252,000 units had been injected, but not after 105,000 units. Thus it may be possible to protect a person by the prior injection of pseudo-cholinesterase, but to obtain a prolonged protection the dosages will have to be large. In none of the patients did we discover any excretion of pseudo-cholinesterase in the urine.

We have elsewhere dealt with the suggestion that thiopentone was the true causative agent in increased sensitivity to succinylcholine (Evans, Gray, Lehmann, and Silk, 1952b); it will be noted that, at least in Case 1, thiopentone was injected before the succinylcholine was given, with and without cholase; the difference in the duration of apnoea can therefore not have been connected with thiopentone. Hall, Lehmann, and Silk (1953) also paid particular attention to this point in their work on dogs, and have excluded apnoea due to thiopentone or to artificial respiration in the animals. We performed a special test on one of us (P. W. S. G.), in whom we injected succinylcholine without prior thiopentone. We have referred to this briefly before (Evans *et al.*, 1952b); here are the details of this experiment:

Man aged 30, weight 15 st. (95.3 kg.). Blood enzyme levels: Ps.ChE., 82 units; Tr.ChE., 136 units. 10 mg. succinylcholine chloride injected; *apnoea of 40 seconds* followed. One week later: Blood enzyme levels: Ps.ChE., 95 units; Tr.ChE., 129 units. 3 ml. pseudo-cholinesterase (63,000 units) injected. Blood enzyme levels: Ps.ChE. 122 units; Tr.ChE., 123 units. 10 mg. succinylcholine chloride injected; this was followed by *no apnoea*.

Since our last publication dealing with two patients (Evans *et al.*, 1952a) we have seen more cases in which a prolonged effect of succinylcholine could be explained by the finding of a low pseudo-cholinesterase level in the serum. There were, however, two patients in whom the enzyme level was normal; both were suffering from cancer and inanition, and had altered electrolyte values in the serum—particularly a low serum potassium. It is conceivable that in such patients a paralysis of muscles will not be easily reversed, because of a loss of excitability. Recently nikethamide was recommended as an antidote against succinylcholine (Barron, 1952); it is possible that it was of use in this type of case. Nikethamide has not been seen by us to lower the response to succinylcholine in man *in vivo* or to have an effect on either true cholinesterase or pseudo-cholinesterase *in vitro*.

Summary

The injection of pseudo-cholinesterase shortens the apnoeic response to succinylcholine. Not all the pseudo-cholinesterase injected can be recovered in the plasma; 20,000–50,000 units are "leaking" into the tissues within a few minutes. In one patient who received 252,000 units (equivalent to about 2.5 litres of plasma) the serum enzyme level was still raised after 24 hours, but no enzyme was found in the urine.

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The history of King Edward VII's Hospital for Officers is the subject of an interesting booklet recently published. The hospital was founded by Miss Agnes Keyser ("Sister Agnes") during the Boer War. King Edward, a personal friend of Miss Keyser, fulfilled the last social engagement of his life at the hospital, of which he was patron. The booklet (price 2s. 6d.) is obtainable from the hospital, now at Beaumont Street, London, W.1, and proceeds from its sale will be devoted to the funds of the hospital.

BREAST-FEEDING IN THE OXFORD CHILD HEALTH SURVEY

PART I—A STUDY OF MATERNAL FACTORS

BY

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The present investigation relates to 574 mothers* who regularly attended the Oxford Child Health Survey for at least a year. Its purpose is to compare the circumstances of mothers who failed to establish or maintain lactation with those who succeeded in feeding their babies for several months. It will shortly be followed by a descriptive account of the effect on the babies of breast- as opposed to bottle-feeding.

Prevalence of Breast-feeding

None of the mothers failed to put their babies to the breast at least once, but lactation had ceased in 88 within four weeks of delivery, and a further 82 had weaned their babies before the age of 4 months. At the opposite end of the scale there were 70 mothers who gave their babies nothing but breast milk for six months or longer, and 53 who were still giving their babies some breast milk after the age of 10 months. The mean duration of complete breast-feeding was 5.3 months (± 3.62) and of partial breast-feeding (weaning period) 3.7 months (± 1.90).

