

Appropriate Technology

Child health

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Much of the mortality and morbidity among children in developing countries is preventable. The three main causes of admissions to hospital are protein energy malnutrition, respiratory infections, and diarrhoea. These three account for 30-40% of all paediatric admissions. The next most common illnesses are anaemia, common infections of childhood such as measles and pertussis, parasitic diseases (especially malaria and intestinal helminths), tuberculosis, and burns and other accidents including poisoning. Together these nine conditions account for most of the paediatric problems in the developing world.

Undernutrition and infection make a lethal combination

Nutritional surveys of preschool children have shown that about half the children in the poorer communities are undernourished. These children have a low resistance to infection, and each minor illness tends to run a protracted course, which results in further deterioration of the children's nutritional state. Multiple pathological conditions may coexist, and many of the children who are admitted to hospital with protein energy malnutrition have other medical problems such as anaemia, vitamin deficiencies, and lower respiratory tract infections including tuberculosis. For these children even a trivial illness may precipitate a life threatening condition.

The extent to which poor nutrition influences mortality is shown in a study of 3000 children aged 1-36 months in the Punjab. Child mortality doubled with each 10% decline in body weight below 80% of the Harvard median.¹ A similar study in Bangladesh showed that children who weighed less than 65% of the Harvard median had a threefold higher death rate in the next two years compared with those whose weights were above this level; the 10% of children with the smallest arm circumference had a five times higher risk of death than the top 10%.²

Providing preventive services

Preventive services are important in the developing countries, where the high infant and child mortality is due not to exotic "tropical" diseases but to diseases that result from poverty, ignorance, and neglect. Personal services such as under 5s clinics, prenatal care, and maternity care are particularly important. Preventive care does, however, require painstaking skills of gathering data, organisation, and management. The district hospital should promote this care and get the local community to participate fully in the planning, implementation, and evaluation of health care policies. The hospital also has an educative role in training health staff, who need to have adequate

communication, epidemiological, and management skills to run the preventive clinics effectively.

The routine activities of the under 5s clinic include surveillance of growth by regular weighing or measurement of arm circumference. Parents may not know exactly how old their children are, but arm circumference changes little between the ages of 1 and 5, so that this measurement is a good way of identifying malnourished children. The tape may be made from an old x ray film, which is cheap and does not stretch. This should be cleaned to remove the gelatine, and then a strip may be marked off as shown (fig 1). The tape may be coloured to make the measurements easy to interpret. Any child whose arm cir-

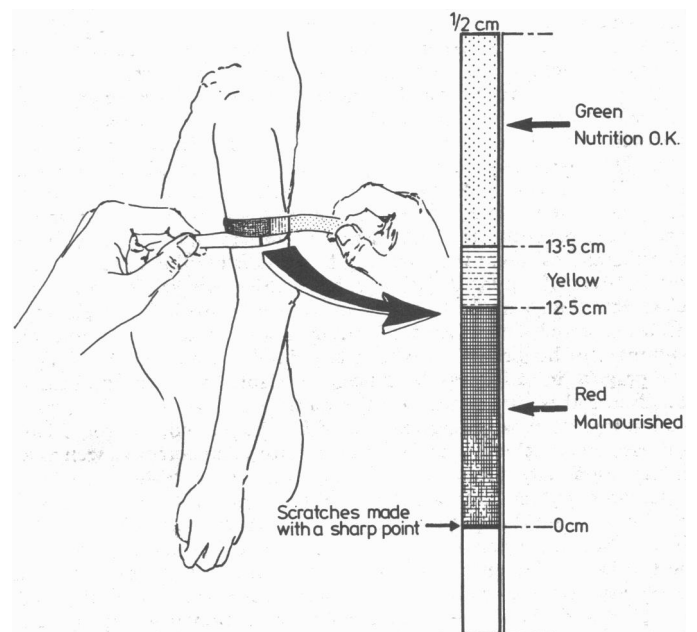


FIG 1—Measuring arm circumference.

