primary health care

AMERICAN PUBLIC HEALTH ASSOCIATION

International Health Programs

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PRIMARY HEALTH CARE ISSUES is a series of reports designed to provide a concise, accurate and authoritative overview of important developments in the field of primary health care (PHC). The series is directed primarily to concerned health professionals such as program managers and decision makers who plan and implement programs around the world. The series will constitute a system of information transfer for an audience with a special need for timely, relevant and useful information that is at once generically useful and specifically applicable. The series will:

- address PHC policy issues of national and international concern;
- analyze common problems in PHC program management including planning, implementation and evaluation;
- identify gaps in knowledge about PHC and recommend research to fill those gaps;
- provide up-to-date technical and policy information on PHC delivery

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contents

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preface

The purpose of this paper is to examine the state of the art of growth monitoring as it is undertaken on a regular basis at the community or clinic level in primary health care and nutrition programs throughout the developing world. The paper is intended to present essential findings from research and field experiences on monitoring growth that will enable the primary health care program planner to understand:

- *the activities that comprise a growth monitoring project;*
- *the major issues and problems involved in growth monitoring exercises;*
- *some of the lessons learned in various projects and settings.*

Part of an overall research program of the American Public Health Association, the study utilizes reports and analyses of primary health care and nutrition activities worldwide, including AID-*assisted nutrition projects in four regions and 52* AID-*assisted primary health care projects researched by the International Health Programs division of the American Public Health Association. Additional information about growth monitoring in a primary health care context and comments on the paper are welcome.*

The author wishes to thank those people who shared ideas and generously gave their time in responding to written requests for information. These contributions are cited in the bibliography. Special appreciation is extended to the technical advisors and editors listed on the inside cover, who reviewed the paper in draft and contributed to its final form. They are, of course, not responsible for content or possible errors in the paper. M.G.

Photo: M. Griffiths

executive summary

The experience of hundreds of primary health care and nutrition projects in countries throughout the developing world shows that growth monitoring significantly improves preventive health care by:

- identifying malnourished children and predicting mortality and morbidity risk in time to save lives;
- enabling workers to target limited food supplies to the most vulnerable children and to recommend other interventions accurately;
- providing reliable data for evaluating specific interventions and overall program effectiveness and for tracking community and regional progress;
- teaching families through participation in monitoring activity how diet affects health and motivating them to implement dietary improvements; and
- involving communities and families in informed decision-making and preventive action initiatives.

Moreover, since growth monitoring is inexpensive and can be implemented by minimally-trained workers in any setting, it can be an appropriate component of virtually any health care program.

This paper shows planners how to maximize the benefits of growth monitoring by matching program objectives, resources, and demographic and cultural contexts with the options presented concerning anthropometric indicators, nutritional status classification systems, measurement tools, and record-keeping systems. Practical guidelines are established for program organization, worker training, collection and use of aggregate growth monitoring data, and nutrition education during monitoring sessions.

An analysis of each anthropometric indicator's ability to predict mortality risk and to evaluate intervention effectiveness concludes that weight-for-age most inclusively identifies children with mortality risk, while weight-for-height provides the most accurate picture of intervention effectiveness.

The systems designed to classify children as adequately or inadequately nourished, their reference populations, and the statistical procedures they use are examined and compared. Program planners are advised to choose a classification system that is compatible with resources available to treat identified children and that keeps client and staff morale in mind.

Planners are shown how to select recording systems (cards) that record the information required by each project, can be understood by clients as well as by workers, and facilitate community and regional profiles. Various cards are described, their advantages and disadvantages in use discussed, and ordering information provided.

Eight measuring instruments are evaluated and rated according to nine criteria. Additional detailed discussion follows on the manufacture and use of arm circumference measurement tapes, the effects of choosing various scale types and models, and the manufacture and use of length/height measuring boards. A description of each instrument, sources of directions for making tools, and manufacturers' addresses are provided in Appendix A.

The responsibilities of program managers, communities, and families are specified in a rationale for effective program organization. Guidelines are presented for establishing periodicity, selecting participants, setting up monitoring sessions, using growth monitoring to target recipients of food programs, and motivating and supporting community and family initiatives.

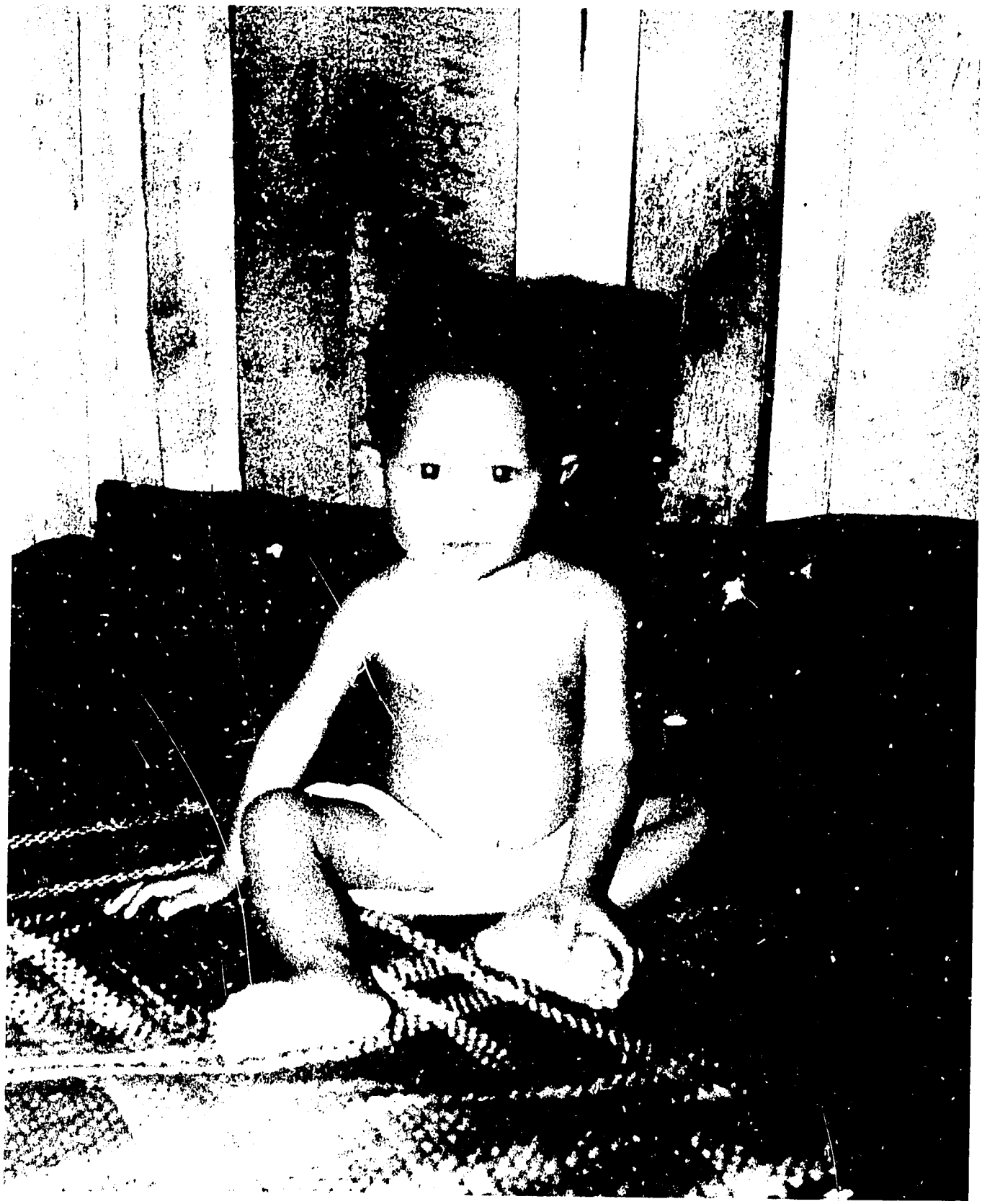
Planners are shown how to use growth monitoring activities to teach improved nutrition. Successful behavior-oriented messages along with strategies for message formulation and for insuring mothers' active participation are presented.

