



WORLD HEALTH ORGANIZATION
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Diarrhoea - prevention and control
Appraisal
Nutritional status

CDD/86.1

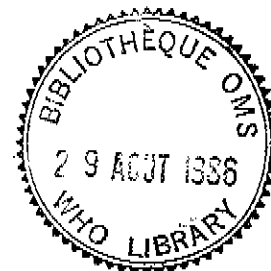
ORIGINAL: ENGLISH

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INTERVENTIONS FOR THE CONTROL OF DIARRHOEAL
DISEASES AMONG YOUNG CHILDREN: GROWTH MONITORING PROGRAMMES

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SUMMARY

This review examines whether growth monitoring programmes can reduce diarrhoea morbidity, mortality or severity either by improving the nutritional status of infants and young children or by increasing their contact with primary health services. We have located no evidence that growth monitoring improves nutritional status. There is some evidence that village-based growth monitoring programmes increase the utilization of primary health services, and this increased utilization can be expected to reduce diarrhoea mortality and possibly morbidity and severity. Data from Jamaica suggest an impact of growth monitoring on diarrhoea mortality through increased utilization of curative services. Further field research is needed to determine the impact of growth monitoring on nutritional status, health service utilization and diarrhoea.

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INTRODUCTION

In this series of reviews, eighteen potential interventions for the control of diarrhoeal diseases are being examined (22). Ten of these reviews have been published to date (3-5, 15-21). The rationale for considering growth monitoring programmes as a potential intervention to control diarrhoeal diseases is based on the following reasoning. First, growth monitoring programmes aim to improve the nutritional status of infants and young children and data have been presented in this series showing that poor nutritional status predisposes to more severe and longer-lasting diarrhoea and to a higher case-fatality rate (18). Second, growth monitoring programmes aim to increase the contact between primary health workers and families with young children with a view to combating diarrhoeal and other diseases. This review therefore examines whether growth monitoring programmes can reduce diarrhoea morbidity, mortality or severity by improving the nutritional status of infants and young children and/or increasing their contact with primary health services.

Growth monitoring is considered an essential element of primary health care and during the last decade growth monitoring programmes of differing magnitude have been implemented throughout the developing world (27). The potential of this intervention lies in its use as a diagnostic tool to detect problems before the child's nutritional status is seriously jeopardized. Most growth monitoring programmes use weight charts. A weight chart is a graphic representation of a child's weight-for-age. An under-nourished or sick child will have a slower rate of weight gain than a well-nourished, healthy child. Monitoring a child's growth by plotting his weight at regular intervals, and comparing his pattern of growth to reference curves of healthy children, permits the early detection of growth faltering. Some growth monitoring programmes use arm circumference measurements instead of weight (27). Whichever indicator is used, a growth chart is a useful tool for identifying a child with a nutritional or health problem. Keeping a growth chart permits remedial measures to be implemented at an early stage, and enables the effectiveness of these measures to be assessed. To delay action may result in a deterioration of the child's condition which may lead ultimately either to his death or to expensive curative treatment. The principal aim of growth monitoring is to promote healthy growth of the individual child, the logic being that "a child who is growing normally cannot under any circumstances develop protein-calorie deficiency" (34). In practical terms, the purpose of growth monitoring is to help mothers and health workers perceive health and nutrition problems and to motivate them to take action to promote growth. Growth monitoring therefore has a dual role, namely as a diagnostic tool and as a catalyst for action (41). In order that mothers and health workers acquire the necessary skills and resources to take action, growth monitoring must be linked with nutrition education and with other health and development activities.

Growth charts are invariably designed to serve as health records so that the child's medical history and current nutritional status may be seen at a glance. Space may therefore be provided for recording immunization status, major illnesses, feeding history, reasons for special care, family planning practice and, if appropriate, malaria prophylaxis and vitamin A supplementation. The emphasis is thus on the provision of total care to the individual child through regular supervision. The growth chart is frequently given to the mother for her safe-keeping. The reasons for this are to stimulate collaborative involvement of the mother and family in growth monitoring, to provide continuity of care, and to save time at the health centre.

