

‘Disease prevention and health promotion’*

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“Howe to do them good that have most nede, that is to saye chyldren.”—*Thomas Phaire*, 1545.

THE evolution of a preventive outlook in a doctor practising in a developing country is slow and the basic principles of public health and the prevention of disease have to be learnt by experience, and often through a process of trial and error. This slow evolution of a preventive outlook may be initiated by a variety of stimuli. Often it evolves as a mechanism of self defence against an impossible work load, the solution appearing to be that of preventing disease in order to decrease the work load. Again it may be a questioning as to why the physician is constantly called upon to deal with such shocking cases—an endless procession of ruptured uteri, neonatal tetanus and gross malnutrition. A further stimulus is the constant viewing of the bodies of dead children who could have been saved.

This essay deals with the realization that the prevention of disease and the promotion of health is vitally urgent, based on experience in one developing country, Sumatra; the preventive and health promotion possibilities which are possible with the two most ‘at risk’ groups; and finally with the full implementation of these possibilities in another developing country, Zambia. To a lesser extent these possibilities were put into practice in two other developing countries, Uganda and South Korea, but only in Zambia are they on the correct road to reaching their full potential since Zambia is probably the most advanced of all developing countries in its care for maternal and child welfare.

Experience in Sumatra

Shortly after arrival in Sumatra the immediate priorities became obvious in spite of many competing priorities—learning the language, running a 250-bedded hospital with 200 to 300 outpatients a day (aided by another doctor), caring for the whole gamut of diseases seen in a hospital which was the only source of medical help for a population of 40,000, caring for the estate’s field clinics, the estate’s sanitation, the emergency surgery and the final two years of the Sumatran Revolution.

The paternalistic estate management provided cloth and wood for the interment of employees and their dependents providing that the bodies were brought to the hospital. This enabled the management to keep a check on the number of employees and dependents for ration purposes but also enabled the physician-in-charge to keep a check on the mortality. Further, by questioning the relatives an impression could be gained as to the cause of death.

Each week some four to five young children’s bodies were viewed, children who had died in the estate’s many villages, since as in all developing countries there was a considerable reluctance to come to hospital when ill; in addition a large number of children who were admitted in very late stages of illness and died in the wards.

The impression of the high proportion of child deaths was confirmed by a com-

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parison of 1,337 estate deaths (in the hospital and villages) with the estate's population:

TABLE I
COMPARATIVE ANALYSIS OF 1,337 ESTATE DEATHS AND THE PERCENTAGE COMPOSITION OF THE ESTATE

	<i>Deaths</i>	<i>Deaths as a percentage of total deaths</i>	<i>Percentage composition of the estate</i>
Male employees	76	5.7	24.6
Female employees and dependents	106	9.2	23.8
Children	1,155	86.4	51.6

The children had to be considered the prime priority and it was necessary to determine which were the 'at risk' ages and the main cause of death. An analysis by age of 1,665 consecutive child deaths showed:

TABLE II
AGE AT DEATH OF 1,665 CONSECUTIVE CHILD DEATHS

<i>Age at death</i>	<i>Number</i>
Stillbirths	153
First year of life	*1,023
Second year of life	280
Third year of life	105
Fourth year of life	36
Fifth year of life	15
Age 5 - 15 years	53

TABLE III
THE 'CAUSE' OF DEATH IN 100 VILLAGE DEATHS

<i>Cause of death</i>	<i>Number</i>
Fever and diarrhoea	64
Fever only	8
Fever and cough	8
Delivery	7
Neonatal tetanus	4
Malaria	2
Other	7

* Under 1 week old 105; under 1 month old 187

The 'cause' of death was ascertained from 100 mothers who brought their child's body to the hospital:

Viewing the bodies it was very obvious that a large number had suffered from marasmus or kwashiorkor, and protein calorie malnutrition was the greatest cause of inpatient deaths followed by diarrhoeal dehydration. The mothers very rarely mentioned a loss of weight or that the child was becoming thinner. They knew nothing of malnutrition and accepted a 'thin' child as a natural part of their environment. They were much more concerned with a fever, always reporting 'Fever and . . .', never '. . . and fever'. This may well have been due to the great amount of malaria in the estate which bordered the jungle.

Not only was it essential that the young children had to be given especial care and attention but it was also essential to determine the cause of the malnutrition, the diarrhoea and also to establish a weight-for-age graph. The lack of knowledge of the standard weight for age made it difficult to 'spot' those children who were underweight but not yet exhibiting signs of malnutrition. This graph was finally established and later was published.

It was usually impossible to establish if the diarrhoea was primary or secondary to the malnutrition; in the majority of cases it was probably secondary since in so many cases a primary diarrhoea led to rapid dehydration and death before signs of malnutrition could appear. By plotting cases of primary diarrhoea, when it could be diagnosed, on an estate map showing villages, it was possible to localize villages and investigate their water supply.

Malnutrition is due to a great number of factors—low socio-economic state, the planting of poor food-value crops such as cassava instead of rice, lack of knowledge, etc., but in the estate the prime cause was probably prolonged breast feeding without weaning. Weaning was usually undertaken with pre-chewed rice but was greatly delayed. An investigation of 300 mothers showed a mean period before starting weaning of 15·6 months and a median period of 12·9 months (standard deviation 7·1 months; range 4–36 months).

The second priority was the maternal mortality, the chief causes of which were bad obstetric practices by the village 'wise women' often leading to rupture of the uterus, obstructed labour or antepartem or postpartem haemorrhages. In England and Wales in 1931 the maternal mortality was 4·11 per 1,000 total births and this had fallen to 0·64 in 1955. The combined maternal mortality for the estate's villages and hospital in 1960 was 20·12.

This high maternal mortality was due to three factors:

1. Not attending for antenatal care
2. Meddlesome 'wise woman' village practices, especially in obstructed labour, abnormal presentations, etc.
3. Delay in being brought to the hospital after an emergency. A delay of 24 hours was common following a severe ante- or postpartem haemorrhage, ruptured uterus, etc. Patients arrived in extremis and, due to Indonesia's lack of foreign exchange, no intravenous fluid, blood grouping sera, etc. were available.

This Sumatran experience led to the realization that in a developing country the prime priorities lay in the fields of the young child, antenatal care and hospital delivery.