cumference is below 12.5 cm—that is, in the red zone—is considered to be malnourished; 12.5-13.5 cm is borderline; and above 13.5 cm the child is adequately nourished. Monitoring the rate of growth in childhood is important, for growth is a sensitive indicator not only of health and nutritional state but also of illnesses and even emotional upsets. Thus growth charts should be kept, and the shape of a child's growth curve is a sensitive indicator of his wellbeing. The growth chart shown in fig 2 is adapted from the one currently recommended by the World Health Organisation and the United Nations Children Fund. Local growth standards vary from country to country, but the World Health Organisation has issued a growth chart for inter-

national use based on growth data for children in the United States.³

In addition to surveillance of growth, under 5s clinics provide an immunisation service and advise mothers on infant feeding and family planning. The clinics may also have a diagnostic role and give advice and treatment for common disorders such as diarrhoea, malnutrition, and intestinal infestation. Experience in several countries has shown that the under 5s clinic (and the antenatal and maternal clinics) may be run by auxiliary health workers provided they have periodic supervision and back up from professional health staff.

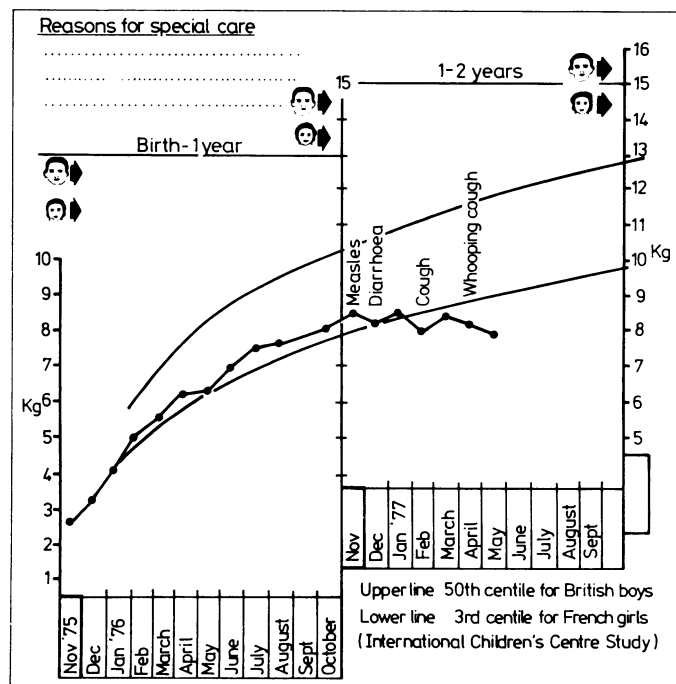


FIG 2—Growth chart, suitable for both boys and girls.

If the coverage by the maternal and child health services is adequate regular collection of data may yield valuable information for developing criteria for identifying those at risk of diseases among the local community. This is important as it enables the community to identify the preventable antecedents of malnutrition and other illnesses and offers the opportunity to provide appropriate health education and early corrective action.⁴

Developments in child care

Three recent developments in nutritional and medical care hold promise for the future: firstly, a better understanding of the nutritional requirements of children and of the pathophysiology and management of diarrhoea; secondly, improved immunisation policies and methods and new, more robust vaccines; and, thirdly, advances in the intermediate technology for providing safe water and disposal of waste. These three factors have prompted the World Health Organisation and the United Nations Children's fund to promote new strategies and health programmes.³ These include an expanded programme of immunisation and the promotion of oral rehydration therapy. These aim at helping developing countries achieve better levels of immunisation than the previous 11-20% and setting up nationwide facilities for the management of diarrhoea. (These programmes also include strategies for training health workers, methods of epidemiological surveillance, and the development of facilities for storage and transport of necessary supplies.)