The main objectives of growth monitoring programmes are:

1. to promote growth monitoring as an instrument of individual health and nutrition surveillance and to instigate effective action in response to growth faltering
2. to teach mothers, families and health workers how diet and illness can affect child growth, and thereby stimulate individual initiative and improved practices
3. to provide regular contact with primary health services.

With regard to the first objective, growth monitoring can assist the health worker in identifying which children need special care as distinct from those who need routine care,

and in evaluating the outcome of any advice given, or intervention initiated. The growth chart can serve as a reminder to the health worker as to what preventive measures should be taken and when. With regard to the second objective, the chart can make visible the adverse effect of infection and inadequate feeding, and stimulate the mother to feed her child appropriately and take action to prevent infections or minimize their effects. For these reasons, growth charts may portray health education messages, particularly in relation to breast-feeding, improved weaning practices, immunization and the preparation and use of oral rehydration solution. Through a better understanding of the factors that affect growth, it is envisaged that the health worker and mother will be motivated to maintain regular contact, and that the family and community will be stimulated to become effectively involved in a collaborative effort to improve child health (27, 47).

The best known record for monitoring growth is the Road-To-Health chart developed 25 years ago in the Ilesha Clinic, Nigeria, by Dr David Morley (13, 35). In 1961 the use of growth charts was recommended by a Joint Committee of FAO and WHO (50) and since then growth charts have been introduced in more than 80 countries (47). Over the years, at least 280 different types of growth charts have been designed. Recently WHO has developed a growth chart for international use (51) and a training module for the recording of a child's growth (52).

The common sense logic behind the advocacy of growth monitoring is summarized above. It is a convincing logic, both to the medical and public health professions and to the educated lay public. The purpose of this paper is to go beyond the common sense appeal of growth monitoring and to present and analyse evidence that growth monitoring programmes confer measurable benefits on the children for whom growth charts are kept. The benefits considered here are improved nutritional status, increased frequency of contact with the health services and decreased diarrhoea rates or severity.

EFFECTIVENESS

For growth monitoring to be an effective diarrhoea control intervention it must be true that:

either

Young children with improved nutritional status and/or increased frequency of contact with primary health services have reduced diarrhoea morbidity, or mortality, or severity

hypothesis 1

and

Growth monitoring programmes can improve the nutritional status of young children and/or increase the frequency of contact with primary health services