The theory of the Maternal and Child Health Centre

This concept is relatively recent and at present some of its chief protagonists are more concerned with the Under Fives Clinics. The inclusion of simple antenatal care is equally essential. This is being undertaken in Zambia by the medical assistants (who are not trained in deliveries) by separating the 'at high risk' antenatal patient from the 'normal'—who is regarded as being only 'at high risk'. This separation is undertaken on the present and past obstetric history, the general history and general examination. The 'at risk' antenatal patients in the rural health centres are strongly urged to attend the district hospital.

The under fives clinic, U.F.C.s

In all outpatient clinics, hospital, urban or rural health centres, the greatest proportion of patients are under five years of age. In most of the developing countries there is an appalling death rate in the 'under fives' and proportionally they are badly served. In one Lusaka urban clinic the under fives (18·8 per cent of Zambia's population) formed 45 per cent of the clinic's first attenders. In an urban clinic in Pusan, South Korea, open to all children up to the age of 16, the under fives accounted for 71·5 per cent of 2,710 consecutive first attenders. The death rate of the under fives in the developing countries may reach to over 50 per cent. In Zambia a small investigation showed that four out of every ten babies born alive died before reaching their fifth birthday. It is not uncommon for the 'under fives' mortality in these countries to be 40 times that in the United States (Jelliffe, D. B., undated, *Child Nutrition in Developing Countries*. U.S. Department of Health, Education and Welfare, Public Health Service publication no. 1822).

An investigation in Lusaka in 1967 showed that whereas the under fives accounted for 45 per cent of an urban clinic's first attenders; 66 per cent of the total deaths in Lusaka hospital; 75 per cent of the burials in Chingwele Cemetery and 80 per cent of the notified infectious diseases in Lusaka—they were only catered for to the extent of 17

per cent of the total hospital beds in the Lusaka hospital. This was proportional to the population composition, but not to their morbidity and mortality.

Table IV shows that the main causes of death amongst the under fives in various developing countries are constant, with only slight differences in differing countries. This table shows that a large number of the deaths were preventable and could have been diminished by health education, early diagnosis and improved public health. The interaction of infection and malnutrition and malnutrition and infection, which form the vicious circle of early childhood and account for the majority of the under fives' deaths, is a constant occurrence.

TABLE IV
CAUSE OF DEATH IN THE UNDER FIVES, AS PERCENTAGES

Cause of death	Imesi, Nigeria*	Luapula, Zambia**	North Sumatra***	Pusan, Korea***
	per cent	per cent	per cent	per cent
Diarrhoeal disease	12	18	25	15
Pneumonia	12	10	11	9
Protein calorie malnutrition	12	16	26	14
Malaria	8	15	8	3
Pertussis	8	—	2	4
Measles	8	13	7	16
Tuberculosis	5	—	6	8
Smallpox	5	—	—	—
Anaemia	—	7	5	7
Other, mostly neonatal	30	21	10	24
Children:	Unknown	340	1,282	1,036

* Imesi Village, Nigeria. Dr D. Morley (1966). *Medical Care in Developing Countries*. Ed. M. King. Oxford University Press.

** Luapula Province, Zambia. Dr H. Fuglsang (1970). Report to Department of Health.

*** North Sumatra and Pusan, South Korea (1963 and 1968). Unpublished.

There are only two ways in which this vicious circle may be broken, either by the elimination of malnutrition or by immunization. The elimination of malnutrition is a vast operation but it is being attempted in Zambia. The active participation of agriculturists, educationalists, social welfare workers, community development workers and a considerable amount of available capital are necessary. Much also can be achieved through 'self help'. The alternative method, immunization, is technically easier although it, also, presents considerable difficulties. The ideal is a combination of both methods, as is being practised in Zambia.

The aims of the under fives clinic are therefore to immunize, to detect malnutrition early, to treat existing diseases and provide health education to improve the understanding of disease and its prevention and to raise the existing standards of public health.

The functions of an under fives clinic

Immunization

Immunization schedules vary from country to country, especially between the developed and developing countries. It is unwise to adopt the schedule of a developed country and essential to know the disease pattern of a given country before considering any specific schedule. In developing countries infectious diseases, especially measles and whooping cough, occur at an earlier age than in the developed countries. Moreover they are different diseases with a much higher morbidity and mortality.

BCG immunization presents no real difficulties. There is, however, the problem of the advisability of undertaking vaccination prior to Mantoux/Heaf testing and the

fact that BCG vaccination will destroy the value of later Mantoux/Heaf testing as a diagnostic tool. In countries where tuberculosis presents a major problem, as in South Korea and Zambia, the wisest course is to undertake mass BCG campaigns without previous Mantoux/Heaf testing. A mass BCG campaign was undertaken in Pusan, South Korea, by the Swedish Save the Children Federation. At first vaccination was only undertaken after preliminary Mantoux testing but later all children were immunized without Mantoux testing. Very often the mothers did not return with their children to have the test read and so many who required it were not vaccinated. This difficulty was surmounted by intensive home visiting—a luxury no developing country can afford. Following the abandonment of preliminary Mantoux testing no rise was seen in the complication rate.

The Tuberculosis Prevalence Survey in Korea in 1965 (Ministry of Health and Social Affairs 1966) disclosed that 11.3 per cent of male and 12.6 per cent of female under fives without an old BCG scar showed a tuberculin reaction of 6 mm or over. The Swedish Save the Children Federation survey of children in Pusan City revealed a higher figure (table V). In countries with such a high prevalence rate of tuberculosis it is important to undertake mass BCG vaccination in infants even though thereby the value of the Mantoux/Heaf test as a diagnostic aid is lost.

The age of 1,500 Commonwealth Save the Children Fund patients in Pusan with tuberculosis was investigated and this showed the large number of children belonging to the under fives who had tuberculosis:

TABLE V
POSITIVE MANTOUX REACTORS IN PSUAN CITY
UNDER FIVES

Age group	Positive Mantoux reaction	
	5-9mm	10 & +mm
	<i>per cent</i>	<i>per cent</i>
2-3 years ..	0.8	10.1
3-4 years ..	0.9	13.6
4-5 years ..	1.1	18.7

TABLE VI
TYPE OF TUBERCULOSIS AND AGE OF CHILDREN; 1,500 SAVE THE CHILDREN FUND PATIENTS.
KOREA, 1960, 1961, 1962 AND 1963

	Type of tuberculosis	Under fives	Age 5-17 years
	<i>per cent</i>	<i>per cent</i>	<i>per cent</i>
Pulmonary ..	63.6	71.7	28.3
Osseous	27.6	44.1	55.9
Other	8.8	51.1	48.9
	100.0		

During the Swedish Save the Children Federation mass BCG campaign in Pusan difficulty was also found with the potency of vaccine from differing countries. With one vaccine some 40 per cent of children had reconverted to Mantoux negative a year after vaccination. This was not found using the same teams and the same methods with vaccine from another country. It is unfortunate that it is not yet known what immunity such a child possesses and for what period of time—the Mantoux negative child who converts to Mantoux positive after vaccination and later reconverts to Mantoux negative.

