the milk problem, and the dealer should also have extra compensation for any additional labour and care on his part²."

The fear of being "voted out of office" exists on this side of the Atlantic, and is one of the factors to be reckoned with by the reformer. If the agitation for "clean milk" results in raising the price of milk so as to take it beyond the reach of the poor the milk reformers will have done more harm than good.

Let it be granted, however, that clean milk at ordinary prices is brought to the door of the consumer, is the problem of the prevention

¹ Swithinbank and Newman, *op. cit.*

² Chapin, *The Theory and Practice of Infant Feeding*, 1903.

of contamination solved? By no means, for, as we have already seen, in diarrhoea the contamination takes place largely, if not chiefly, in the home of the consumer. One of the chief advantages of the milk depot is that the milk is supplied in such a way as to reduce the possibility of contamination within the home to a minimum. But here another objection is raised. It is contended that home contamination is best prevented by educating mothers and the elder school-girls in the methods of artificial feeding, and in the care of infants generally¹. Provided that the curriculum includes instruction in the enormous advantages of breast-feeding—a point somewhat neglected by English writers—the writer fully accepts this statement, but he would point out that there is no antagonism between the Milk Depot and education. On the contrary the depot is in itself an important educational influence. It is, as Variot urges, “Une école d’Alimentation.” And the diseases due to ignorance are far from being limited to those depending on imperfect infant feeding. The prevalence of tuberculosis and small-pox would be immensely diminished if the public were adequately instructed as to the proper preventive measures, but pending the arrival of that period of enlightenment a compulsory vaccination law has its uses even in Germany. At the present time it is unsafe to rely on educational methods only for the prevention of any disease.

We may conclude, then, that the real objects in connection with artificial infant feeding at which the sanitary authority should aim are (1) clean milk, and (2) the education of present and future mothers, but that the attainment of these objects is a matter of very great difficulty; and if it be admitted that pending such attainment the Infants' Milk Depot fulfils a useful function we must also conclude that its period of usefulness will certainly be protracted.

Another objection brought against the English depots is that inadequate provision is made for the medical supervision of the infants. It is urged that regular weighing and inspection by a medical practitioner should be insisted on in all cases, as in some of the Gouttes de Lait. Niven has some valuable suggestions on this point². It must

¹ Swithinbank and Newman, *op. cit.* See also Niven, *Annual Report on the Health of Manchester*, 1902.

² *Op. cit.* Niven's suggestions as to the methods on which a milk depot should be conducted are as follows:

1. The milk must be obtained from farms kept under inspection by the Corporation, and preferably managed by the Corporation.

2. When modified and sterilized it should be sold at paying prices except to persons willing to submit to certain rules.

be confessed that improvements in the practice of the depots in this respect are desirable, but at the same time it is important to avoid anything like undue restriction, otherwise a prejudice against the depot is raised. It does not follow that methods which are practicable in France will succeed in this country, where there is a strong feeling against official regimentation. And it is important that any steps in this direction should be taken with the cordial co-operation of the local medical practitioners; otherwise success will certainly not attend the depot.

Another objection deserves consideration. It is contended that when a municipality undertakes a supply of milk, the sources of the supply should be subject to strict supervision and control, and that only milk of a high degree of bacteriological purity should be used. This is, of course, indisputable, and it must be admitted that there is room for improvement in this respect. In the Straus depots in New York, however, the milk is certified by the Milk Commission and is of a high standard of purity. In some of the Gouttes de Lait great care is exercised to obtain clean milk. The milk for the Rouen Goutte de Lait comes from a model cow-shed where the conditions are excellent, and is transported to the city in special motor-waggons¹. In Liverpool and Battersea, to name only two of the British depots, the contractors are under special regulations.

But it must be admitted that it is easier to lay down regulations than to ensure their fulfilment, and the writer entirely agrees with Niven's suggestion that the farms from which the milk for a municipal milk depot is drawn should be municipal institutions under the direct

3. These rules should include systematic weighing of the infant, inspection of the house, and supervision by officers of the Corporation.

4. A written undertaking must be given to keep up the feeding of the child for a period of not less than three months with milk obtained from the depot; to give the infant no other food whatever, and if it is desired to give up the method of feeding to lodge at the Health Office a statement of the reasons why the mother desires to be released from her undertaking.

5. The person assisted must also undertake to carry out the other instructions given by the visiting officer of the Corporation in the management of the infant.