hypothesis 2

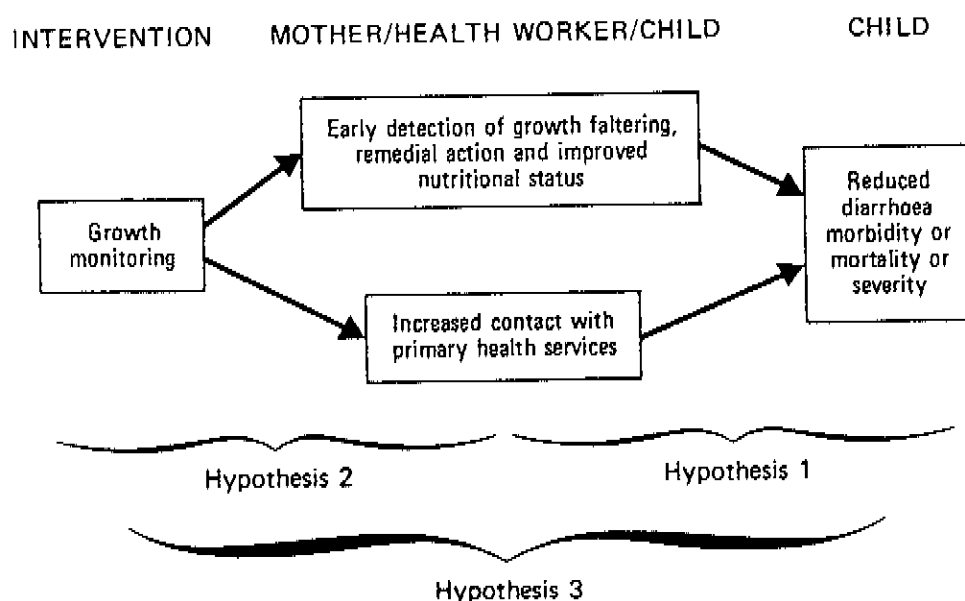
or

Growth monitoring programmes can reduce diarrhoea morbidity, or mortality, or severity in young children

hypothesis 3

The potential effectiveness of growth monitoring programmes would be suggested by a demonstration either of the correctness of hypotheses 1 and 2, or of the correctness of hypothesis 3.

This is schematically represented in the following diagram:



The evidence for and against these hypotheses is examined below.

Hypothesis 1: Young children with improved nutritional status and/or increased frequency of contact with primary health services have reduced diarrhoea morbidity, or mortality, or severity.

The first part of this hypothesis, namely that young children with improved nutritional status have reduced diarrhoea morbidity, mortality or severity, was examined in an earlier review in this series in relation to supplementary feeding programmes (18). There was little indication of an association between nutritional status and diarrhoeal disease incidence, but there was evidence that a poor nutritional status predisposed to increased severity and duration of diarrhoeal attacks and to increased diarrhoea mortality. Further evidence of an association with diarrhoea duration, and not with incidence, has since been reported from Bangladesh (8).

We have located no objective evidence that young children with increased frequency of contact with primary health services have reduced diarrhoea morbidity, mortality or severity, but the proposition is plausible. For example, oral rehydration delivered within a primary health care system is effective in reducing mortality due to dehydrating diarrhoeas. Likewise, immunizations delivered as a primary health service can be expected to reduce the incidence, duration and severity of diarrhoeal attacks by preventing (i) measles-associated diarrhoea (20) and (ii) the deterioration in nutritional status that is particularly associated with measles, pertussis and tuberculosis. Increased frequency of contact may also provide a greater opportunity for health workers to promote other diarrhoea control interventions. For example, health education may include the promotion of breast-feeding and advice on weaning, food hygiene, personal and domestic hygiene, water supplies and sanitation.

We therefore conclude that hypothesis 1 is tenable in so far as improved nutritional status can be expected to reduce diarrhoea duration, severity and mortality. We also conclude that hypothesis 1 is theoretically plausible if increased frequency of contact leads to an increased, effective utilization of primary health care and if mothers implement the advice that is given. Effective utilization will depend, in part, on the availability of oral rehydration fluids, vaccines, and other essential inputs within the primary health system. Implementation of advice will depend on resources within the home and the cultural appropriateness of the advice given.

Hypothesis 2: Growth monitoring programmes can improve the nutritional status of young children and/or increase the frequency of contact with primary health services.

This hypothesis will be considered in two stages. First we shall examine the effect of growth monitoring programmes on nutritional status. Later we shall examine their impact on the frequency of contact with, and utilization of, primary health services.

Growth monitoring programmes can improve the nutritional status of young children.

Studies that relate to this hypothesis have been conducted in Indonesia, Thailand, Jamaica, Malawi, Ghana and Lesotho, and are described below.

In Indonesia, where rural mothers are trained as 'Kaders' (42), measurements were made of the change in weight of children who were newly entered into one of three growth monitoring programmes (44). These were (i) monitored by mothers in the village, (ii) monitored by paramedical staff in the village, and (iii) monitored by professional midwives at the clinic. Children were weighed for 4 consecutive months, during which the average weight-for-age declined to some extent in all three types of programme, as shown in Table 1. Unfortunately, no measurements of nutritional status were made of children whose weight was not being plotted on growth charts, and it is possible that their nutritional status may have declined to an even greater extent. In more recent evaluations in Indonesia, conducted two or three years after the initiation of village-based growth monitoring, no evidence of improved nutritional status has been found (W.H. Mosley, personal communication, 1985).