The section on training workers describes skill objectives, the rationale for action-oriented, practical training and on-site practice, workable techniques for each segment of training, and references to training courses for instructors. Appendix B presents a measuring protocol to be used during training.

Finally, the value of aggregated growth monitoring data for program planning, implementation, and evaluation is reviewed. Planners are shown how community profiles assess intervention impact, demonstrate progress to communities, and help communities identify, solve, and prevent problems.

"Is this child healthy?"

Photo: M. Griffith



CHAPTER I

why monitor growth?

Many times each day, primary health care workers are faced with the deceptively simple question, "Is this child healthy?" To answer it, the health worker should consider many factors affecting the child's health. What information is needed about an under-five child to judge if he or she is healthy?

An assessment of the child's nutritional status should be among the first considerations. Is the child well nourished? Does the child look content and strong?

The techniques employed to assess nutritional well-being reflect the assessor's understanding of what it means to be malnourished.* For example, the mother of the child in the photograph felt her daughter was well nourished because she was "easy to care for" and "liked to eat" (51).

The community health worker, having learned that certain physical signs indicate malnutrition, looked for skin lesions, a swollen belly, light-colored hair, signs of apathy, and illness (cough, cold, diarrhea). Since none of these signs were present, the health worker concluded that the child was healthy.

An auxiliary nurse, however, knew that children who are small or light for their age may be malnourished. The nurse weighed the child and compared her weight to reference population values on a chart. The nurse found that the girl's weight was only 76 percent of the median weight for her age, and concluded that the child was moderately malnourished and that her growth was retarded.

This diagnosis indicated that a dietary or health problem was present. If this early warning sign of growth failure were overlooked, the child's condition could deteriorate, and, if left untreated, could lead to death.

Such problems will not be overlooked if health workers monitor growth by a systematic, periodic measuring of children. For a relatively small expenditure per beneficiary, growth monitoring can greatly strengthen preventive health programs.

The importance of growth monitoring is illustrated by the above example. Although health workers easily notice acute signs of malnutrition in children who require drastic attention, the majority of malnourished children are not in such a severe state. Moreover, it is often too late and always expensive to help the severely malnourished child with obvious signs of malnutrition. For early detection of children with growth retardation and hence high mortality risk, health workers need special tools and training.

Two kinds of tools are needed, those that measure body size, such as weight, height, and arm circumference, and charts that allow health workers to compare their measurement results to values from a larger reference population. Health workers also require training in the use of the tools, the interpretation of the results, and the selection of an intervention program appropriate for the child and feasible within the program's resources.

The cost of growth monitoring is extremely low, usually ranging between U.S. $0.02-$0.10 per child per year, depending on equipment, charts, and training needs. The tools are relatively inexpensive to buy or can even be locally made at little or no cost (see Chapter V). Moreover, the most expensive equipment should last for many years. This makes the cost per child negligible when divided by the under-five population that will use the equipment over the years. Growth charts range in cost from U.S. $0.03 (29) to $0.33 (67). Since ideally one chart is used per child over a five-year period, the expenditure per child per year is minimal.

The cost of training existing health workers depends on many factors. Training in growth monitoring will be less costly when incorporated into ongoing training related to health workers' other responsibilities.

The benefits of integrating growth monitoring into any health or nutrition program are many. The pioneering programs in the development of growth monitoring in Imesi, Nigeria (87), Narangwal, India (68), and Hanover, Jamaica (4) showed the benefits of growth monitoring for:

- following the progress of individual children to predict the extent of malnutrition and the risk of morbidity and mortality; and
- targetting appropriate curative and preventive interventions based on the diagnosis.

In the Hanover project workers felt growth monitoring in itself was an intervention. Mothers learned so much about the relation between diet and health by watching their child's growth pattern that this alone led to dietary improvements and substantially reduced malnutrition and mortality. These observations have led some health professionals to conclude that:

> . . . in communities where social or cultural factors play a greater role than absolute resource inadequacy in the

*The general term *malnutrition* is used throughout this paper, although the major concern is with undernourished children.

etiology of malnutrition, nutrition monitoring appears to have the potential for a significant impact on mortality even in the absence of more expensive and more difficult to implement components such as nutrition supplementation or education (p. 19, 53).

Recent surveys, however, indicate that growth monitoring components are not as widespread as expected. A survey of 52 AID-sponsored primary health care projects shows that only 24 or 46 percent currently include growth monitoring activities (5). A recent survey of 201 *nutrition* projects, in which growth monitoring might be expected to be universal, shows that only 129 or 64 percent have a growth monitoring component (10).

Growth monitoring should be part of all programs. It supports the primary health care approach in that it:

- helps identify children with high morbidity/mortality risk;
- helps maximize scarce resources for those most in need;
- assists in evaluating the impact of other health intervention activities on the beneficiaries;
- does not require a lot of time or expense;
- can be carried out reliably by health workers trained at low cost;
- offers mothers useful information that, when explained in a culturally relevant manner, provides a basis for understanding and implementing specific dietary improvements;
- is a health care activity that can and should be performed without trauma to mother or child;
- stimulates collaborative involvement of the health system, the community, and the family in this diagnostic activity; and
- helps identify parts of the community or the country for special health attention.

Above all, growth monitoring has the potential for assuring better preventive and therefore more effective care for all children.

Photo: M. Griffiths

CHAPTER II

what to measure

There is widespread agreement on two points related to growth monitoring. One is that growth status is the best available indicator of overall nutritional status. The second is that it is practical and effective to use growth data to evaluate the health of children under five and to plan appropriate follow-up activities.