6. The Corporation to provide adequate means of supervising the application of the milk supplied, and to keep a record of the condition of the children supplied with modified and sterilized milk.

7. Where the milk is supplied at a paying price no supervision should be maintained or agreement entered into.

¹ Une Vacherie modèle annexée à la Goutte de Lait de Rouen, *La Clinique Infantile*, Paris, January 15th, 1904.

management of the responsible officers of the sanitary authority. In this connection it is interesting to note the experience of the city of Rochester, N.Y., U.S.A. In 1897 the municipality began a supply of milk on methods similar to those afterwards adopted in this country. At first the milk was sterilized or pasteurized, but in 1899 the following plan was adopted :

“A central station at which the milk is prepared is organised each season on a farm outside the city, where a trained nurse and assistants have full control of the cows, utensils, bottles, etc., and where all of the milk work is carried on in a portable milk laboratory. Everything coming in contact with the milk is thoroughly sterilised in steam sterilisers. The milk itself is not subjected to any pasteurising or sterilising process. Sterilising and pasteurising are only an open invitation to the milkman to be careless in the production and handling of milk.

“At the milk station on the farm the milk is taken from clean, well-fed, tested cattle into sterile cans, which are carried to the barn in sterile cheesecloth bags. Just before milking the cows' udders are washed. A sterile cheesecloth fly cover is placed over the cow, the first portion of the milk being rejected. So soon as the cans are filled they are immediately covered by a layer of cheesecloth held in position by a rubber band. The cans of milk thus covered are immediately taken from the barn into the laboratory, about 200 yards away, where the milk is properly diluted, sweetened, and turned off into sterile nursing bottles of various sizes of the Siebert type. The bottles are corked with sterile rubber corks, placed in racks, covered with cracked ice, and immediately transferred to the city for use. Of the cleanliness of milk prepared in this way, 43 daily samples were found to average not more than 14,000 bacteria per cubic centimetre, while city milk for the same period approximated 235,000 bacteria per cubic centimetre¹.”

These methods are far in advance of anything which has been done by the British municipalities, and it is much to be hoped that they will be introduced into this country. Not only would the necessity of any heating process be removed (and with it the charge of disseminating scurvy², a danger which has been greatly exaggerated) but an object-lesson could be given in methods of clean milk production which would give an immense impetus to the movement for the reform of the milk supply now on foot in this country.

¹ “The Influence of the Municipal Milk Supply on the Deaths of Young Children.” Dr Goler, Health Officer, Rochester, N.Y., U.S.A., *New York State Journal of Medicine*, December 1903.

² Ashby, *British Medical Journal*, February 27th, 1904.

APPENDIX.

Dr Dufour gives the following list of towns in which Gouttes de Lait are either projected or actually established¹:

France (65 towns) as follows:

Aix—Albert (Somme)—Alger—Alençon—Amiens—Alfortville—Anzeville par Cartenay—Avignon—Barentin—Bellevue (Seine)—Besançon—Bolbec—Bordeaux—Bourgoin (Isère)—Biarritz—Bléville (près Le Havre)—Beauvais (Oise)—Boulogne-sur-Mer—Bourg—Caen—Cahors—Castres—Cambrai—Chateauneuf (Nièvre)—Châlons—Châtellerauld—Clermont-Ferrand—Deville-les-Rouen—Dunkerque—Elbeuf—Epernay—Jouy-en-Josas—Le Havre—Le Mans—Lille—Les Ponts-de-Cé (Maine-et-Loire)—Lobrosse (près Auxerre)—Lorient—Melun—Marseille—Moulin—Nantes—Nancy—Nice—Orléans—Paris—Poitiers—Rouen—Reims—Rennes—Roanne—Saumur—Sarlat—Saint-Just—Saint-Nazaire—Saint-Martin-Vésuby—Saint-Pol-sur-Mer—Saint-Germain-en-Laye—Tours—Toulon—Toulouse—Tourcoing—Versailles—Valence—Vinsobres (Drôme).

Other European countries (35 towns) as follows:

Antwerp—Athens—Battersea—Berlin—Bucarest—Bigheur (Belgium)—Brussels—Barcelona—Cadiz—Crasiova (Roumania)—Corélare (Portugal)—Düsseldorf—Florence—Gand—Geneva—Halle—Kœnigsberg—Lisbon—Liverpool—Lozen—La Haye—Mannheim—Madrid—Naples—Odessa—Pfozheim (Baden)—Parbou—Rome—Stockholm—Schwabgmund—Saint Helens—Tennesway—Turin—Varna (Bulgaria)—Zurich.