Table 1: CHANGE IN NUTRITIONAL STATUS DURING 3 MONTHS
IN CHILDREN WITH GROWTH CHARTS MAINTAINED BY DIFFERENT
PERSONNEL IN INDONESIA^a

Person weighing the child	No. of children	Mean age (months)	Mean weight-for-age as % of Harvard 50th centile	
			1st visit	4th visit
Mother	25	20.0	84.6	82.0
Paramedic	110	18.8	82.0	80.8
Midwife	16	15.6	82.8	80.9

^aAll data from Rohde et al. (42) and Siswanto et al. (44).

In Thailand, the weight of pre-school children was monitored over a 6-month period following the introduction of growth charts in remote villages (48). In some villages, growth monitoring was combined with a structured programme of nutrition education. During the 6-month period, the proportion of children weighing less than 75% of the Thai standard decreased by 17% in the control villages, by 22% in the villages with growth charts alone, and by 59% in the villages where growth monitoring was combined with an active programme of nutrition education (Table 2). Village health volunteers and village health communicators were responsible for the nutrition surveillance and education. The data indicate that growth monitoring per se is ineffective in changing nutritional status. Unfortunately, no villages received nutrition education alone, and it is therefore not possible to ascertain whether growth monitoring contributed to the success of the nutrition education programme by motivating mothers to change their child-feeding patterns.

Table 2: EFFECT ON NUTRITIONAL STATUS OF INTRODUCING GROWTH CHARTS, OR GROWTH CHARTS AND NUTRITION EDUCATION, IN RURAL VILLAGES IN THAILAND^a

% of preschool children						
Nutritional status (% weight-for-age: Thai standard)	Control (n=218)		Growth charts (n=219)		Growth charts and education (n=447)	
	Initial	After 6 months	Initial	After 6 months	Initial	After 6 months
90	47	49	55	53	44	56
75-89	45	44	35	39	41	38
75	8	7	10	8	15	6

^aAll data from Vitavaidhya et al. (48).

In Elderslie, a rural area in the parish of St. Elizabeth in Jamaica, locally recruited health auxiliaries were trained to use growth charts and to provide regular instruction on diet, sanitation and hygiene at monthly home visits, and to make an immediate referral to the clinic if medical attention was needed (1). After 2 years, the nutritional status of the under-fives was unchanged (Table 3), although mortality was halved. The investigators concluded that these contrasting results - reduced mortality and unchanged prevalence of malnutrition - indicate the relative ease of treatment and the difficulty of prevention.

Table 3: PREVALENCE OF MALNUTRITION IN ELDERSLIE AND HANOVER, JAMAICA, BEFORE AND AFTER GROWTH MONITORING WAS IMPLEMENTED

Location	Gomez grade	Percent of children falling into three Gomez grades ^a of malnutrition		
		Initially	After 1 year	After 2 years
Elderslie ^b	I	33	31	30
	II	8	6	6
	III	1	1	1
Hanover ^c	I	34	not stated	not stated
	II	11))
	III	1) 6) 6

^aGomez grade I = 75-90%, II = 60-75%, III = 60% weight-for-age compared with the 50th centile (25)

^bData from Alderman et al. (1) (Used Mexican 50th centile)

^cData from Alderman et al. (2) (Used Harvard 50th centile)