Measles vaccine presents theoretical and practical difficulties. These have to be solved by compromise, bearing in mind that the maximum possible benefit must be given to the greatest possible number. The difficulties are three-fold—the cost, the difficulty of storage and the maternal antibodies.

The storage properties of the vaccine negates a 'cheap' mass immunization campaign in a country which consists largely of small and widely scattered villages—a large village holding only 100 persons. The vaccine must be used within four hours of being taken out of the refrigerator and this necessitates mounting a refrigerator in a Land Rover for any campaign; under such circumstances the refrigerator has a very short life.

The real difficulty with measles immunization lies in the maternal immunity which is given to a baby—especially in the developing countries where the great majority of mothers possess measles antibodies. This immunity lasts on average for six months but may last a few months longer. To be certain that a child receives an immunity the immunization should be delayed until the child is one-year old. In developed countries this offers no difficulties since the age of onset of measles is well after the first birthday. However in developing countries a considerable number of children develop measles, and many die of it, before their first birthday. Meuwissen (1969) reported on the admission and death of children with measles in Kasama Hospital in Zambia's Northern Province, between September 1967 and September 1968. In all, 532 children with measles were admitted, 23·8 per cent of the total child admissions. Of these, 135 cases (25 per cent) occurred in children aged between 7 and 11 months old and 20 (3·8 per cent) in children younger than six months old. 34·6 per cent of the total measles cases died and 5·8 per cent of those aged under 12 months. Morley in Nigeria found a peak age for measles between one and two years of age (some 35 per cent of the total cases) and about 32 per cent of the cases occurring in children under the age of 12 months.

With such a high prevalence and mortality in children aged under one year it is essential that immunization should be given before the first birthday. Some developing countries immunize at 9 months of age and others, like Zambia, at 7 months of age, and thereby prevent a large number of deaths. It must be accepted that immunization at 7 months and even at 9 months does not confer immunity on all babies since in some the persisting maternal antibodies negate the immunization. Unless this is understood public health tragedies can, and have, occurred. Recently a medical officer in a district hospital banned all measles immunization in his district after two 'immunized' children developed severe measles, one dying, believing that the vaccine was useless.

To overcome this double factor of maternally-transmitted immunity and the large numbers of children who develop measles, with many deaths, before their first birthday there are two possibilities. First antibody titrations could be undertaken on all children who have been immunized before their first birthday so that those with poor titrations could be reimmunized. This is not possible in many developing countries. A second possibility is to reimmunize all children soon after their first birthday, but with a vaccine as costly as measles this is not possible in the developing countries. We must therefore accept that the maximum possible has been done for the greatest number and accept the fact that at present we are unable to do more.

To assess the relative value of measles immunization at the monthly ages of between 7 and 12 months old, it is necessary to know both the numbers of cases occurring at accurate ages and also the antibody titration rates of those ages. At present this is not possible in Zambia since the hospital reports divide their morbidity and mortality returns into only three age groups—'under 1'; 'age 1-14' and 'over 14'. This is being investigated. It will be necessary to use titration figures from another country. In this way it is possible to tell if the increased percentage of satisfactory titration is outweighed by the number of children acquiring measles and the number of deaths from measles before any given month of age.

DPT immunization is unsatisfactory technically in that the three required visits

mean that many children do not finish their full course of immunization. This also applies to immunization against poliomyelitis.

Reports from 253 doctorless clinics (rural and urban health centres and small rural hospitals) in 1969 in Zambia showed:

TABLE VII
SECOND AND THIRD DPT AND POLIOMYELITIS IMMUNIZATIONS EXPRESSED AS A PERCENTAGE OF
THE FIRST IMMUNIZATIONS. DOCTORLESS CLINICS IN ZAMBIA IN 1969

	<i>DPT</i>	<i>Polio.</i>
Second immunization as a percentage of first	55.0	52.6
Third immunization as a percentage of first ..	34.1	38.2
Total first immunizations	51,079	53,128

Dr J. P. Stanfield of the Medical Research Council Child Nutrition Unit in Kampala has said that it is difficult to know at what percentage of third doses, expressed as a percentage of the first doses given, the physician should aim. He believes that 70 per cent should be strived for. Thus 70 per cent of the children are satisfactorily immunized and provided the coverage on first dose had included nearly all susceptibles, then an umbrella effect would be achieved.

It must be admitted that a figure of 51,079 is very, very far from 'nearly all susceptibles'.

Clinic staff often say that the reason for mothers not returning with their children for the second and third DPT immunization is because their child had a minor reaction to the first immunization. However, this cannot be the only reason as the reattendance rates for poliomyelitis are little better than for DPT.

In the running of an under fives clinic it would considerably ease matters if both DPT and poliomyelitis could be administered in fewer doses and if the small reaction to DPT were less.

Immunological literature fails to state the permissible maximum period between the first and second and third DPT immunizations. This is important in the running of an under fives clinic when few mothers, for one reason or another, return on the date, or month, requested. In Zambia we follow the advice given by Professor D. G. Evans that a maximum period of five months is permissible between the first and second immunization and up to a year after the second dose the third may still be administered. A good response would be obtained for diphtheria and tetanus and probably a good response to pertussis.

Smallpox is the last remaining immunization used in the under fives clinics. Its use gives no trouble. It has, however, been noted that vaccines from differing countries give differing grades of lesions. Even using the multiple pressure method with a bifurcated needle some major local reactions are found with the vaccine from some countries.

In general the number of visits required by an under five to complete the necessary immunizations are too many. A child may only be brought to the clinic two or three times a year. It will take a considerable time to change this so that a method of administering the full schedule in fewer visits would be of great benefit.

Weighing

Malnutrition is usually likened to an iceberg in that the clinically obvious cases of marasmus, kwashiorkor and marasmic kwashiorkor represent the one tenth visible above the surface of the sea. A further 10 per cent of protein calorie deficiency cases

may be identified by laboratory means—serum protein, serum albumin, serum amino acid ratio, urinary urea-creatinine ratio, urinary sulphur-creatinine ratio, hydroxyprolene index and the urinary creatinine–height index. The last requires a 6 to 24 hour urinary specimen which cannot be obtained under clinic conditions and all require a competent laboratory—urban and rural health centres and the rural hospitals cannot undertake such investigations and indeed they cannot be undertaken in most district hospitals.