America: Buenos Ayres—Santiago—Montevideo—Montreal.

Asia: Bombay.

Africa: Canary—Constantine.

In addition to the above list, Milk Depots have been established in the following towns:

Great Britain: Ashton-under-Lyne—Bradford—Dukinfield—Leith—York. The Corporations of Glasgow and Dundee have decided to establish Milk Depots.

United States: Chicago—New York—Philadelphia—Rochester, N.Y.—Yonkers, N.Y.

¹ *La Clinique Infantile*, Paris, November 1st, 1903.

EXPLANATION OF PLATES XVIII.—XXIV.

- PLATE XVIII. This illustration indicates the three main features of the work of the Goutte de Lait, viz. (1) systematic weighing of the infant, (2) regular medical supervision, (3) distribution of sterilized milk. This Goutte de Lait was established by Dr Variot in 1892 at the Belleville Dispensary, Paris.
- PLATE XIX. The Brussels Goutte de Lait or "Laiterie Maternelle" was founded in 1897 by Dr Eugène Lust. This illustration is reproduced from Dr Lust's *Contribution à la Puériculture*, Brussels, 1903.
- PLATE XX. The Liverpool Corporation's Depot at Earle Road was opened in 1902. It is the largest and most completely equipped depot in this country.
- PLATE XXI. In this illustration the machine for weighing the babies is shown on the lowest shelf. Affixed to the second shelf is the butyrometer by means of which the milk is tested for fat every morning.
- PLATE XXII. The task of filling several thousands of small bottles daily involves considerable labour even when a good machine is used. In this appliance the milk is first poured into the large receiver at the upper part of the machine whence it flows into the row of cylinders. When the handle at the right of the machine is pulled the milk is discharged into the bottles below. The quantity per bottle for each set of bottles can be easily regulated.
- PLATE XXIII. In this plate the six different quantities per bottle supplied at the Liverpool depots are indicated. The stopper of each bottle is protected by an adhesive printed label before leaving the depot.
- PLATE XXIV. This illustration shows the loaded trolley entering the sterilizing chamber. The door is then drawn down and securely clamped, and steam is injected through the pipe in front of the machine. The bottle-filling appliance is shown standing on the left-hand trolley.
- PLATES XX.—XXIII. are from photographs kindly supplied by Dr Hope, Medical Officer of Health of Liverpool; Plates XX. and XXI. appeared in Dr Hope's Annual Report on the Health of the City of Liverpool, 1901. The writer's thanks are due to Dr Hope for permission to reproduce these plates, and to Dr Lust for permission to reproduce Plate XIX.



“ L'Œuvre de la Goutte de Lait ” (Belleville Dispensary, Paris).
From the painting by M. Jean Geoffroy, exhibited in the Paris Salon in 1903, now the property of the municipality of Paris.



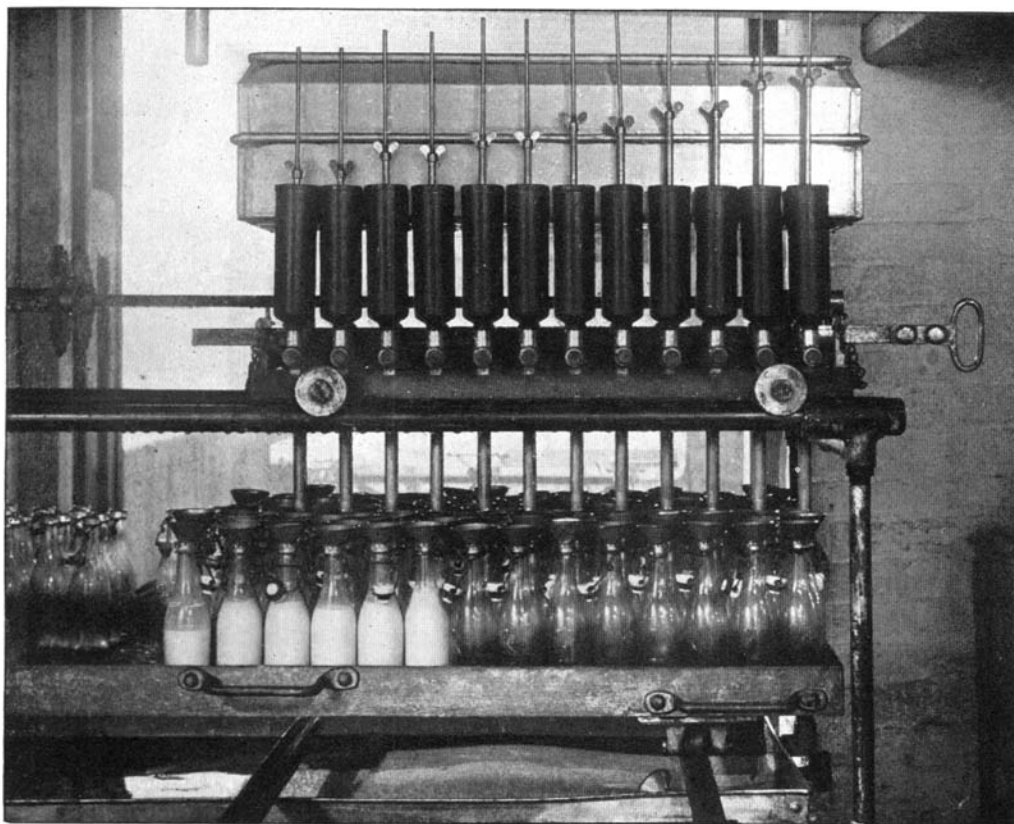
Group of mothers and babies in the "section gratuite" of the "Laiterie Maternelle," Brussels.