A similar service was subsequently provided in the neighbouring parish of Hanover where, in addition to a 60% reduction in 0-47 month mortality, a 40% reduction in the prevalence of malnutrition was also observed (Table 3), although the incidence of malnutrition was unchanged (2). The reason for a positive impact on nutritional status in Hanover, but not in Elderslie, is not clear. The programmes, however, were not identical. The main differences were that in Hanover (i) malnourished children were visited weekly, (ii) food supplements, when available, were given selectively to malnourished children, and (iii) all children attending the monthly field clinics were medically examined and simple curative care was dispensed. Secondary analysis of the Hanover mortality data suggests that the impact of the programme may have been overestimated because declining trends in child mortality were occurring coincidentally, and because mortality rates were calculated using a constant denominator while birth rates were declining (30). The pertinent fact from these two studies is that both showed a similar reduction in mortality yet in only one was there a reduction in the prevalence of malnutrition. This implies that improved nutritional status was not causally associated with the decline in mortality and prompt medical attention may have played the major role.

In Malawi, a programme establishing a national network of under-fives' clinics increased the number of clinics from 73 to 362 during 1968-72. From the clinic returns, based on data from growth charts, the percentage of total attendances that were less than 80% weight-for-age were 37, 29 and 29% for the first three years of the programme, respectively, which suggests some improvement in the nutritional status of clinic attenders (11). However, under-fives' clinics provide many services in addition to growth monitoring, each of which may have affected nutritional status, and there may have been other concurrent projects that may have led to a general improvement in child health.

In Ghana and Lesotho, 9 clinics in each country were graded as high, medium or low according to their use of growth charts (39). Grading was based on (i) the number of growth chart-related teaching sessions, (ii) whether the growth chart was used as an educational tool or simply as a clinic record, (iii) whether mothers had growth charts in their possession, (iv) whether the child's growth was discussed with the mother, and (v) whether advice was given to mothers and, if so, the quality of the advice. Over 3000 children were weighed. In addition, information was collected concerning family and household characteristics, mothers' nutritional knowledge and attitudes, mothers' and children's food behaviour, reported illnesses and mothers' understanding of growth charts. The data reveal no clear pattern of improved nutritional status associated with better chart use. The percentages of children less than 80% weight-for-age in the high-, medium- and low-rated clinics were respectively 33%, 34% and 37% in Ghana and 31%, 19% and 23% in Lesotho. The families served by the three grades of clinics appeared reasonably comparable, except that Ghanaian mothers who were attending high-rated clinics had received more schooling, and fewer of them were unemployed, compared with mothers attending medium- and low-rated clinics.

Growth monitoring programmes can increase the frequency of contact with primary health services.

We have located negligible data that relate to this hypothesis although the proposition is a plausible one. Forcible arguments have been made that regular growth monitoring will lead to an increased demand for primary health care, thus increasing the coverage of both preventive and curative activities (41). Where growth monitoring programmes are village-based, villagers are reported to ask for immunizations, oral rehydration packets, deworming, contraceptive resupply, vitamin A and simple curative care, thus bringing primary health services out of the clinic and into the community (41). Thus, in Haiti, the contact of rural children with primary health services has been increased, as evidenced by higher rates of immunization in villages with monthly growth monitoring rallies compared with control villages (15% v. 2%), a greater use of oral rehydration (30% v. 17%) and higher coverage by vitamin A supplementation (34% v. 16%) (J. Rohde, personal communication, 1984). The control villages had the same cadre of workers with the same resources, training and job description. Growth monitoring was the only difference. Interestingly, no measurable difference in nutritional status was found.

Conclusion on hypothesis 2.

Any conclusions must be tentative since the data are limited and most of the studies that we have reported in relation to nutritional status are tangential to the hypothesis. We have found no evidence that children whose mothers keep growth charts have a better nutritional status than children whose mothers do not keep growth charts. Since it is reasonable to expect that mothers who are actively and successfully involved in growth monitoring will be more aware than other mothers of the health and nutrition problems of their children and will be catalysed to take action, one may conclude that the lack of effect on nutritional status is due to either a failure of growth monitoring programmes to involve mothers actively and successfully, or an inability of mothers to take effective action due to resource inadequacy.