In spite of this it is essential to be able to identify this 90 per cent of premarasmic and prekwashiorkor cases so that they can be prevented from entering the marasmic and kwashiorkor stages, as these are very late stages of malnutrition and have a high

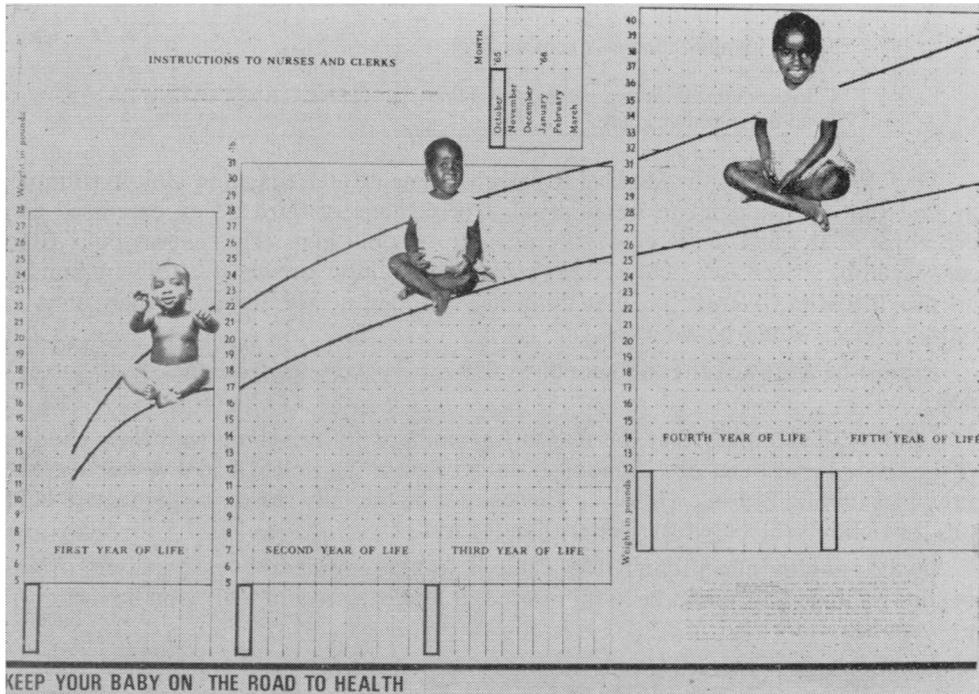


Figure 1. The weight for age 'Road to Health' chart

This is an expanded chart used as a teaching aid in instructing medical assistants. In this teaching aid the whole five years are shown, in the actual chart the fourth and fifth years are on the reverse side.

The photographs of the children are mounted on the teaching aid as at first medical assistants have difficulty in relating a dot weight on a chart to an actual child.

mortality. In 1967 a National Food and Nutrition Commission report (Ministry of Health 101/1/1, May 1967) quoted the medical superintendent of the Lusaka Central Hospital as estimating that '... about 50 per cent of the malnutrition cases discharged from the Lusaka Hospital wards die within six months'.

In mid-1969 the paediatrician in the Lusaka Central Hospital estimated that some 50 per cent of patients admitted with malnutrition were complicated by an infectious disease (the vicious circle of early childhood) and these have a mortality between 40 and 50 per cent; the estimated mortality in the uncomplicated child with malnutrition being 10 per cent.

As it is not possible to diagnose the premarasmic or prekwashiorkor child clinically the problem is approached in another way—using the knowledge that a healthy, well-nourished child will steadily increase in weight. In this way children and infants who have a low weight for age may be identified. The method is not infallible since some children who are well 'normally' have a lower weight for age than their peers. Other

anthropometric measurements may be undertaken. The length-height for age is not so useful since height retardation appears well after weight retardation and further the accurate measuring of length-height is difficult. This also applies to the weight for length ratio with the added disadvantage that the ratio may be normal in children whose weight and height are both abnormal. The weight for head circumference requires a further and fairly difficult measurement and the head circumference may also be affected by malnutrition. The triceps skin-fold measurement is useful in marasmus but of little value in kwashiorkor. This measurement is also subject to inaccuracies due to inexperience, different observers often getting different measurements in the same child. Not only are skin thickness calipers expensive but they are also frightening to a child, who will scream and thresh about at the sight of the opened calipers and the older child will run away. Lastly the mid-arm muscle circumference involves an additional measurement to the triceps skinfold measurement—which itself has considerable drawbacks.

What is required is a technically easy investigation which can be undertaken under difficult conditions, by paramedical staff and rapidly in view of the numbers attending the under fives clinics.

A recent screening technique—the QUAC stick (Quaker arm circumference measuring stick) was devised by Arnhold in Nigeria in 1969 (Arnhold 1969). This relates the arm circumference to the height. The values for 85 per cent or 80 per cent of the standard arm circumference for a specific height are marked directly on to the stick at the corresponding height levels. The child's arm circumference is measured with a tape, the stick is placed behind the child and the arm circumference reading is found on the stick. If the child's actual height is below this mark then his arm circumference is greater than 85 per cent of the arm circumference of an average child of his height, and he is not malnourished.

At present in the under fives clinics the screening technique is weighing. The disadvantages of weighing are two-fold—first, the scales themselves, as will be mentioned later, and second, the child's age. If a child attends regularly it is possible to see the growth curve in which case an accurate age is not so important. However, for a child who only attends once or twice if the given age is not accurate a false impression will be gained by comparing its actual weight to a weight for age chart.

In attempting to deal with a mass of children interspersed with adults in an overcrowded and under-staffed clinic, three difficulties arise:

1. It is impossible to give enough time to the under fives, the most 'at risk' group.
2. It is impossible to visualize clearly the child's progress from a long string of past weights.
3. It is impossible to judge a child's weight for age without constant reference to known standards and one must have a fair idea of the child's age. Not infrequently a poorly nourished child of three-years old may be mistaken for a well-nourished child of two.

These difficulties were encountered daily in Sumatra. Not only had the children attending the outpatients clinic to be judged, but prior to commencing outpatients the physician had to look through some 200 infant welfare cards from the previous day's field clinics to identify the children who should be called to the hospital for further examination. Each card had the weights recorded in figures at each visit so that the eye had to glance through the long list of figures, seeking some pattern. Morley's great contribution to public health and disease prevention was two-fold. First he isolated the under fives from the general outpatients. By the creation of a special under fives clinic a whole period could be devoted to them alone without other distractions. Secondly, he introduced a weight for age chart, which is now known in Zambia as the 'Road to Health' chart and has been adopted with slight variations by a number of countries. The chart consists of a graph divided vertically into 60 columns, one for each month of the first five years of life. The weight scale is on the horizontal axis.