Nutrition

Mother's milk is now recognised to be the sheet anchor of sound infant and child nutrition,^{5,6} as well as contributing to mother-infant bonding. Human milk contains only 1% protein (range 9.5-12.0 g/l),⁷ but at 25 J (6 cal)/g solid matter human milk has one of the highest energy densities among foods, and infants all over the world thrive on it, doubling their weights during the first four months of life when fed on breast milk alone. The origins of malnutrition are often traced to the weaning period with the introduction of local staple foods in the form of a gruel.⁸ Many traditional gruels have an energy density of only 4.2 J (1 cal)/g, and the sudden change from an energy rich food to a watery gruel is largely responsible for the slowing of growth. Hence the emphasis in nutritional education has shifted from the concentration of protein to the energy content of weaning foods.

The main problem with traditional gruels is the high starch content, the source of energy in all cereals and tubers. On heating in water starch granules swell and coalesce, resulting in increased viscosity, which increases even further on cooling.⁹ The young infant can manage only foods of a fluid consistency, so there is a limit to the amount of cereal that can be used in the preparation of the gruels, most of which contain 85-90% water. One way out of the dilemma is to add a small quantity of edible oil to the gruel. This not only increases the energy content but also helps to keep the consistency of the gruel more fluid. Similar considerations apply to solid foods. For example, boiled rice is up to 65% water; if foods containing fat, such as ground nut, soya, or coconut, are added this increases the energy content. Alternatively, if the cereal grain is sprouted before it is ground into flour the amount of starch is reduced by conversion to dextrins, dextrimaltose, and maltose, and so much more flour can be added to make a gruel of the same viscosity.

Adequate amounts of essential amino acids in the weaning diet may be provided by a judicious mixture of cereals and legumes.¹⁰ Cereals tend to be low in lysine content but relatively rich in amino acids containing sulphur. Regional recipes for weaning foods based on multimixes have been developed for most countries.¹¹

Oral rehydration: a major breakthrough

Oral rehydration, with a sugar and electrolyte solution, for the management of diarrhoea in children has led to an improvement in mortality as well as early recovery.¹² The mixture currently recommended for oral rehydration¹³ contains glucose 110 mmol/l (2.0 g/100 ml) (made from 20 g glucose); sodium 90 mmol (mEq)/l (3.5 g sodium chloride); potassium 20 mmol (mEq)/l (1.5 g potassium chloride); chloride 80 mmol (mEq)/l (2.5 g sodium bicarbonate); and bicarbonate 30 mmol (mEq)/l (1 l water).

The distribution and provision of a continuous supply of prepackaged ingredients are unlikely to be practicable for every village and settlement, but the techniques may be simplified. Mothers should be shown how to make the solution from sugar, salt, and water, using a special plastic spoon (available from TALC, PO Box 49, St Albans, Herts) or a home made scoop (fig 3). The solution should be freshly made up each time, for it supports bacterial growth and may easily become contaminated if left to stand for long periods. One large scoop of cane sugar and one small scoop of salt should be added to a glass or cupful (200 ml) of boiled clean water. The child should be given one cupful for each bowel movement during the episode of diarrhoea. Breast feeding should continue, and the older infant should be persuaded to eat a normal diet, for he or she is likely to absorb about 70% of the nutrient value of the food despite the diarrhoea. An alternative to the sugar and salt solution is to give the child the water that the family boils the rice in. This contains salt and starch and is an effective form of fluid replacement for the dehydrated child.