There was a general tendency for mothers who weaned their babies early to do so quickly, and for mothers who weaned them late to do so slowly. Thus half the babies breast-fed for more than six months had a weaning period which exceeded twelve weeks, whereas nearly two-thirds of the babies who were given bottle feeds within four weeks of birth were completely weaned in less than three weeks.

Compared with recent surveys in this country, the prevalence of breast-feeding is high (see Bibliography). In view of the method of recruiting into the Child Health Survey (Stewart and Russell, 1952) this is unlikely to be a characteristic of all Oxford mothers.

Factors Associated with Breast-feeding Habits

In the following account three groups of mothers will be distinguished: (1) those who did not begin weaning until their babies were over 4 months old (53.8%); (2) those who maintained complete breast-feeding for more than three weeks but less than four months (30%); and (3) those in whom lactation was never firmly established (16.2%).

Age and Parity

In the National Survey of all babies born in England and Wales during the week March 3–9, 1946 (Royal College of Obstetricians and Gynaecologists, 1948) it was found that, after standardizing for social class and parity, there was no consistent relationship between the age of the mother and the duration of breast-feeding, but first babies were breast-fed longer than other babies. Hughes (1942, 1948), and Dummer (1949) also found that the incidence of breast-feeding was higher among primiparae, but Norval (1947) and Dykes (1949, 1950) found no relationship between breast-feeding and parity, and Neale *et al.* (1943) thought that first-born babies had less breast milk than other babies.

In the present investigation there were 264 primiparae, of whom 111 were under 25 years and 20 over 34 years. In these two age groups 11% and 25% respectively failed to

*There are 580 babies in the Survey Group, but five were adopted and two were twins.

establish breast-feeding, and 42% and 35% maintained it for more than four months. The corresponding figures for primiparae of intermediate age were 9% and 65%.

For multiparae there was no distinction by age, but mothers with two or three children more often maintained lactation for over four months (59%) than either primiparae (53%) or mothers with four or more children (45%), though these differences only reach the 5% level of significance. When both parity and social class (Registrar General, 1938) were taken into consideration two distinctly different trends were revealed. For mothers in social classes I and II the incidence of prolonged breast-feeding increased steadily with increasing size of family; but in all other classes mothers with two or three children had a higher incidence than either mothers with first babies or mothers with four or more children. Despite previous observations to the contrary, there seemed to be no association between spacing of children and breast-feeding habits, but this may be due to the fact that only 30 mothers had produced two babies within a year.

To sum up, the observed relationships between breast-feeding habits, age, social class, and parity suggest that previous experience of maternity has a favourable effect on lactation, but that this is not enough to offset the adverse effects of heavy domestic commitments and a low wage packet.

Physique and Health

Breast-feeding habits were found to bear no relationship to the height or weight of the mothers, or to a combined assessment of physique based on the height/weight ratio ($Ht\sqrt[3]{Wt.}$). There was, however, a close association between health and lactation. Thus, 58% of mothers whose health was uniformly good after delivery breast-fed their babies for more than four months and only 14% failed to establish lactation. The corresponding figures for mothers whose post-natal health was poor are 38% and 24% respectively. These differences reach the 1% level of significance. No definite relationship between health and social class could be established, but there was a definite tendency for health to deteriorate with age and with succeeding pregnancies.

Social and Economic Circumstances

The relationship between social class and breast-feeding has been variously interpreted in different parts of the country. In the National Survey there appeared to be a distinct social gradient, mothers in the professional and administrative classes being more successful in establishing and maintaining breast-feeding than working-class mothers. Gordon (1942) at Ilford and Ross and Herdan (1951) at Bristol found the same tendency, but Robinson in Liverpool, Dummer in Hitchin, and Dykes in Luton found no consistent association between social class and lactation.

In the present survey 66% of the mothers in social classes I and II completely breast-fed their babies for more than four months, compared with 54% in social class III and 44% in social classes IV and V. The same trend was observed in respect of the period of partial breast-feeding, but in social classes IV and V a disproportionately large number of mothers continued to feed their babies for more than nine months. This tendency for a low general prevalence of breast-feeding to be associated with a high late prevalence is apt to cause confusion when comparing the breast-feeding habits of different groups of mothers.