Part of the chart is devoted to the recording of necessary information, e.g. name, date of birth, address, parents, siblings and further spaces are reserved for recording immunizations and for stating any reasons for special care—a glance at this space will enable the physician to pick out the 'at risk' children. The plotting of a child's weights on this graph instead of recording them in figures on an outpatient card completely changed the physician's task. No longer was there any necessity for attempting to find a meaning in a long string of figures nor of trying to relate a weight, or a series of weights, to a standard weight for age. Instead it became a question of purely visual appreciation of a graph of weights which could be instantly related to the upper and lower lines marked on the charts.

The value of comparing a child's actual weight with a standard weight for age was shown in an investigation in the Lusaka Central Hospital paediatric wards in 1967. In that year the hospital returns stated that 9 per cent of all child admissions were due to malnutrition. By means of a weighing scales and a weight for age chart it was possible to show on a certain day that 95 per cent of the children in the paediatric wards on that day had weights below the expected weight for age. The hospital's malnutrition reports should not be discredited since the type of reports in use allow only one diagnosis. Thus a child with measles who is also underweight (if weighed) would be reported as measles and not as malnutrition. Further the finding of 95 per cent underweight children was on a selected group in that they had been admitted to hospital for various illnesses.

An investigation by Fuglsang (Dr H. Fuglsang 1969, report to Department of Health) showed that of 400 new attenders in a Northern Province under fives clinic in a month, 40 per cent were underweight judging by Morley's Nigerian lower line.

Health education

The treatment of sickness, infant weighing to detect low weight babies and follow the progress of all babies and young children and immunization by themselves are not enough. Any under fives clinic which does not incorporate health education will certainly fail in its aim to reduce the under fives morbidity and mortality rates. Health education consists not only in nutrition education but also in education in all aspects of public health which affect the mother and child as well as caring for the sick child. Nutrition education consists in a short nutrition talk and discussion followed by a demonstration. The talks should be short and encourage audience participation and words which would not be understood by the mother must be avoided. The terms proteins, carbohydrates, fats, minerals and vitamins in Zambia are changed to 'body building', 'energy giving' and 'protective' foods. The body is a house and the body building foods the bricks, the energy giving foods are the fire and the protective foods the lock on the front door.

The cooking demonstrations must obey certain rules. The pots and pans, type of fire, etc. must be identical with those used by the mothers in their own homes. The goods used must be readily available locally and cheap. The demonstrations are simple—thus the addition of an egg to the weaning porridge of mealie meal or cassava; and after the demonstration the prepared food is given to the children attending the demonstration so that the mothers can see not only the ease with which it is prepared but the fact that their children will eat it.

Non-nutritional education must also be undertaken; the dangers of dirty water; the lethal effect of bottle feeding, where it is undertaken, due to enteritis; the lethal effect of stopping breast milk or supplementary feeding when an infant develops diarrhoea; elementary public health and hygiene—e.g. the dangers of micturating and defaecating in or near a stream in a country where bilharzia is very prevalent; the nursing of a sick child; the importance of immunization; the importance of weighing and regular attendance at the under fives clinics, etc. The nutritional aspects include how and when

to wean—with an elementary explanation on the reasons why the child must start supplementary feeding in the fifth month; the use of dried skim milk when it is provided—this is used by mixing it into the weaning porridge or in very young babies by means of a cup and spoon, etc.

Maternal and child health centres in Zambia

In 1966 a FAO/WHO team visited Zambia and undertook a survey. They reported that four out of ten children born alive died before their fifth birthday from malnutrition.

In 1967, following the presentation of their report the government of Zambia established the National Food and Nutrition Commission. The Ministry of Health added the post of nutritionist to their existing staff of public health specialists—tuberculosis, leprosy, malaria, health education and epidemiology. Early in 1969 the nutritionist was replaced by a maternal and child health specialist.

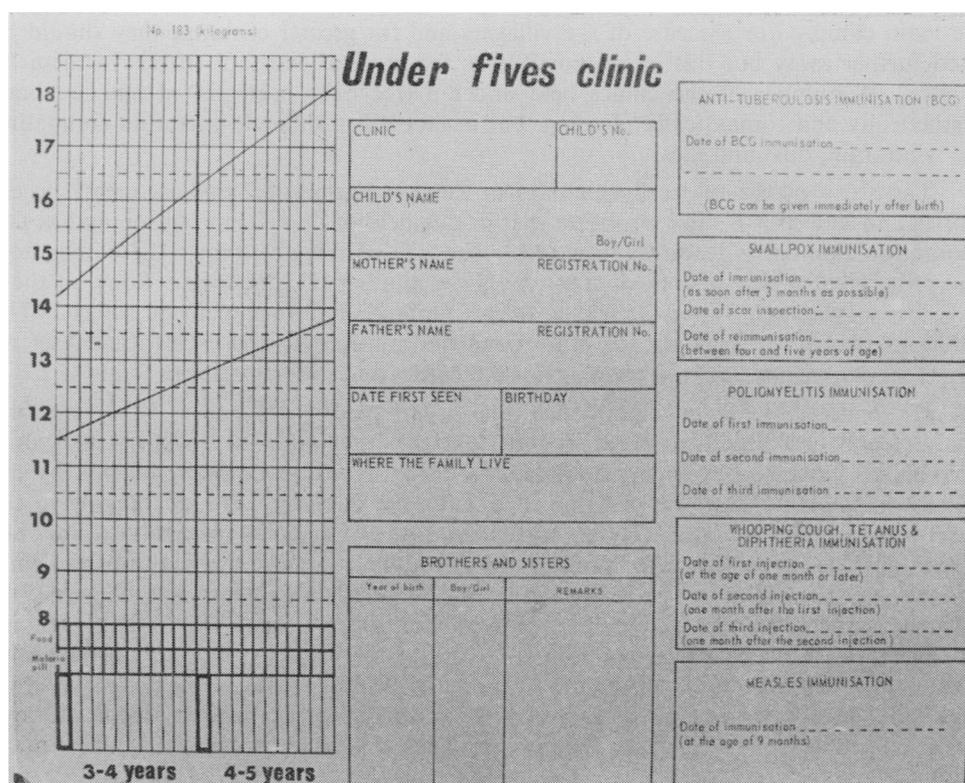


Figure 2. The reverse side of the 'Road to Health' chart used in Zambia

The immunization schedule is that used in Nigeria and is slightly different from the one in use in Zambia.