Preliminary findings in Haiti suggest that village-based growth monitoring programmes can increase the utilization of primary health services. Greater maternal awareness of health problems as a result of growth monitoring and increased frequency of contact with primary health services may both contribute to an increased utilization of services.

Hypothesis 3: Growth monitoring programmes can reduce diarrhoea morbidity, or mortality, or severity in young children.

We have located no published studies of diarrhoea rates in children whose mothers keep growth charts compared with diarrhoea rates in similar children whose mothers do not. Preliminary reports from Haiti indicate that village-based growth monitoring programmes have not reduced diarrhoea morbidity (J. Rohde, personal communication, 1984). One reason could be that the utilisation of the supporting services such as immunization, although improved, is still low. Neither is there any objective evidence of a reduction in diarrhoea morbidity or mortality in Indonesia where village-based growth monitoring has been in progress for several years (W.H. Mosley, personal communication, 1985). A possible reason for this, as will be discussed later, is that the volunteer workers have not met expectations as counsellors and educators of mothers (28). In this case, increased frequency of contact may not have led to an increased utilisation of health services.

In the clinic-based studies referred to earlier in Ghana and Lesotho, clinics rated as high, medium or low according to their use of growth charts did not differ in the number of diarrhoea cases reported during a two-week period (39). The reduced mortality in the two Jamaican projects referred to earlier (1,2) could conceivably be due in part to growth monitoring, and some of the substantial reduction can be expected to have been due to averting deaths caused by diarrhoea. As has been noted, this mortality reduction was probably achieved by improved contact with the health services and not by improved nutritional status.

In summary, we have located no evidence that growth monitoring programmes improve nutritional status. We have located evidence from Haiti that village-based growth monitoring programmes increase the utilization of primary health services. Effective use of primary health care can be expected to reduce diarrhoea mortality, and possibly morbidity and severity. In Jamaica, greater access to primary health care in association with growth monitoring was accompanied by a substantial reduction in mortality. It is reasonable to assume that this included a reduction in diarrhoea mortality.

FEASIBILITY

For a growth monitoring programme to be feasible, and have the potential to affect nutritional status and/or health-service contact, mothers must regularly attend at a weighing-point with their children and their growth charts. The children must be correctly weighed and their weight and age correctly plotted. This information must be correctly interpreted and the appropriate advice or therapy must be given to children whose growth is faltering. Ideally, mothers should themselves be able to interpret the information on the charts and take appropriate action. In practice, one or more of these essential steps may not be achieved.

Attendance.

Experience shows that many mothers fail to attend regularly if the weighing necessitates a visit to a clinic. The main reason is likely to be that mothers simply cannot afford the time (29, 31, 33, 45, 53). As Scrimshaw has observed, "all health programmes are vulnerable to the myth that the poorer a person and the greater his need, the more time he will have available to wait in clinics, bring children to health centres, make repeated visits, or attend lectures and demonstrations. Health programmes often fail because such persons cannot do so without economic losses that are critical and without neglect of crushing family responsibilities" (43).

Attendance might be improved by reorganization within clinics to create rapid "lines of flow", and by improvements in their accessibility. Mobile clinics have been tried but are costly (31). Village-based growth monitoring should improve the frequency of weighing but any practical benefit will depend on the correct interpretation of the growth chart, the appropriateness of any advice that is given, the motivation and resources of mothers to take action and the availability of rehydration fluid, drugs and vaccines.

Recording growth and interpreting charts.

Even though growth charts are simple in concept, health personnel may encounter difficulties in their use (9, 38, 47). In 1978, postal questionnaires were sent to 787 health personnel who were using growth charts in over 50 countries (37). Replies were received from 322 persons, of whom 85% were doctors or nurses. The problems encountered in introducing growth charts in their clinics are summarized in Table 4. Unresolved problems remained even after growth charts had been in use for 4 years or more, and 40-65% of respondents reported that various staff problems persisted despite the fact that 84% provided follow-up supervision.