There is little agreement, however, about which is the best anthropometric* measure to use. The measures most commonly used by community programs are weight, height, and/or arm circumference. To assess the nutritional status of a child, the value from one measure is usually related to another measure and then compared to values from a reference population. (See Chapter III for a discussion of reference populations.) Weight, for example, is often related to age, so that the weight of a two-year-old can be compared to that of other two-year-olds. The most common combinations of measures are weight-for-age, height-for-age, and weight-for-height. Because arm circumference changes relatively little in children between the ages of one and five, measuring it to determine nutritional status does not require relating it to another measure. It can be compared directly to the same single measure in the reference population (32, 106, 118).

Each of the indicators described above provides a different piece of information on a child's nutritional status. Weight measurement assesses total body size, arm circumference the size (muscle, fat, and bone) of that area, and height the degree of skeletal development or the amount of linear growth. Measurements of tissue mass (weight and arm circumference) can quickly increase or decrease according to a child's current dietary intake and health status. Weight can fluctuate more rapidly than arm circumference because it is subject to such variables as retention of fluid and time of day. Height neither changes rapidly nor decreases, but will be arrested by long-term deprivation.

Over time each of these indicators has been advocated for use in growth monitoring projects. In the 1950's and 1960's, weight-for-age was the most widely used indicator for identifying children with nutrition and health problems. Although weight-for-age is still the most commonly used indicator, alternatives became well accepted in the 1970's. Projects in communities with limited resources and using minimally-educated health workers introduced arm circumference as an acceptable indicator (107).

In 1972 a system using height-for-age and weight-for-height was introduced (124). By comparing results from both of these measurements (weight and height), health workers can distinguish between long-term, chronic malnutrition and current, acute malnutrition. In chronic malnutrition, which leads to stunting, height and weight are reduced, but weight is normal for height. In acute malnutrition, which leads to wasting, weight is low for height. This system and the weight-for-age system were endorsed in 1978 by the World Health Organization. Since that time support has increased for the use of the weight-for-height comparison alone in growth monitoring projects (102, 125). Weight-for-height is favored because it eliminates the difficulty of estimating a child's age, sometimes a formidable problem, and it distinguishes those children currently suffering from acute malnutrition from those who are small because of past malnutrition.

With all of these indicators to choose from, health workers must understand that each one does not provide the same diagnosis. Each measures different aspects of growth and therefore offers a different picture of the child's nutritional status (8, 117). For example, a child who has not received an adequate diet over a considerable period of time, who has not grown adequately in either height or weight, but who is not extremely thin and has no edema, would most likely be classified by the different indicators in the following way:

Weight-for-age:	Moderately undernourished
Height-for-age:	Mildly undernourished
Weight-for-height:	Normal
Arm circumference:	Borderline

Which measure is the most reliable indicator? The answer depends on what the measurement is supposed to do and on how the information will be applied.

GENERAL CONSIDERATIONS FOR CHOOSING A MEASURE

Program planners should decide what measure to use after considering the following:

- What is the main purpose of initiating growth monitoring? All projects follow the progress of the individual child, but what is done with the results? Will they be used to:

—identify children with high mortality risk for

*Refers to measuring the body or a part of the body.

emergency medical treatment?

—identify children with high morbidity risk for emergency medical treatment?

—identify children with minor growth failure for dietary improvement?

—evaluate the effect of an intervention?

- What is the nutrition profile of the area as best determined by surveys? Is severe malnutrition common or is the population relatively healthy with only a few individuals experiencing malnutrition? Are there seasonal peaks for malnutrition? Are there particular ages at which malnutrition is most prevalent? The indicator should be sensitive to the community's needs as they are defined by the profile to ensure that the fewest number of malnourished children are misclassified.

- What is the level of training of field workers? What training will be necessary to take the measure?

- How objective and reliable is the measurement? Will a repeated measure render the same result?

- How much time is required to take the measure?

- What instruments are needed and what financial resources and logistics are necessary for adequate use?

- What cultural factors should influence the decision (e.g., availability of age data, attitude of mothers toward measuring)?

The primary concern of most health care projects is to select the measure that most inclusively identifies children in need of nutrition and health interventions and that indicates if and how well a child is responding to an intervention.

The Measures as Predictors of Mortality Risk

Severely malnourished children, as measured by any indicator, have a much higher risk of mortality than well-nourished children. In Bangladesh (28), where severely malnourished children showed a fourfold increase in mortality over those with mild or moderate malnutrition, all the measures provided a good indication of mortality risk over a short period of growth monitoring. However, the indicators which most correctly identified children with mortality risk over a 24-month period were weight-for-age and arm circumference-for-age. The high correlation between weight-for-age and mortality outcome was substantiated by two projects in India (68, 104). Weight-for-age has been shown to be a reliable indicator of mortality risk through age five (28), although mortality rates are highest during the first three years of life.

While limited scientific data suggest that weight-for-age is a better predictor of mortality than other indicators, additional evidence has found arm circumference without correlation to age to be a measure of equal utility (28, 118). More evaluation is needed on individual nutritional status as defined by different indicators and mortality outcome.

Evaluating Intervention Effectiveness

The first change noted in a child responding to program interventions is a weight increase. If the child is not ill and eats well, changes eventually occur in both height and weight. Since change can be detected in both measurements at different times, some sources recommend looking at all indicators during evaluation (36, 71). Many programs, however, do not have the resources to collect such a complete set of data.

Traditionally, weight-for-age has been used to evaluate a program's success in improving nutritional status. When some programs failed to show results with this indicator and its accompanying classification system, attention focused on using weight-for-height for evaluation purposes (8, 15). The argument against the weight-for-age system is that it groups children who are stunted from past malnutrition with children who are wasted from a current health or nutrition problem. Recovery rates of those wasted children are usually more rapid than those of stunted children. Therefore, a system that distinguishes those currently suffering from acute malnutrition is the more desirable for highlighting program impact.

Evaluating children with current acute malnutrition as indicated by weight-for-height is a reasonable approach. Of course, exclusion of stunted children should not mean they are forgotten. These children can recover from height retardation (136). Additionally, if weight-for-height is used to monitor a program's progress or impact, health workers should distinguish children who gradually increase both weight and height and those who gain in height before adding muscle or fat. These children should not continue to be classified as part of the population that has not improved, even though they may not change category under the weight-for-height system (27).

As with mortality risk prediction, no indicator is perfect for assessing program impact. More study of these questions is needed. In choosing an indicator for a program, planners should consider program goals, the type of population that is being measured, and the program resources.

PARTICULARS OF EACH MEASURE

Studies done under a wide variety of conditions have compared the different growth indicators using various criteria. The advantages and disadvantages of the different indicators are found in Table 1, and the indicators are rated according to various criteria in Table 2.

TABLE 1. Comparison of Advantages and Disadvantages of Different Anthropometric Indicators for Growth Monitoring Projects.