One of the first aims of the nutritionist and the Commission, in conjunction with the WHO Intercountry Nutrition Adviser, was to establish pre-school protection areas where an especial effort would be made to care for the under fives. The first such clinic was opened in May 1967, although a few under fives clinics had already been created by mission hospitals.

By December 1967 there was a total of 36 under fives clinics in Zambia, run by either government or mission staff. By December 1968 the number had risen to 309 and by December 1969 to 457. The total number is probably greater, since the

municipalities, mines and flying doctor service do not return detailed reports to the Department of Health. The figure includes not only main but also subclinics. By December 1969, 62 per cent of all government and mission medical institutions were undertaking under fives clinics.

The under fives clinics are run as an integral part of the work of a health centre or hospital. In the clinics and hospitals half a day a week is put aside for the clinics, the centres being open only for other emergencies. The under fives clinics, in the rural health centres and hospitals are run by the main centre or hospital staff, i.e. in the rural health centre by the medical assistant aided by his indoor servant, and in the hospitals by the outpatient staff. In the urban health centres there are special staff—a few health visitors and community nurses (see (9) below) who are helped by the medical assistant from the general clinic. Many of the hospital, urban and rural main clinics also undertake subcentres which are conducted in schools, village halls or occasionally under a tree. It has been found that the ideal number of subcentres per main clinic is four and that they should not be sited more than five to seven miles from the main clinic. For the ease of the villagers and for greater coverage they should be sited further away but this is not possible as the medical assistant travels to them by bicycle. A number of the clinics held under a tree have been visited and are both aesthetically and romantically pleasing, but in fact it is a difficult operation combating the wind, rain, dust and flies.

The story of the under fives clinics in Zambia is one of Zambia's great success stories and indeed it is most probable that in this field of disease prevention and health promotion Zambia is leading the world. The size of the operation—the clinics now cover the greater part of the country—reveals a number of difficulties. Some of these have been overcome, others are being overcome and some remain to be solved. The solutions may well be of use to other countries considering the establishment of an MCH service on a mass scale. The major difficulties and problems are as follows:

(1) *Reattendance rates.* Until such time (it is hoped by the end of 1970) as a cost analysis and cost-benefit analysis is undertaken of the under fives clinics, it is only possible to judge the average reattendance rate by dividing the reattendances by the first attendances. This gives a figure of 2.7 for the doctorless clinics, ranging in the eight provinces from 0.6 to 7.8. A reattendance rate of 2.7 plus the first visit does not give enough visits to complete immunization let alone supervise the health of the child and instruct the mother. The reattendance rate in Luapula Province was highest (7.8) as well as the third DPT and poliomyelitis immunizations expressed as a percentage of the firsts. This province has been the closest-supervised, with a provincial health visitor for MCH who visits all the urban and rural health centres regularly. Two other provincial health visitors have been appointed and a further establishment of three has been granted. For one year Luapula Province also had a provincial MCH medical officer.

(2) *Immunization.* (a) *Completed DPT and poliomyelitis courses.* The unsatisfactory figure of 34.1 per cent for DPT and 38.2 per cent for poliomyelitis have already been referred to under immunization. These figures should be improved when the provincial health visitors are able to supervise all the clinics.

(b) *Under five clinics undertaking immunization.* From the monthly returns of the 253 doctorless clinics undertaking under fives clinics in 1969 it is seen that 85 per cent were immunized for smallpox during the year; 81 per cent for DPT; 79 per cent for poliomyelitis; 72 per cent for tuberculosis and 59 per cent for measles. The number of clinics giving measles immunization must be considerably increased and will be supervised by the health visitors. Measles immunization is especially important since measles carries such a high fatality rate. The non-doctor clinics, many of which have a few inpatient beds, also report the deaths of inpatients. In 1969 these totalled 2,006 deaths

and the believed cause of death was reported in 86 per cent of the deaths—these deaths including men, women and children; diarrhoea or malnutrition accounted for 22.3 per cent; measles for 18.6 per cent; pneumonia, tuberculosis and cough for a further 17.0 per cent; all forms of malaria for 14.1 per cent and all other causes for 11.0 per cent.

(3) *The lack of basic information.* This lack is felt in all developing countries and Zambia, though some information is available there, is no exception. The mean heights and weights of the under fives is unknown. The percentage of under fives attending the main clinics; the cost of the UFCs, their cost-benefit; the mean age at various parities; the mean haemoglobin at various parities; the village maternal death rate, etc. etc., are all unknown.

A considerable body of information will be available between 1971 and 1974 since the National Food and Nutrition Commission is conducting a Food Consumption and Nutritional Status survey in each province. Mortality, morbidity and obstetric questions have been included in the Nutritional Status survey. This survey, which is believed to have been the largest ever conducted, is being undertaken province by province with the appropriate statistical guidance. The first province will be completed by the end of 1970.

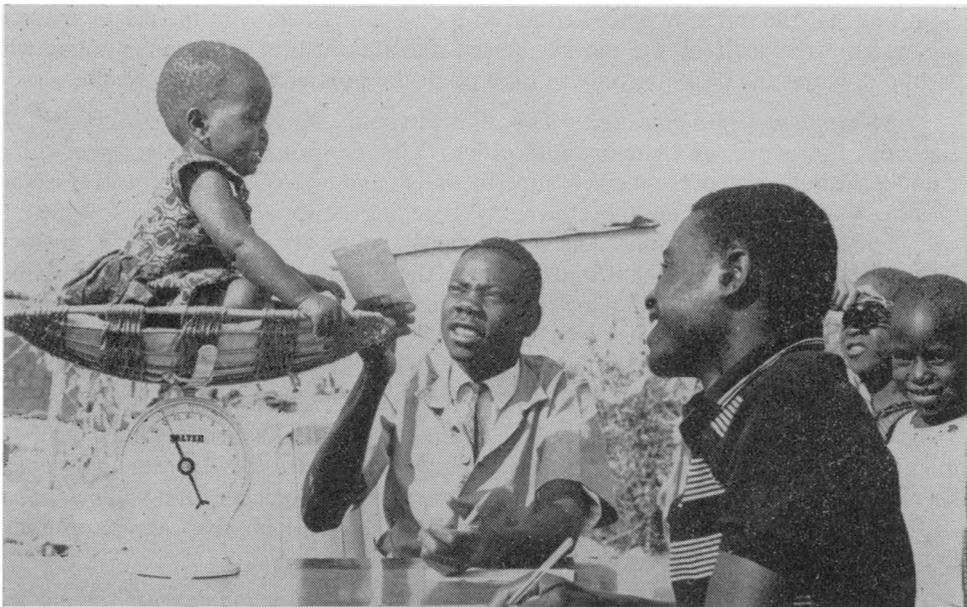


Figure 3. An 'open air' under fives subclinic being run by a medical assistant assisted by an 'indoor servant'.