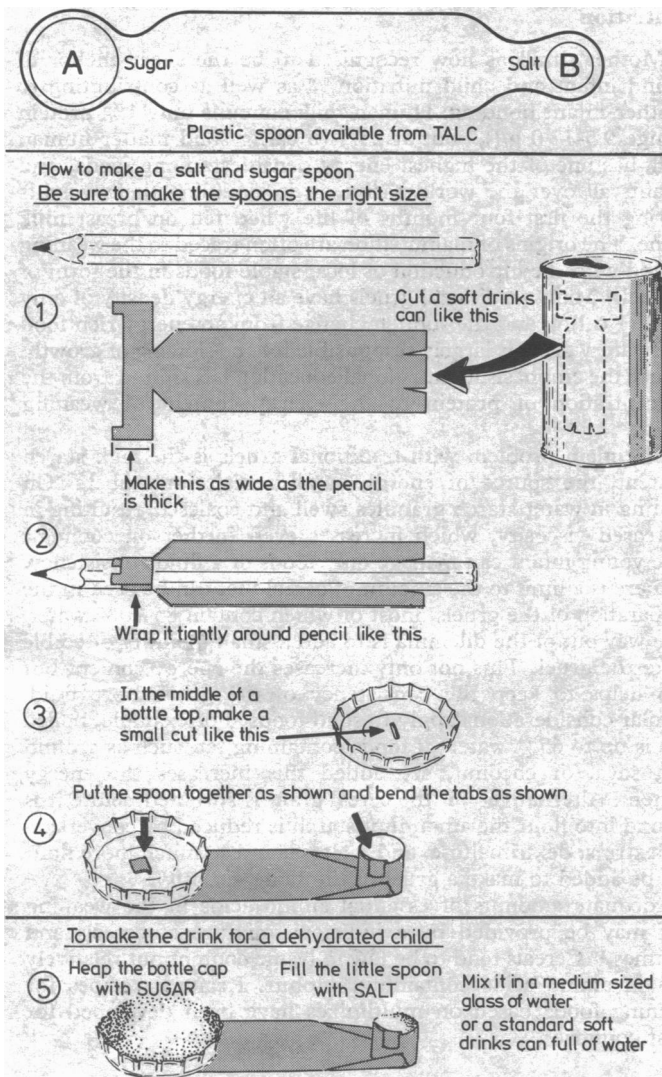


FIG 3—Plastic spoon used in making up a simple oral rehydration fluid, and the do it yourself equivalent.

Immunisation

The role of immunisation in controlling the prevalence of pertussis, diphtheria, poliomyelitis, and measles is well known. The success of relatively poor countries such as Cuba, China, and Sri Lanka in achieving high rates of immunisation has shown that it is not the cost of vaccines but the ability and determination to set up a delivery system that are the crucial factors. Preventive services such as the under 5s clinic should carry out immunisation, and the standard schedule that is applicable to all third world countries is shown in fig 4. Successful uptake rates with live polio vaccine have been low in some countries—about 50%, compared with about 90% in Western countries. Possibly the cluster technique of immunisation, whereby many children are offered the vaccine on the same day, may help improve these low conversion rates.¹³ (The value of BCG is under question, but the World Health Organisation recommends the continued use of vaccine that is currently available until further information is accrued.)

In all developing countries that have made rapid progress in health the key factors have been community awareness and good organisation, and these have enabled the local preventive service programmes to be implemented.

The illustrations were adapted from *Paediatric Practice in Developing Countries*, by G J Ebrahim.

Age or visit	Vaccine
Antenatal period	Tetanus toxoid to the mother (2 doses in the last trimester if not previously immunised. One dose if immunised)
Birth	BCG
One month (or first visit)	Triple antigen (DPT), oral polio. (BCG if not previously immunised)
Second month (or second visit)	Triple antigen; oral polio.
After nine months	Measles; triple antigen; polio.
Entry to school	BCG; diphtheria and tetanus; oral polio

FIG 4—Recommended schedule of immunisation.