Indicator	*Advantages*	*Disadvantages*	*Comments*
1. Weight-for-Age	• Good basic indicator, combining acute and chronic malnutrition, for monitoring ongoing programs (125, 136). • Sensitive to small changes (although many variables influence small fluctuations in weight) (82). • Measure is objective and repeatable (82). • Sole tool (scale) is portable and relatively inexpensive. • Weighing is relatively easy for inexperienced health workers to manage, although it does require a literate worker. • Measure is not time consuming.	• Not sensitive to a stunted child who is growing well (below but parallel to a normal growth channel) (8, 27) or to the very tall child who may be malnourished (1). • Relies on age data, which are often subject to error. Age data for children below two years old have been found accurate, or, if in error, easily corrected. but it is difficult to accurately estimate unknown ages for children over two years (76). • Mothers in some countries have objected to hanging their children from the scale during weighing (67).	• Better if used with children 0-2 years because height retardation is less pronounced (125); however, it is a valid indicator through the preschool years.
2. Length/Height-for-Age	• Good indicator of past nutrition problems (125). • Measure is objective, repeatable, and has a low variability (82). • A length and height board can be made locally for a minimum investment, and the boards are easily transported. • Rarely are mothers reluctant to have child measured because of appearance of the board.	• In growth monitoring projects it should be supplemented by another indicator like weight-for-age or weight-for-height because changes in height occur relatively slowly. • Requires two different techniques if programs include all preschoolers: recumbent (lying down) length (children 0-2 years) and standing height (children 3-5 years). • More difficult for unskilled workers to learn to take accurate length/heights than to weigh a child with a simple scale. • Requires two persons to take the measure. • Relies on age data, which are often subject to error.	
3. Weight-for-Length/Height	• Good indicator to distinguish those who are well proportioned (weight/height) from those who are thin (or heavy) for their height (8, 122). • Indicator does not require age data, which are often inaccurate and difficult to obtain. • Measures are objective and repeatable.	• Depending on the cut-off points chosen (see Chapter III), weight-for-height can underestimate malnutrition by classifying those who are short and thin as normal (102, 106). • Requires taking two measures; therefore, problems of purchasing or making the instruments and transporting them are compounded. • Weighing and measuring height will require more training time and may be too complicated and time consuming for the inexperienced clinic worker to do with frequency. • Some mothers may be reluctant to have their children weighed. • Requires two persons to take length or height measure.	

Indicator	Advantages	Disadvantages	Comments
4. Arm Circumference	• Indicator of severe current malnutrition (1), whether or not stunting is present (8). • While it may not detect changes as rapidly as weight monitoring, it will indicate changes in nutritional status over a short time. • Measurement is taken with an inexpensive and portable arm tape, which can be made by project personnel. • Quick to use. • Arm tape can be color coded for use by non-literate health workers. • Indicator does not require age data, which can be inaccurate and difficult to obtain. • No known objection by community to this measure.	• Will only identify children with severe malnutrition. It is more difficult to determine who is borderline. • Variability is high on measurement. Field workers need practice taking measurement to do it accurately. Finding the mid-upper arm and placing the tape around the arm without compressing the tissue is difficult.	• Some researchers indicate that measure should be used only with children 1-3 years old (7, 96), although others say it is valid for children 1-5 or 6 years old (106), and that it can be used beginning at 6 months (132).

TABLE 2. Rating of the Different Indicators by Ability to Fulfill Criteria

criterion	weight-for-age	height-for-age	weight-for-height	arm circumference
1. Population Group				
• To serve as an overall indicator of malnutrition	4	2	3	3
• To identify current malnutrition (wasting)	3	1	4	3
• To identify a maximum of malnourished children	4	2	2	3
2. Instruments				
• cost	2	3	1	4
• portability	3	2	2	4
3. Difficulty in taking measure	3	2	1	3
4. Time to take measure	3	3	2	3
5. Reliability (low error)	3	3	2	2
6. Sensitivity to change over a short time period	4	1	4	3
7. Resistance to measure by families	3	3	3	4
8. Age preference	0-6 years, but best ≤ 3 years	0-6 years, but best > 2 years.	0-6 years, but best > 2 years	approx. 1-4 years
9. Other			age independent	age independent; system adaptable for non-literate workers.

Each indicator has been rated on a scale of 0-4:
0 = not appropriate 1 = poor performance 2 = moderate performance 3 = good performance 4 = excellent performance

CHAPTER III

defining adequate growth

CHOOSING A REFERENCE POPULATION

Monitoring the growth of a child requires comparing changes in the same measure taken at regular intervals. A single measurement only indicates the child's size at the moment; it offers little information about whether the child's size is increasing, entering a period of stability, or declining. Because most children will continue to grow—even if only slightly—unless they are extremely ill, it is easy to mistake some growth for adequate growth unless the child's measurement is compared to a reference population.

Which population to use for comparison purposes is a controversial question. The debate continues about whether children from different areas of the world have the same genetic potential for growth (54, 125). Several studies indicate that presumably well-nourished, upper-class children in developing countries grow at the same rate as upper-class children in developed countries. This implies that growth patterns may be influenced more strongly by such environmental factors as dietary adequacy and frequency of illness than by genes (17, 54, 89, 119). If this is true, reference values based on the growth of healthy children in industrialized countries are suitable for use in less developed countries or in ethnically distinct communities (17, 54, 61, 66, 94). However, others counter that genetic background does make a difference, particularly for age-specific rates of growth (44, 48, 103, 125). Investigators exploring the effect of environmental factors, such as extremely high altitudes, on growth (18) also conclude that countries, even regions, should establish their own reference values based on more realistic expectations of growth rates in their populations.

Gathering data to establish local reference population values is no minor undertaking: measurements must be taken on a cross-section of a well-nourished population—on a minimum of 200 individuals in age groupings of 3-6 months for each sex—following strict scientific survey methods and standards and with careful data analysis (125). Colombia (35) and India (57) have established their own reference populations. Because creating local standards may not be feasible for each country or ethnic group, internationally applicable reference populations have been recommended for use with adjustments to be made in the cut-off points* for defining malnutrition within each area or project (61, 125).

Over the last two decades two sets of reference population data for preschool children have been used extensively and internationally—the Boston and Tanner standards. Although well recognized, these reference population values are now being replaced by the National Center for Health Statistics' (NCHS) data,** which is drawn from a sampling of a more heterogeneous population than either of the earlier surveys.

Following is a brief description of the three reference populations.

1. The Boston or Harvard Reference Population:

These data resulted from a study conducted by Stuart during 1930-1931 on a small sample of relatively well-nourished Caucasian children in the United States (112). These data are expressed in percentiles for weight-for-age and height-for-age, and from them median scores have been calculated for weight-for-height. The Boston reference population data have been used extensively in designing weight-for-age growth charts in Latin America and Asia.

Often these data are combined with the Iowa or Meredith reference population data, compiled from a survey done in 1923 on a small population of Caucasian school-age children (13). The tables that combine these two sets of data are referred to as the Stuart-Meredith Tables (111).

2. Tanner's Reference Population:

As part of the International Children's Centre's longitudinal research program, growth data have been collected from a number of countries: France, the Netherlands, Sweden, Switzerland and England. The English data, collected by Tanner from a homogeneous population, were used to formulate growth standards for England (115) for the basic growth indicators. These standards have been used extensively in Africa on the Ilesha or Road-to-Health Card (see Chapter IV).