As it was possible that an occupational classification no longer provided a reliable index of material prosperity, an alternative "amenities rating" was applied to the survey mothers (Stewart and Russell, 1952). The object of this was to distinguish mothers who enjoyed the best opportunities for child-bearing from those whose commitments or lack of facilities handicapped them in any way. The rating was based solely on objective criteria and took into consideration such things as the structural repair of the house, the water, sanitary and cooking arrangements, garden facilities, the number of persons per room, the presence of other young children, lodgers, "in-laws," paid helpers, etc. According to this index, 20% of the mothers were favourably situated, and 56% moderately and 24% severely handicapped. The corresponding proportions for prolonged breast-feeding were 64%, 54%, and 43%, differences which are significant at the 1% level.

The individual components of the amenities rating appear to have a cumulative effect. Thus, the relationships between household density—that is, persons per room—and lactation, and between outsiders in the home and lactation, were of the same order but of doubtful significance; but no direct association between the duration of breast-feeding and the presence or absence of a paid domestic helper could be demonstrated. There was little to distinguish mothers who shared the house with "in-laws," mothers who took in lodgers to make ends meet, and mothers who were themselves lodgers in someone else's house; but compared with mothers who had a house to themselves the overall incidence of breast-feeding was low in all three groups.

Wages and housekeeping allowances were not incorporated in the amenities rating, since no figures were available for one-fifth of the mothers; but within the group which was assessed there seemed to be no consistent relationship between the amount of money spent on food and breast-feeding habits.

Only 38 mothers resumed gainful employment before the babies were 4 months old. In this small group the incidence of breast-feeding was exceptionally low, but how many of these mothers deliberately stopped feeding their babies and how many would not have continued in any case is not known. There were eleven unmarried mothers, five of whom continued to breast-feed their babies for over four months.

Maternal Efficiency

Marks were awarded for maternal efficiency on the basis of a number of subjective assessments concerning the appearance of the house and the child on three home visits made during the first year (Thwaites and Sutherland, 1952): 64% of the mothers scored 12 (full marks), 27.6% scored between 11 and 9, and 8.4% scored fewer than 9 marks. The corresponding proportions for prolonged breast-feeding were 61.1, 51.2, and 24.5%.

Since maternal efficiency is correlated not only with social class but also with health, parity, and the amenities rating, it is difficult to assess the significance of its association with breast-feeding. Taken at its face value, the relationship suggests that mothers who are good housekeepers have less difficulty in establishing and maintaining breast-feeding than mothers who are always at "sixes and sevens." But whether this is a direct effect or merely due to the fact that "efficiency" is one of the ways in which health, education, income, and appropriate facilities manifest themselves it is impossible to say. Within the group with top marks for maternal efficiency were 47 mothers from social classes I and II who also attended a private mothercraft clinic. No fewer than 35 of these (approximately 75%) maintained full lactation for at least four months. In this clinic great stress is laid on the importance of breast-feeding; small complementary feeds are encouraged until lactation is established, and a long weaning period is advised.

Mode, Place, and Time of Delivery

Less than half the survey babies were born at home. The hospital and nursing-home deliveries included 34 forceps deliveries and 7 caesarean sections; but in spite of this the group as a whole had a relatively high incidence of prolonged breast-feeding (56%). Further analysis of the institutional deliveries showed that the mothers in social classes I and II represented a typical cross-section of the whole survey group in respect of "general health" and "obstetrical emergencies," but the mothers in social classes IV and V included an exceptionally large number of abnormalities under both headings. Both subgroups were mainly composed of primiparae. When the corresponding rates for prolonged breast-feeding were inspected it was found that only 39% of the mothers in social classes IV and V breast-

fed their babies for four months, compared with 68% in social classes I and II. For mothers who were confined at home the overall incidence of prolonged breast-feeding was 50% with no variation in the different social classes.

The babies who were born in the winter and spring (December to May inclusive) were breast-fed longer than babies born in the summer or autumn, but the difference is of doubtful significance ($P<0.20$). Neither sex nor birth weight appeared to influence breast-feeding habits.

Discussion

So interwoven are the factors which influence breast-feeding habits that it is not only impossible to assess their individual contribution but even difficult to distinguish favourable and unfavourable influences. It is, for instance, unlikely that previous experience of child-bearing has anything but a beneficial effect on lactation, but it is not until parity and economic status are separated from one another that the true physiological effect is seen.