Table 4: DIFFICULTIES IN INTRODUCING GROWTH CHARTS REPORTED BY 322 HEALTH PERSONNEL IN 50 COUNTRIES^a

Difficulty	Percent of respondents
Determining the month of birth	78
Interpreting a growth chart	51
Plotting the child's weight	49
Understanding 'at risk'	47
Understanding the weight curve	43
Taking effective action	42
Weighing correctly	30

^aAll data from O'Brien (37)

Follow-up on growth faltering.

Failure to take any action after plotting the child's weight was highlighted in a recent evaluation of the Indonesian Family Nutrition Improvement Programme, which is a collaborative venture between the Government, USAID, UNICEF and WHO and combines the

elements of GOBI-FP (growth monitoring, oral rehydration, breast-feeding promotion, immunization, family spacing and food supplements) into one national intersectoral programme (28). It was concluded that village volunteer workers, although competent in weighing and recording the child's weight, too often failed to give advice or discuss with the mothers the significance of the child's weight. Better selection, longer training followed by refresher courses, and more frequent field supervision were recommended.

Lack of action is not confined to minimally-trained workers. In Zimbabwe, many mothers attending health centres received no advice, including those whose children's weight curves were following a consistent downward direction (René Loewenson, personal communication, 1984). Similarly in Mozambique, little conversation was held with mothers at under-fives' clinics, and nurses did not spend any longer with the mothers of children whose growth was faltering (29). On the other hand in Kenya, where the use of growth charts fluctuated because of supply problems, health workers responded more effectively to a child's condition when his weight was plotted on the chart than when it was not (F. Savage King, personal communication, 1984). Feedback from health worker to mother is crucial if growth monitoring is to be effective. Where growth charts are badly used, improved training is required. One of the problems in training health workers to use growth charts is the limited amount of time available for teaching, compounded by a lack of commitment from administrators and other teachers (F. Savage King, personal communication, 1984).

Mothers' understanding of growth charts.

Experience shows that many mothers are unable to interpret growth charts or understand their use (37, 38, 40, 49), and the effectiveness of growth charts as an educational tool may therefore be questioned. Furthermore, mothers' comprehension of growth charts is not necessarily reflected in the nutritional status of their children (23,24). Thus, in Papua New Guinea, when mothers who already had weight charts were given additional individual instruction designed to help them discriminate between 'good' and 'not good' growth curves, and when health staff were also given additional instruction, the nutritional status of children aged 18 months or less nevertheless declined in the following 4 months, regardless of the type of instruction received (Table 5). Although older children showed a small improvement in nutritional status compared with control children, the effect was not statistically significant (24). In Thailand, nutritional status was unrelated to mothers' understanding of growth charts (H. Hughson, personal communication, 1985).

Table 5: CHANGE IN NUTRITIONAL STATUS DURING 4 MONTHS IN CHILDREN WITH GROWTH CHARTS ACCORDING TO TYPE OF INSTRUCTION, IN PAPUA NEW GUINEA^a

Type of instruction	Mean weight-for-age as % of local 50th centile			
	18 months of age		18 months of age	
	Initial	After 4 months	Initial	After 4 months
Additional, individualized to mothers	88	84	81	82
Additional, to health staff	90	88	81	82
Additional, to mothers and health staff	88	86	80	82
Routine	96	91	91	89

^aAll data from Forsyth (24).

Collaborative involvement.

It is envisaged that growth monitoring will motivate the health worker and mother to maintain regular contact. In Haiti, growth monitoring increased health worker-mother contact. In Colombia, mothers with growth charts followed not only the progress of their own children but also that of their neighbours' children (53). This suggests that growth monitoring can be a stimulus and can lead to collaborative involvement of the family and the community in efforts to achieve adequate growth.