3. National Center for Health Statistics (NCHS) Reference Population:

In 1974 the U.S. National Academy of Sciences recommended updating the reference population used for comparing the health status of groups within the U.S. The result of several years of work is a set of

* Cut-off point: as defined by WHO is "the value which marks the boundary of acceptability" (39).

** Most recently, this was the conclusion of a workshop on reference population selection held at the XII International Congress of Nutrition, San Diego, California, U.S.A., August, 1981.

tables and charts that combine two reference populations, both large and randomly selected from different economic and ethnic groups in the United States. The tables for children from birth to three years are compiled from measurements collected by the Fels Research Institute. The tables for children two to eighteen years are based on data collected by the Health Examination Survey of the National Center for Health Statistics. Tables and charts are available for: weight, height, skinfold thickness, head and arm circumference (90).*

The differences among the Boston, the Tanner, and the NCHS reference populations are minor: the NCHS values are slightly lower (see Fig. 1 for a comparison of the fiftieth and third percentiles of Boston, Tanner, and NCHS data). However, the World Health Organization, the Centers for Disease Control, and other groups strongly urge adoption of the NCHS reference population data because interpretation of a comparison made to NCHS data is more useful and clearer: the individual or group is being compared to all contemporary U.S. children of the same age and sex without selection for economic or ethnic background.

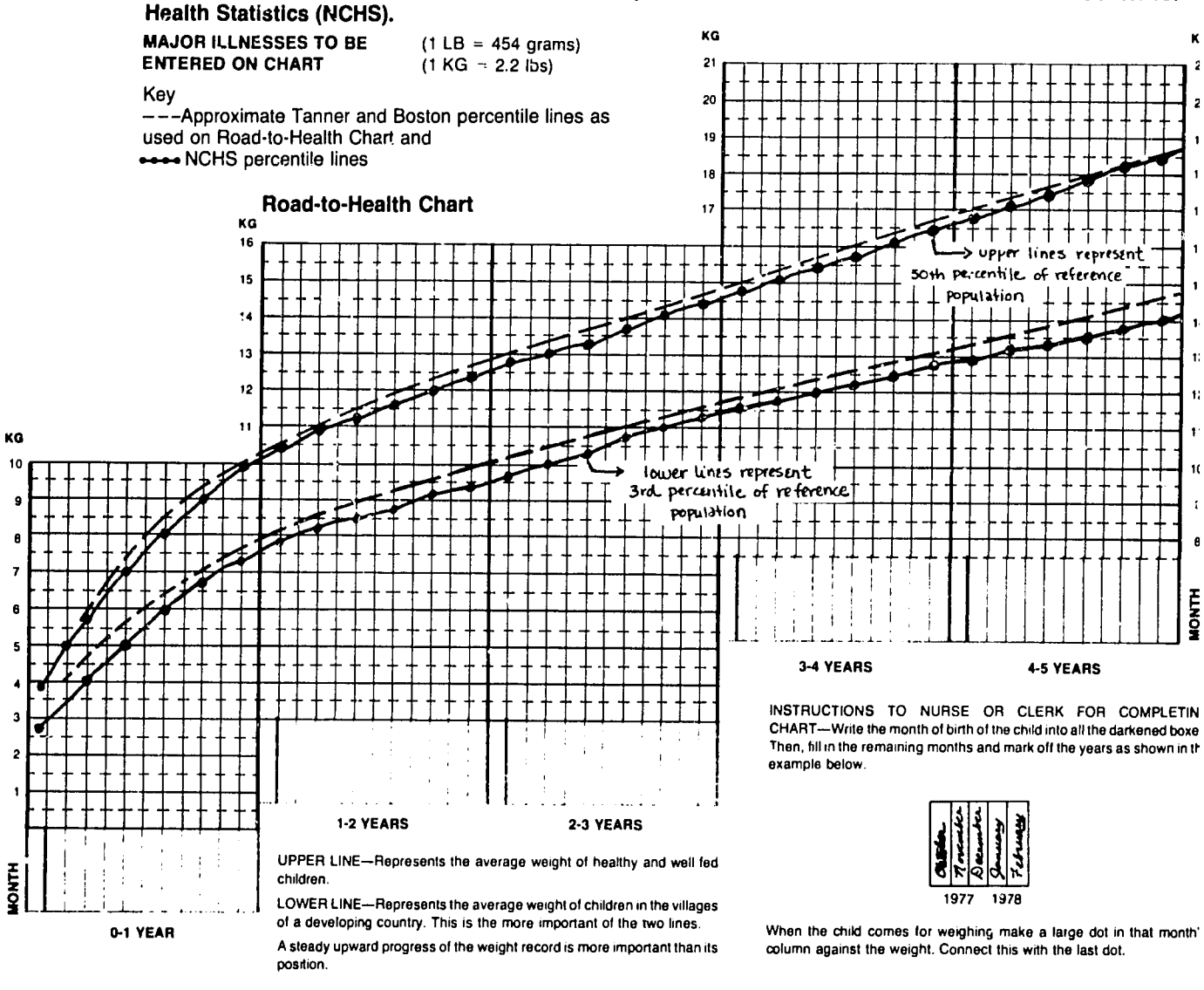
INTERPRETING THE LINE FOR ADEQUATE GROWTH

While reference population values serve to relate the progress of an individual child to a known growth potential, this comparison becomes most useful to the health worker or mother when cut-off points between adequate and inadequate progress, and between acceptable nutrition and malnutrition are specified. Determination of cut-off points is an important issue for local consideration since it can determine how severe the problem appears and can determine the priority assigned to child nutrition programs in a particular region.

An examination of the ways to express cut-off points should precede a discussion of the systems currently

* A copy of these tables and a sample of the growth charts can be obtained free of charge from:
U.S. National Center for Health Statistics
3700 East-West Highway, Center Building 1-57,
Hyattsville, MD 20782 U.S.A.

FIGURE 1. Comparison of Tanner and Boston 50th and 3rd percentile values with those of the National Center for Health Statistics (NCHS).



in use. Cut-off points are expressed in three ways: percentages of the median, percentiles, and standard deviation units.