References

- Kielman AA, McCord C. Weight for age as an index of risk of death in children. *Lancet* 1978;ii:1247-50.
- Chen LC, Chowdhury AKMA, Huttman SL. Anthropometric assessment of energy protein malnutrition and subsequent risk of mortality among pre-school age children. *Am J Clin Nutr* 1980;33:1836-45.
- World Health Organisation. *A growth chart for international use in maternal and child health care. Guidelines for primary health care personnel.* Geneva: WHO, 1978.
- Al-Dabagh A, Ebrahim GJ. The preventable antecedents of childhood malnutrition. *J Trop Pediatr* 1984;30:50-2.
- Ebrahim GJ. *Breastfeeding, the biological option.* London: Macmillan Press, 1978.
- Jelliffe DB, Jelliffe EPP. *Human milk in the modern world.* Oxford: Oxford University Press, 1978.
- Department of Health and Social Security. *The composition of human milk.* London: HMSO, 1977. (Report on Health and Social Subjects No 12.)
- Rutishauser IHE. Growth of the pre-school child in West Mengo district, Uganda. In: Ower R, Ongom VL, Kirya BC, eds. *The child in the African environment—growth, development and survival.* Nairobi: East African Literature Bureau, 1974.
- Ljungquist BG, Mellander O, Svanberg US. Dietary bulk as a limiting factor for nutritional intake in pre-school children. *J Trop Pediatr* 1981;27:68-73.
- Protein Advisory Group. *Guidelines on protein food mixtures for older infants and young children.* New York: United Nations, 1970. (Guideline No 8.)
- Cameron M, Hofvander Y. *Manual on feeding infants and young children.* Oxford: Oxford University Press, 1983.
- International Study Group. Beneficial effects of oral electrolyte-sugar solutions in the treatment of children's diarrhoea. Studies in seven rural villages. *J Trop Pediatr* 1981;27:136-9.
- John TJ, Joseph A, Vijayarathnam P. A better system for polio vaccination in developing countries. *Br Med J* 1980;281:542.
- World Health Organisation. *Treatment and prevention of dehydration in diarrhoeal diseases: a guide for use at the primary level.* Geneva: WHO, 1976.

Recommended reading

Nutrition for Developing Countries: M King, D Morley, L and A Burgess. Written in simple English, with exercises that can be undertaken in the community (English Language Book Society edition.)

Using the Method of Paulo Freire in Nutrition Education: Therese Drummond. Excellent account of adult literacy and nutrition programme.

Paediatric Priorities in the Developing World: David Morley. Alternative priorities to those suggested by traditional paediatrics. (English Language Book Society edition, Indonesian, Spanish, Portuguese, or French.)

See How They Grow: David Morley. A follow on to *Paediatric Priorities in the Developing World:* the importance of the growth chart is emphasised. Also in Spanish.

Primary Child Care Book One: Maurice and Felicity King: Comprehensive child care in simple language, well illustrated.

Primary Child Care Book Two: A Guide for the Community Leader, Manager and Teacher: Maurice and Felicity King. An excellent and most useful book; also contains 3000 multiple choice questions.

Manual on Feeding Infants and Young Children: M Cameron and Y Hofvander. A new edition completely rewritten; simple and practical.

Child to Child. Prepared for the International Year of the Child, this

describes how older children can help younger children's health and development.

Booklet on the University of London's master of science course in mother and child health. This describes the course. The curriculum it gives may be of help to others setting up teaching programmes.

Visual Communication Handbook: Denys Saunders. For those desiring to become more effective in communication.

Breast Feeding in Practice: E Helsing and F Savage King. An aid to health workers to guide and support mothers in successful breast feeding.

Breast Feeding, the Biological Option; *Child Care in the Tropics*; *Care of the Newborn in Developing Countries*; *Practical Mother and Child Health in Developing Countries*; *A Handbook of Tropical Paediatrics*: all by G J Ebrahim. Designed for use in small hospitals and health centres. (English Language Book Society editions.)

Paediatric Practice in Developing Countries: G J Ebrahim. Continues the themes of the preceding five titles and is meant for the district officer who has to provide a comprehensive child care service for the district population.