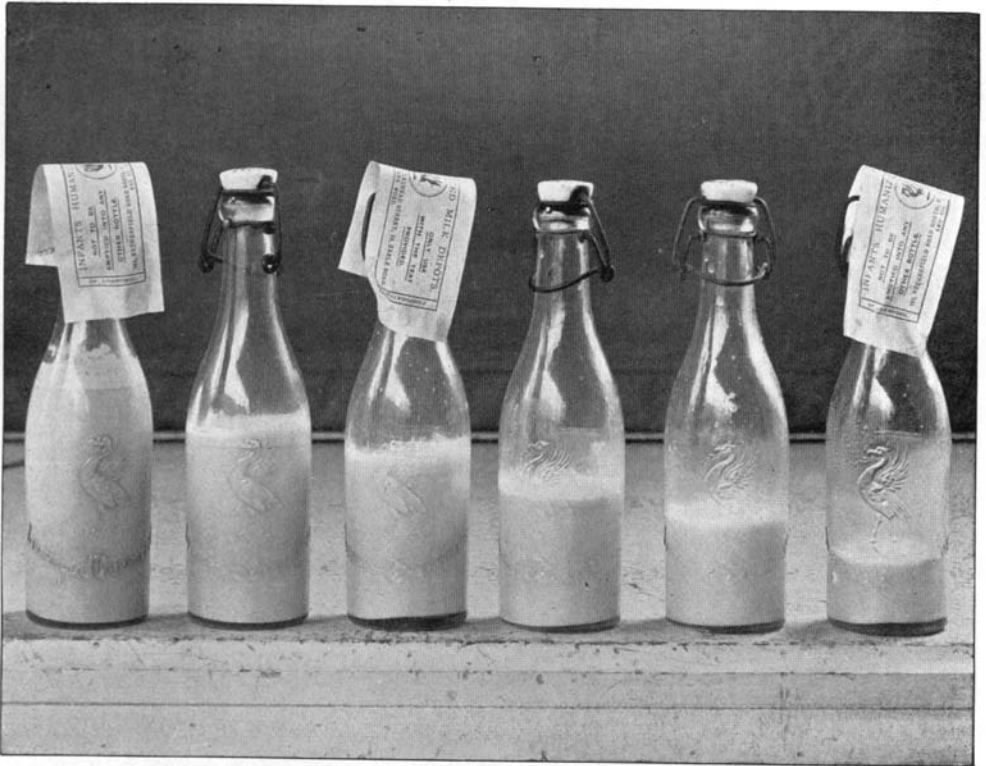
Exterior of Infants' Milk Depot, 52, Earle Road, Liverpool.



Infants' Milk Depot, Earle Road, Liverpool. Corner of interior of Shop.



Infants' Milk Depot, Earle Road, Liverpool. Bottle-filling machine.



Bottles of milk supplied at the Liverpool Milk Depots, showing the different quantities supplied to children at different ages.



Infants' Milk Depot, Battersea. Interior of sterilising room, showing steriliser with loaded trolley.