Figures 1, 2 and 3 by courtesy of the National Food and Nutrition Commission.

(4) *Understaffing.* At present the average rural health centre is staffed by a single medical assistant (a few by dressers) who is helped by an indoor servant. In time each rural health centre will be staffed by a minimum of a medical assistant, maternity assistant and health assistant. The training of these cadres of workers has been greatly increased to meet the need. When a centre is fully staffed a considerably greater amount of under fives work can be undertaken by an increasing number of subclinics.

(5) *Lack of communications.* Feeder roads are poor, if existent, so that there is considerable difficulty in taking a medical service to the people, especially with Zambia's very small 'average' villages. As the country develops roads will improve and villages

will become fewer and larger with the Government's policy of village regrouping. At present the under fives service is carried on by medical assistants on bicycles; six UNICEF Land Rovers (UNICEF will also be giving Zambia five Land Rovers a year for the next five years for the MCH work); some Land Rovers belonging to the Netherlands' Volunteer Nurses; and the Honda scooters, also used by the Netherlands' Volunteer Nurses.

(6) *Weighing scales.* The lack of an appropriate weighing scale is felt in every country undertaking under fives work. The customary beam-balance scale used in the usual hospital infant welfare clinic is quite unsuited for the under fives work. The scale required has to be light (so it may be carried on a bicycle), durable and easy to work, as under fives clinics need only a few staff. In Zambia the Salter spring-type scale is being established as the accepted scale. Some MCH workers insist on a very accurate scale—such as the hanging beam-balance type used in the Ankole Pre-School Protection Project in Uganda. However, not only is a beam balance a time-consuming type, moving the beam up and down to its exact point, but it requires a staff member to do it, it cannot be undertaken by the mother herself. This great accuracy is not required in an under fives clinic since the weight cannot be plotted on the Road to Health chart, if the mark is big enough to be easily seen, with greater accuracy than a quarter pound or kilogram. The great advantage of the Salter-type scale is not only its extremely light weight but that the infant is placed either on the weighing pan or in the plastic trousers hanging from the scale by the mother herself and the medical assistant or nurse who is sitting down at the desk has only to look up at the pointer to read the weight.

(7) *Multiplicity of authorities.* This difficulty only applies to urban clinics. In these areas clinics are run by many authorities. Thus in Lusaka the government clinics are under the authority of the medical superintendent and matron of the Central Hospital, who now that it has become the University Teaching Hospital, are much too busy to spare them much of their time; the municipality clinics are overseen by the medical officer of health; one Lusaka clinic is under the authority of the Central Province provincial medical officer (Lusaka being in the Central Province); two clinics appear to be under no authority as they were opened by the nutritionist; other clinics are run by voluntary agencies. There is thus a gross reduplication of staff and transport—both of which are scarce and very valuable—and no overall guidance or policy.

In Lusaka it is hoped that this will be overcome as a senior health visitor has been appointed to oversee all the government clinics and to liaise closely with the medical officer of health and voluntary agencies. If this new policy is successful it will be applied to all municipalities until such time as the municipalities themselves accept responsibility for all clinics within their boundaries.

(8) *Reorientation of medical assistants and other staff.* For many years the medical assistants were trained in a hospital and mainly by nurses. They were thus trained in hospital work and quite unfitted when later they were moved out of the hospitals to run rural health centres by themselves—although many of them have done superb work.

Recently the training policy was changed in that the medical assistants now are trained away from the hospital, largely in the urban clinics, and are taught all the elementary diagnosis and treatment they will require when they take charge of a health centre. However, many of those already in the field, graduates of the old type of training, require help. Realizing this problem the Department of Health created a policy of undertaking two fortnightly courses a year in each of Zambia's eight provinces, for the medical assistants. The first week of the course consists entirely of maternal and child health and the second week is occupied with other aspects of preventive medicine—which is a new subject to most of the 'old type' medical assistants—tuberculosis, leprosy, malaria, bilharzia, etc. In all subjects treatment, as appropriate, is dealt with. Health

education is conducted throughout the two weeks by the health education specialist concerning the matters discussed on any given day.

Provincially courses are also run for other grades of staff in the rural and urban health centres—female assistants, dressers, etc.

Before the start of each course and after it an assessment is made using a multiple choice question paper. On the courses already undertaken two points have emerged. First, the pre-assessment papers have shown a sad lack of public health knowledge, and secondly the post-assessment ones have shown a considerable increase of this knowledge. As yet staff shortage prevents the most necessary follow-up in the field.

(9) *Community nurses.* Community nurses are enrolled nurses who have also undergone the enrolled midwives course. They then undergo a further year's training. Some 25 to 30 a year were being graduated as enrolled-level health visitors. A number of them were undertaking excellent work but the fact remained that in a country desperately short of midwives the community nurse school was taking over 50 per cent of the midwives output. Further the community nurses did not undertake midwifery since deliveries are not, as yet, undertaken in the rural health centres and only a few in the urban health centres. It is also, I believe, morally difficult to justify home visiting at this stage of development. When a triple-trained enrolled nurse spends her day visiting two or three families, she could spend the day more profitably in a clinic dealing with some dozens of antenatal mothers and under fives.

The training of community nurses has now been stopped, the last course graduating at the end of 1970. In future a considerably greater public health content will form part of the course of the state and enrolled nurses, the state and enrolled midwives and the medical assistants. In this way a multi-purpose nurse will be graduated for use in all fields of medical care.

(10) *Malaria.* As in many African countries, and most of the developing countries, malaria is a scourge. Unfortunately in Zambia the main vector is an outside restor so that little could be expected from a massive spraying campaign. The malarial morbidity and mortality is considerable, especially in the under fives—many of whom are grossly anaemic from repeated attacks.

In an attempt to guard the under fives, the under fives clinics will be commencing prophylactic Camolar injections.