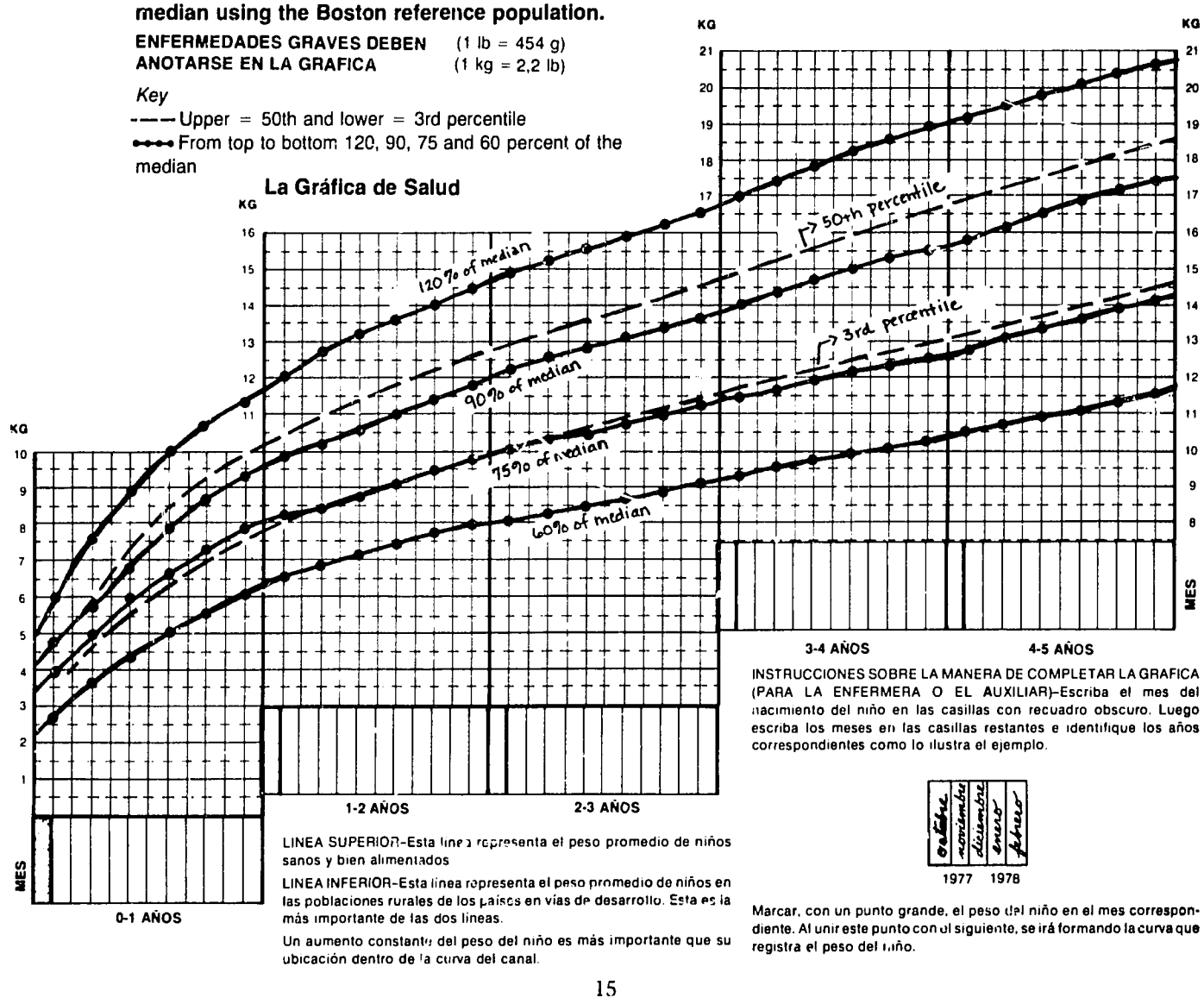
Percentage of the Median. To adapt data derived from well-nourished populations in industrialized countries for use in developing countries, classification of nutritional status has been shown in terms of percentages of the median of the reference population. Percentages of the median are calculated by first identifying the median (middle) value for the reference population; this median value, then, is called 100 percent. Second, absolute values at different percentage units from the median are calculated. For example, if the median weight of all two-year-olds in the reference population is 12 kilograms, 90 percent of the median would equal 10.8 kilograms and 60 percent would equal 7.2 kilograms.

Several classification systems have been proposed using percentage of the median (see Tables 1-5). Gomez *et al.* in 1956 (46) proposed one system for calculating weight-for-age, first using a Mexican population and then transferring to the Boston reference population. This system is well known and has been used extensively in Latin America. Slightly modified classification systems, using the same principles, were later proposed (see Table 1). Cut-off points based on percentage of the median have been developed also for weight-for-height and height-for-age by Waterlow (125), McLaren and Read (79), CDC (37), WHO (39), and others.

Percentiles. Some health professionals, dissatisfied with the percentage of the median method of expressing cut-off points, have advocated using percentiles from the reference population data (86, 114). The number of the percentile represents a position out of 100. The fiftieth percentile represents the midpoint of the population; exactly half the children will be above and half below this value. For example, if in a group of 100 children one child falls at the tenth percentile line, nine children would be below and ninety above this child.

Figure 2 illustrates how percentages of the median and percentiles compare using the same reference population. In this figure, 120, 90, 75 and 60 percent of the Boston median are compared to the fiftieth and third percentiles. Note that 75 percent of the

FIGURE 2. Comparison of 50th and 3rd percentile curves with curves at 120, 90, 75 and 60 percent of the median using the Boston reference population.



median value and the third percentile are almost identical.

Standard Deviation Units. Standard deviation (SD) units also called Z scores, are most often used to express survey results. However, WHO (129) and Waterlow *et al.* (125) now advocate using standard deviation units to express growth monitoring results. To date only the WHO chart designed for use by health professionals has cut-off lines that represent SD units calculated from the NCHS reference population data (129).

Following are SD unit equivalents for different indicators as they are commonly expressed in growth monitoring:

- 1 SD unit = 11-12 percent units from the median weight-for-age (132).

e.g., if a child is 75 percent of the median weight-for-age, (s)he would be 25 percentage units below the median or just below -2 SD units.

- 1 SD unit = 10 percent units from the median weight-for-height (125).

e.g., if a child is 85 percent of the median weight-for-height, (s)he would be 15 percentage units below the median or -1.5 SD units;

- 1 SD unit = 4-5 percent units from the median height-for-age (132).

e.g., if a child is 105 percent of the median height-for-age, (s)he would be 5 percent units above the median or +1 SD unit.

The normal growth channel for any population is considered to be that range between plus and minus two standard deviation units of the median, a range that includes almost 98 percent of the *reference* population. For guidance, the rough equivalents for -2 SD units, the concern when describing undernutrition, are given as percentages of the median:

weight-for-age: 77 percent of median (approximates 3rd percentile)
weight-for-height: 80 percent of median
height-for-age: 95 percent of median

VARIOUS CLASSIFICATION SYSTEMS

Using these basic statistical procedures, sometimes combined with clinical signs, a variety of systems have been designed to define a child's nutritional status.* The aim of all systems is to identify those children most in need of help—either because they are malnourished or because they are in danger of becoming malnourished. Each system attempts to identify 100 percent of those who are truly malnourished (to have no undetected positive cases) and to minimize the identification of children who do not need nutritional help (to minimize detected negative cases).

As stated earlier, the choice of a classification system, or where the cut-off lines will be drawn, greatly influences how the incidence of malnutrition will be reported and thus, the priority assigned to nutrition programs.

The following tables show a variety of classification systems by indicator.

* The one exception is in Tamil Nadu, India, where a regional program is experimenting with comparing absolute weight gain by the child each month to reference population values for weight gain (49).