COST

The cost of a growth chart is approximately US\$ 0.10. The cost of growth monitoring, however, will include the costs of other material inputs. UNICEF, for example, estimates that weighing and charting activities in India cost US \$2.09 per child-year (6). Consideration should also be given to the costs of the educational and support activities for health personnel and mothers that are necessary if the benefits of growth monitoring are to be realized. In India, the combined costs of weighing, charting, training and education in the Tamil Nadu Integrated Nutrition Project amount to US \$8.09 per child-year (27). The provision of supporting services will increase the cost still further. An analysis of the Indonesian experience suggests that the cost per child-year of an ideal GOBI-FF package under 'best-practice' conditions is US \$31.23 (12). Such expenditure may not be feasible when one considers that central government expenditure on health and education in Indonesia was US \$8 per caput in 1980 (12).

CONCLUSIONS

We have provided examples which show that many difficulties arise in growth monitoring programmes. We have focused on the problems encountered by health staff in recording and interpreting growth data and in taking effective action, and the problems encountered by mothers, particularly the need for regular attendance. The problems, however, should not be seen as reasons for rejecting growth monitoring, but rather as signaling the need for better training and for more functional, service-oriented research.

Improved training is not easily accomplished since staff are often few in number, isolated and overworked. Attention has recently been given to the design of clear, well-structured growth charts to minimize errors (47), and training materials have been prepared to instruct health workers as to their use (46, 52). It is important to stress, however, that growth monitoring will not of itself produce any benefit. The practical benefits of growth monitoring in promoting better nutritional status and child health are dependent on (i) the motivation and ability of mothers to promote child growth, (ii) the effectiveness of the supporting services, such as the availability of vaccines, rehydration fluid and drugs, and (iii) the appropriateness of any advice that is given.

In reviewing recent global experience, Gopalan and Chatterjee conclude that the major focus of growth monitoring programmes at present seems to be the identification of 'beneficiaries' for food supplementation, and that the objective of educating mothers and health workers is being woefully neglected (26). Their analysis of operational problems encountered by 'front-line' health workers suggests that growth monitoring programmes "have been initiated at great cost, without adequate attention to the basic requisites for proper monitoring and, more importantly, for follow-up." They warn that the "over-enthusiastic promotion of growth-monitoring techniques involving weight measurement and growth charts in situations where the basic requisite infrastructure for such operations does not exist could well result in a backlash of disillusionment with growth monitoring per se."

We have located no evidence that growth monitoring improves nutritional status although such an effect is theoretically plausible and should be investigated. Preliminary reports from Haiti suggest that village-based growth monitoring increases the utilization of primary health services. Reductions in diarrhoea morbidity and mortality are therefore likely and should be studied. Field studies are required that compare groups of children and mothers who keep growth charts with groups of similar children and mothers who do not. The following criteria should be compared.

1. The nutritional status of the two groups of children matched for age, sex, maternal education and socioeconomic status.
2. The utilization of primary health services by the two groups of matched children, paying particular attention to use of oral rehydration therapy and immunization rates.
3. The diarrhoea rates among the two groups of matched children.

To assist in interpreting any difference between the two groups, comparisons should be made of the knowledge of the two groups of matched mothers about diarrhoea and its therapy, and the action taken by the two groups of matched mothers when their children suffer a diarrhoea episode.

ACKNOWLEDGMENTS

The authors are grateful for the constructive criticisms of earlier drafts of this paper provided by R. Cook, W.A.M. Cutting, I. de Zoysa, P. Harman, R. Hogan, J. Kevany, M. Merson, D. Morley, W.H. Mosley, N. Murthy, A. Pradilla, J. Rohde, F. Savage King and P.M. Shah. The assistance provided by Lynne Davies, Maelorwen Jones, Caprice Mahalla, Susan H elary and Suzanne O'Driscoll in the preparation of the manuscript is much appreciated.

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