(11) *Lack of senior supervision.* Zambia with 290,586 square miles divided into eight provinces is a very large country. Senior supervision must be undertaken on a provincial level. There are already three provincial health visitors to supervise the MCH clinics and advertisements have been placed for a further three. In time, it is hoped, each province will have a provincial public health doctor, to aid the provincial medical officer, and one of his tasks will be to supervise the provincial MCH.

(12) *Weekly under fives clinics.* At present in the rural health centres this is all that can be hoped for. In time when each rural health centre is also staffed with a midwife, daily clinics can be undertaken. In the urban clinics an attempt is now being made to see if it would be possible to undertake daily clinics by a reorganization of the various clinic staffs and an elimination of the present reduplication of work. On non under fives clinic days the under fives are seen in the general clinic.

National and international help. It is said that God helps those who help themselves and certainly this seems true of the response of both national and international agencies who have recognized Zambia's immense effort for the under fives.

The United Nations Special Fund has allocated \$750,000 for the nutrition survey presently being undertaken in Zambia under the auspices of FAO in conjunction with

the National Food and Nutrition Commission. The Government of Zambia has contributed a similar amount.

The National Food and Nutrition Commission is concerned with the nutrition of all age groups. However, it has given great help to the under fives clinics and the pamphlets and teaching aids produced by its Public Relations Unit are in use in all UFCs.

UNICEF apart from considerable past help has recently committed itself to \$150,000 in association with Zambia's MCH five-year plan. The provision of UNICEF land rovers has already been mentioned and is most welcome since Land Rovers are a *sine qua non* for effective under fives work in Zambia.

WHO: WHO's Inter-country Nutrition Adviser is readily available on request. He will soon be visiting Zambia again to advise on a preliminary cost-benefit analysis of the under fives clinics.

WFP: The World Food Plan is in the process of undertaking an agreement for the supply of milk powder, sugar and CSM for all under fives who are found to be under-weight (below the lower reference curve on the 'Road to Health') in the UFCs.

Governments. Many governments have helped the under fives work. In particular the Netherlands' government which has provided the Netherlands Volunteer Nurses—some of whom with the nutritionist initiated the first UFCs in Zambia and whose continuing work ensures their success. Other governments provide volunteers whose work touches on under fives, eg, the VSOs who, although stationed in hospitals are, interested in the under fives work. The public relations officer of the National Food and Nutrition Commission and the NFCC medical officer, who was seconded to supervise the under fives work in Luapula Province, were provided by the Danish and Norwegian governments.

Conclusion

The World Health Organization (1968) stated that 'On a world-wide basis, nutritional disorders and their consequences constitute the most serious single threat to the health of children'.

Any doctor who works in a developing country will soon realize that the two most 'at risk' groups are the child under five years and the pregnant and delivering mother. The threat to the under fives lies mainly in the vicious circle of malnutrition and infection. These conditions and priorities have been found by me in North Sumatra, Uganda, South Korea and Zambia. In Zambia they are being combatted by a national policy of maternal and child health centres.

The under fives clinics were evolved by Morley in Nigeria where he also evolved the invaluable public health tool of the weight for age chart. He showed that such a clinic could drastically alter the under fives mortality and morbidity by a combination of immunization, regular weighing, the treatment of existing diseases and health education to the mothers. Such a clinic was evolved, by me, in South Korea with the addition of the emphasis on antenatal work. The work could not be extended due to the limitation of finances of the voluntary agency concerned. The implementation of such clinics is now being proved in Zambia on a national scale, where already over 457 such clinics exist and 62 per cent of all government and mission medical units undertake this work. Each clinic is guided by two imperatives. First the under fives clinic is an intrinsic part of the existing work of the health centre or hospital and secondly, preventive and curative medicine must NEVER be separated.

In this nation-wide public health work a number of difficulties have been encountered. Some have been solved, others are being solved and others remain to be solved.

However, in this way the question raised by Thomas Phaire over 400 years ago is being partly answered:

'Howe to do them good that have most nede, that is to saye chyldren'

Note. The Ministry of Health in Zambia in 1968 was changed to the Department of Health, a Department of the Ministry of Labour and Social Affairs. Both terms have been used here when appropriate.

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THE AMBACHE RIDDLE MEMORIAL FUND

This fund was set up two years ago to commemorate two young men who were killed by a land mine in Nigeria/Biafra whilst working as volunteers for the Save the Children Fund. One was just commencing his clinical studies at University College Hospital, having completed his second M.B. at Trinity College, Cambridge—Jonathan Ambache, both of whose parents are doctors, one having been a general practitioner in Chiselhurst.

The purpose of the Fund is to assist young people who wish to carry out short-term projects in underdeveloped countries. The Fund announces the first 13 awards as under.

- Mr Adrian Gilham, St. Mary's Hospital, Paddington to Mariannahill Hospital, Durban from March to June, 1971—£100.
- Miss Penny Goard, King's College Hospital, London to Kuluva Hospital, Arua, North-West Uganda from December, 1970 to March, 1971—£100.
- Mr Ian Holmes, Ratcliffe College, Leicester to San Paulicarpo, Italy for Social work with the Mother Theresa Project from July to September, 1971—£50.
- Mr William House, The Middlesex Hospital, London to Mengo Hospital, Kampala, Uganda from April, 1971 to July, 1971—£150.
- Miss Margaret Woodgate-Jones to St. Joseph's School, Nazareth, Addis Ababa, Ethiopia for Social and teaching work (Project Trust Scheme) from November 1970 to July 1971—£100.
- Miss Jean Hughes, Christ's College, Liverpool for social work in Bihar, India from September 1971 to September 1972.—£100.
- Miss Margaret Kennedy, Christ's College, Liverpool for social work in Bihar, India from September 1971 to September 1972—£100.
- Miss Christine Lenton of the Middlesex Hospital to Mengo Hospital, Kampala, Uganda from April to July 1971—£150.
- Mr George Lewith, Trinity College, Cambridge to Sao Paulo, Brazil for field-work with a team studying Simian Malaria in connection with Professor Deane of the Institute of Tropical Medicine from July, 1971 to April, 1972—£250.
- Mr J. Lovejoy of the Westminster Hospital to St. Francis Hospital, Katete, Zambia from May to July 1971—£150.
- Miss Catharine Pouncey of King's College Hospital to St. Anne's Hospital Livli, South Tanzania from June to August 1971—£100.
- Mr Michael Vaugham of St. Mary's Hospital, Paddington to the Charles Johnston Memorial Hospital, Zululand from March to June, 1971—£100.
- Mr. Michael Wain of St. Mary's Hospital, Paddington to the Charles Johnston Memorial Hospital, Zululand from March to June, 1971—£100.