The present investigation has shown that mothers with heavy domestic commitments and lack of suitable facilities tend to wean their babies early, but we are still no nearer knowing what in "the complex of adverse circumstances which accompany poverty" (Ryle, 1946) has the most harmful effect. Other observers have failed to establish a direct relationship between lactation and nutrition (Robinson, 1939). It is improbable, therefore, that the observed association is due to malnutrition. It could, however, be due merely to the fact that the commercial advertising of baby foods is more successful in working-class than in professional circles. Once established, breast-feeding is both simpler and cheaper than artificial feeding. It is therefore unlikely that a working-class mother with several children weans her baby merely to "save trouble." On the other hand, breast-feeding can be very tedious in the early days and, other things being equal, a mother with heavy commitments and inadequate assistance is less likely to be successful in establishing lactation than a mother who can devote more time and attention to the new baby.

The relatively high level of breast-feeding among mothers delivered in hospital could be due to a bias in favour of hospitals by mothers who are otherwise favourably situated to establish and maintain lactation, or to the setting itself, which is, domestically speaking, restful and one in which good habits could be encouraged not only by precept, but also by example. It has certainly been a feature of other investigations (Hughes, 1948; Dummer, 1949; Dykes, 1950; Royal College of Obstetricians and Gynaecologists, 1948), but the relative importance of temporary freedom from worry, "selective recruitment," and example has not yet been measured.

Enough has been said to show how difficult it is to disentangle even the few factors chosen for special study, and how impossible to arrive at firm conclusions. With the small numbers available, the survey data have done little more than confirm the observations of previous writers and provide a background for the survey children. It may, however, be possible for larger clinics to select one or two of the more promising lines of inquiry for closer study. Meanwhile, the relatively high incidence of prolonged breast-feeding in the group as a whole suggests that a target of "breast-feeding by 80% of mothers for six months [which] would materially reduce both morbidity and mortality rates in infancy . . . is perhaps more readily obtainable than is generally believed" (Cruickshank, 1945).

Summary

Among 574 mothers attending the Oxford Child Health Survey, 53.8% breast-fed their babies completely for over four months and 16.2% for less than three weeks.

Social and economic conditions have a pronounced effect on breast-feeding habits. If they are good the incidence of prolonged breast-feeding increases with the increasing size of the family; if not it will diminish.

The high prevalence of breast-feeding among mothers delivered in hospital emphasizes the importance of freedom from domestic commitments in the early days of lactation.

I am indebted to Sister Wood, of the Oxford Mothercraft Clinic; to my colleagues in the Child Health Survey, particularly to Miss Thwaites, until recently our social worker; and to Dr. Alice Stewart for her encouragement and help. The Medical Research Council contributed towards the expenses of this investigation.

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Medical Memoranda

Cholangiography by Means of a Barium Enema

The inflamed gall-bladder containing stones not infrequently becomes attached to a neighbouring hollow viscus, and on occasion a stone or stones may ulcerate into the intestinal tract, either completing the passage safely or producing intestinal obstruction, the complication of obstruction being more likely when the fistula is between the gall-bladder and duodenum.

Examples of the spontaneous passage of gall-stones by the intestinal route were commonplace when biliary surgery was a rarity. The following case is worth recording because the safe passage of the stone or stones did not result in the fistula closing, owing to the normal channel being blocked by a stone in the ampulla of Vater. Moreover, the patient's symptoms were presumably due to the persistence of the fistula, and the presence of this fistula was demonstrated radiologically before operation.

CASE REPORT

The patient, a married woman aged 70, was referred to me by Dr. Russell Fraser. She had been a known diabetic since 1939. In 1947 she suffered from severe diarrhoea for about nine months, and this cleared up after a single injection of liver extract. Up to three months previously she remained well so far as her gastro-intestinal system was concerned, and then the diarrhoea recurred. The bowels were opened 10 to 12 times daily, and she was most affected at night and in the mornings, but the bowels were not opened in the afternoon. The stools were pale yellow and liquid, and there was no blood or mucus. Liver injections were tried again, but with no relief. There was no loss of weight. She also suffered from frequency of micturition, pruritus vulvae, and cataract, all these symptoms being attributed to the diabetes. It was thought that the diarrhoea was due either to the diabetes or to a neoplasm of the colon.