TABLE 1. Weight-for-Age

System	*Reference Population*	*Method*	*Classification*
Gomez (46)	Boston	% of median	> 90%: normal 90-75%: mild malnutrition (grade 1) 75-61%: moderate malnutrition (grade 2) ≤ 60%: severe malnutrition (grade 3)
Jelliffe (61)	Boston	% of median	110-90%: normal 90-81%: mild malnutrition (grade 1) 80-61%: moderate malnutrition (grades 2 and 3) ≤ 60%: severe malnutrition (grade 4)
Bengoa (16)	Boston	% of median	Gomez classification with all cases of edema added to the category of severe malnutrition
Kasa Project, India (104)	Boston	% of median	> 65%: not at risk ≤ 65%: high nutritional risk
WHO (129)	NCHS	Percentile	50th-3rd percentile: normal ≤ 3rd percentile: malnourished
Tamil Nadu (49)	Indian Council of Medical Research	Absolute weight gain	6-11 mo.: 500 gm/months: normal 12-35 mo.: 500 gm/3 months: normal anything less is inadequate
Candelaria Project Columbia (35)	Boston	% of expected gain	< 85% of expected weight gain shows nutritional risk
Indonesia (20)	Boston	% of median + weight gain	Gomez classification on chart but records kept by weight gain; gaining weight each month: normal; no weight gain: at risk

TABLE 2. Height-for-Age

System	*Reference Poulation*	*Method*	*Classification*
Kanawati and McLaren (65)	Boston	% of median	≥ 95%: normal 95-90%: mild malnutrition 90-85%: moderate malnutrition 85%: severe malnutrition
WHO (39)	Boston	% of median	105-93%: normal 93-80%: short < 80%: dwarf
CDC (37)	NCHS	% of median	≥ 90%: adequate < 90%: stunted or chronically undernourished

TABLE 3: Weight-for-Height

System	*Standard*	*Method*	*Classification*
McLaren/Read (79)	Boston	% of median	110-90%: normal 90-85%: mild malnutrition 85-75%: moderate malnutrition <75%: and/or edema; severe malnutrition
Waterlow (125)	Boston	% of median	110-90%: normal 90-80%: mild malnutrition 80-70%: moderate malnutrition <70%: severe malnutrition
Viteri/Beghin (121)	Boston	% of median	< 92%: warning sign (needs clinical exam)
Patulul Project, Guatemala (34)	Boston	% of median	>90%: normal 90-81%: moderate malnutrition ≤80%: severe malnutrition
CDC (37)	NCHS	% of median	85-80%: moderate malnutrition <80%: wasted/acute malnutrition
NCHS (90)	NCHS	Percentile	75th-25th: normal 10th-5th: moderate malnutrition <5th: severe malnutrition

TABLE 4. Weight-for-Height and Height-for-Age

System	*Reference Population*	*Method*	*Classification*
Waterlow (125)	Boston	% of median	(see above for actual percentages) adequate weight/height and height/age: normal low weight/height, normal height/age: acute malnutrition normal weight/height, low height/age: chronic malnutrition low weight/height and height/age: chronic and acute malnutrition

TABLE 5: Arm Circumference

System	*Reference Population*	*Method*	*Classification*
WHO (39) and Shakir (106)	Wolanski 16.5 cm.	% of median	>85% or >14 cm.: normal 85-76% or 14-12.5 cm.: malnutrition <76% or <12.5 cm.: severe malnutrition

CHOOSING A CLASSIFICATION SYSTEM

The above tables make it clear that a wide variety of systems exist, some with several cut-off points, others with only one. The choice depends on the program goals, the resources available, and the need for cut-off points to reflect achievable goals that will encourage both mothers and project personnel.

Project Goals and Resources. The general goal of most growth monitoring projects is to identify children who are malnourished or whose growth pattern is faltering and to offer particular interventions to improve their condition before it reaches emergency status. Generally, programs have three types of resources to offer these children, their families, and communities: food, medical attention, and education.

Since scarce resources such as food should be provided to those with the greatest need, indicators and cut-off lines should be chosen carefully to indicate only acutely malnourished children. Hence, those who may have been malnourished in the past but currently are growing adequately would not be included. When weight-for-age is monitored, it is important to look at nutritional classification as well as monthly weight gain. If weight-for-height is used, children with very low weight for their height would be included. Each program should evaluate the impact of resources such as food on children with varying nutritional status to determine the cut-off lines and criteria (nutritional and non-nutritional) for admission into the intervention program.

When growth monitoring results are used to identify children who need medical attention, the variety of categories should reflect the types of attention available within the referral system. As a preventive measure, a high curve would be drawn to indicate children in need of a visit to the nearest health center (one professional suggests that all children less than 92 percent of the reference median for weight-for-height should receive a clinical exam (121). A high cut-off line would help ensure that children with a high morbidity risk be examined for common problems and be given immunizations. The cut-off line for sending a child on to a regional health facility or hospital would be lower, identifying acutely malnourished children by their low weight-for-height, inability to gain weight over time, and/or classification as severely malnourished under any of a variety of systems.

All programs with growth monitoring should include health and nutrition promotion and education. Generally, no one should be excluded from these activities. However, if single-subject group discussions or home visits are planned, some screening criteria may need to be established to avoid overburdening the health worker. In this case cut-off points can be so high as to include even mildly malnourished children, but not children growing normally.

Motivation of Mothers and Project Staff. One measure of the impact of a growth monitoring project is its effect on mothers and their willingness to change daily practices to improve their children's growth pattern and thus their nutrition and health status. The choice of cut-off points can affect mothers' motivation because the cut-off points specify goals and emphasize a record of accomplishment. Although the advantage of using only one line to separate the malnourished from the well-nourished is its simplicity, it may leave the mother with no goal once her child is above the line, or her child may be so far below the line that she will presume failure. During a growth monitoring project in Bangladesh, project personnel learned that using three different cut-off points on the child's growth chart helped to motivate mothers because they saw that the goal (the next growth channel) would be reached if the child gained only a small amount instead of one or five kilograms (67).

In this same regard, realistic criteria or cut-off points for judging the success of a program in improving nutritional status will motivate project staff. The inclination of program planners is to say that after a particular period of time there will be no more severely malnourished children and to plot the cut-off line much higher than can be achieved. Before following this inclination, program planners should examine the number of children below various cut-off values, selecting a cut-off level that will include no more children than the program can expect to contact or include in intervention activities. Then consideration should be given to the ability of children within certain age groups to show marked recovery, particularly those who were malnourished in the past. For many programs an example of a realistic measure of impact would be a reduction in the number of children requiring referral to a hospital (those who are wasted). This goal often can be achieved by programs unable to effect improvements in mild and moderately malnourished children.

It is important to remember that while classification systems are useful for statistical comparison of children and geographic areas, at the community level the category in which a child is placed must be linked with a diagnosis and with follow-up activities. Therefore any classification system must be tailored to the program if it is to have meaning to the local health worker.