Better Child Care: Voluntary Health Association of India. Illustrated memory and teaching aid for talking with parents.

The Care of Babies and Young Children in the Tropics: David Morley. Written for European mothers taking their children to hot climates.

Child Health in a Changing Environment: G J Ebrahim. Intended for national planners, it seeks to establish the scientific base for primary health care.

Nutrition in Mother and Child Health: G J Ebrahim. Designed for nutrition workers.

Lesson of the Week

Danger of inadequate urological supervision of patients with congenital neuropathic bladder

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It is customary in the United Kingdom for children with congenital neuropathic bladder to be under close urological supervision. The care these same patients receive as adults is sometimes haphazard as may be illustrated by six cases referred to us in the past four years.

Case reports

Six patients who had had a low level myelomeningocele closed early in life presented with urological problems. With the exception of one (case 1) all walked well. Two patients (cases 2 and 3) had urgency of micturition but were able to stay dry, the others were incontinent of urine but managed this satisfactorily with a penile appliance. All patients had otherwise enjoyed good health.

Case 1—A 21 year old man had had a myelomeningocele at level L4, complete: he was confined to a wheelchair. An intravenous urogram at the age of 3 years had shown normal upper renal tracts. He then had no further urological supervision until he presented with a short history of urinary infections and pain in the right loin. An intravenous urogram showed pronounced bilateral hydronephrosis and bladder stones, and a cystogram showed right vesicoureteric reflux and obstruction of the bladder outlet at the level of the external urethral sphincter. After removal of the stones his hydronephrosis resolved, but he still had vesicoureteric reflux with residual obstruction of the bladder outlet and might require urethral sphincterotomy in the future.

Case 2—A 17 year old man had had myelomeningocele at level S1, incomplete. Details of his previous care are lacking but he had certainly had no urological investigations for at least seven years before presenting with a two year history of increasing urgency and

Patients with congenital neuropathic bladder need lifelong urological supervision to avoid deterioration of the upper renal tracts

incontinence. An intravenous urogram showed moderate bilateral hydronephrosis, and a videourodynamic study indicated obstruction of the bladder outlet due to detrusor sphincter dyssynergia. After endoscopic urethral sphincterotomy his hydronephrosis resolved (though with residual left renal parenchymal damage) and his incontinence improved.

Case 3—A 21 year old man whose myelomeningocele was at level L5, incomplete, had been under urological supervision until the age of 15 but was then discharged because his bladder was "normal"; he stated that he had always suffered from urgency of micturition. He was reinvestigated because of haematuria when an intravenous urogram showed pronounced bilateral hydronephrosis. A resection of the bladder neck was performed elsewhere and he was referred to us when this procedure did not improve his upper renal tracts. A videourodynamic study showed detrusor sphincter dyssynergia. Endoscopic sphincterotomy improved his hydronephrosis but he became completely incontinent after this operation and now needs to use a penile appliance.

Case 4—A 30 year old man had had a myelomeningocele at level L4, complete. Details of his previous care are incomplete though as a child he had had a bladder neck Y-V plasty. No urological supervision was arranged after he left residential school, and he sought our advice purely for a recent problem of impotence. A routine test showed blood urea concentration to be 13 mmol/l (78 mg/100 ml), and a consequent intravenous urogram showed gross bilateral hydronephrosis. A videourodynamic study showed a flaccid but trabeculated bladder with minimal obstruction of the outlet. He was treated for nine months with an indwelling urethral catheter and subsequently with phenoxybenzamine. His glomerular filtration rate (as estimated by ^{99m}Tc-diethylenetriamine penta-acetic acid renography) improved from 33 to 74 ml/min and a recent intravenous urogram showed resolution of his hydronephrosis but with considerable residual renal parenchymal damage.

Case 5—A 36 year old man (myelomeningocele at level S2, incomplete) had never had any urological investigation until he presented with a short history of pain in the loin and haematuria. His serum

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