CHAPTER IV

choosing a recording system

Over the years a variety of systems have been devised for recording and classifying anthropometric information. The choice of a record-keeping system is of prime importance because the purpose of monitoring children's growth can be achieved only when measurements can be compared at regular intervals against reference population values. To enable the health worker to judge the adequacy of a child's growth for diagnostic purposes, the recording system must be more sophisticated than a simple ledger on which the child's weight and/or height are recorded.* Its usefulness will depend upon a mechanism that will allow comparison of a child's measurements over time with reference population values at different cut-off points and which will require no mathematical manipulations of data by health workers.

DETERMINING RECORD DESIGN

The purpose of the monitoring activity within the project will influence the range of information on the card as well as the format for presenting monitoring results. Inclusion of the following recording system variables depends on project objectives for growth monitoring.

Monitoring as Part of Total Child Health Assessment

The primary purpose of growth monitoring usually is to help the health worker assess the health status of the individual child and to involve the child and family in other intervention programs. To this end, growth information should be combined with other variables that the health worker considers. All of this information combined forms a "child management record." Over 100 such records that use the road-to-health graph (Figs. 1A and 1B) were examined at the Institute of Child Health in England (128). The study shows the information most often recorded on the cards:

child's birth date	100%
immunization history	98%
sex of child	93% (although only 2% actually had different cards for males and females)
ages of siblings	60%
nutritional risk category	42%

Other information may be useful depending on program priorities: child feeding history (128), parents' involvement in family planning (128), antimalarial medication (14), history of illness (outpatient and hospital discharges) (14), and mother's nutritional status (14).

Motivation and Education of Families

Another often cited purpose for growth monitoring is to motivate and educate families. Frequently, however, the form on which the monitoring results are recorded is designed for the record-keepers and not for teaching purposes or for understanding and interpretation by mothers and other family members. Often, cards emphasize results and provide no space to record the action recommended to help the child.

To meet the objective of using growth monitoring as an educational tool the card must be designed appropriately. Designing a simple recording tool that is used and understood by everyone from the doctor to the village family helps eliminate the hierarchical relationship between the doctor and the family, increases communication between them, and demystifies the weighing process and the resulting diagnosis.

Experience has shown the following to be important considerations in designing a card for easy use and interpretation:

Size of the card and the writing spaces. The card must be large enough to be distinguished from other papers and to prevent loss. Its size is determined by the amount of information to be included and the format for recording the anthropometric information. Cards with graphs range in size from 16 x 14 centimeters to 50 x 30 centimeters (128).

When planning the space where health workers will record information, designers should remember that health workers may write with large letters. (Weight charts with a calendar system on the bottom axis have spaces between 5.5 and 7.5 millimeters wide in the graphs of a child's first three years (128).) A simple format and large blocks on the card will make it easier for the health worker to plot the results (67) and for the health worker and mother to interpret the card. The ease and accuracy of plotting are important to consider in the context of the average growth monitoring session, where many people have papers to fill out and there are at most only two health workers—one to read the measurement and one to record it.

* An exception is the Tamil Nadu nutrition project, where health workers do not use charts but only look at absolute change between measurements (49). This method has yet to be evaluated fully.

Space should be provided to note the message given to the mother, the changes in feeding practices she agreed to try, and the follow-up medical attention that was given (132). This space will remind the health worker to make recommendations indicated by monitoring. Additionally, writing the message on the card can help the health worker provide more appropriate follow-up during subsequent visits.

Cultural context. The cultural framework and philosophical concepts accepted by the mothers should be incorporated into the card design to make the educational task easier. For example, Dr. Cutting observed in southern India that the Road-To-Health concept could readily be adapted to the "road to peace," a philosophical concept the mothers already understood (31). Additionally, the card should use the appropriate native language, and, if included, motifs and foods should also be local. A study in Pakistan comparing three weight cards found that the card most popular with mothers was the least complicated, was written in the native language, and had pleasing colors and a picture of a healthy baby from the local province. Use of this card appeared to increase dramatically the mothers' participation in the program (60).

During Project Poshak in India (47), health workers discovered the strong identification mothers there made between colors and health status. Red, often chosen by westerners to indicate danger, in this case was selected as the color of health, while green and yellow were selected to represent weakness and illness. When the project ended, workers found that choosing a color association acceptable to mothers enabled 84 percent of the mothers to understand the meaning of the color bands on the chart.

The left-to-right orientation of the card is another variable that should be examined more carefully in Middle Eastern and Asian cultures. Cards that read from left to right are being used in countries where people read from right to left. The rationale for not reversing the orientation is that educated people are flexible enough to adapt (123). But no one really knows how well the village workers and mothers have succeeded (2). It should be noted that at least one weighing program in Egypt adapted its weight card to read from right to left in accordance with Arabic custom (81). Unfortunately, no evaluation of the perceptions of this change has been made.

Symbols, names, colors, and layout should be decided with the help of all intended users. Both the health workers, who complete the record and explain results to mothers, and the mothers, who need to understand the results and follow the interventions, should be involved in designing the card.

Clearly, a great deal of testing should be done with the users if a record satisfactory for local conditions is to be designed.

Assessing Improvement of Individual Children

Another purpose of growth monitoring is to allow program implementers to assess the impact of an intervention strategy on an individual child. Often it is erroneous to assume that because the child is being monitored, full advantage is being taken of the program. As noted above, program personnel should have space to record the specific interventions agreed upon with the mothers.

Assessing Program Impact

The growth record is also used by program planners to make community and regional nutrition profiles and to determine program impact in a geographic area. To aid in the aggregation of growth data, the simplicity of the chart as well as a notation of the interventions recommended or provided to the family are crucial. For more details on the aggregation of growth monitoring data, see Chapter IX.

It is useful to be able to collect cards after three to five years of use for evaluation purposes. Often the measuring is done monthly and the cards stored under less than ideal circumstances. Therefore the record should be printed on durable paper that can withstand considerable folding and unfolding. The review of growth charts by the Institute of Child Health (128) found that over half were printed on satisfactory (heavy) paper and that if the paper was absorbent and easily ripped, "there was difficulty maintaining the health workers' and mothers' pride in the chart" (p. 140, 128). If records are maintained by the family, a plastic envelope to protect the paper both extends the life of the card and encourages mothers to give it more importance and better care.

Since recording systems should be tailored to program needs, the selection of a final design should not be made without considerable testing with the users of the card. David Morley recommends choosing a well-accepted system on a trial basis for a few years and then making modifications after careful consideration (89). The prime consideration is that the format be clear and simple with large spaces that allow for easy and accurate plotting and interpretation. A minimum manipulation of the information obtained from the measurement decreases error. The additional information on the card should be only that immediately useful to the health worker or the mother, or absolutely indispensable in compiling community statistics. Examples are the child's birth date, sex, immunization status, history of illness, nutrition "risk" category, and interventions agreed upon for trial or provided to the child or mother. As mentioned above, local symbols and attractive pictures help increase the prestige of the card as an important record.

SYSTEMS FOR RECORDING ANTHROPOMETRIC MEASURES

Because each of the systems described below has been used in well supervised situations or in large

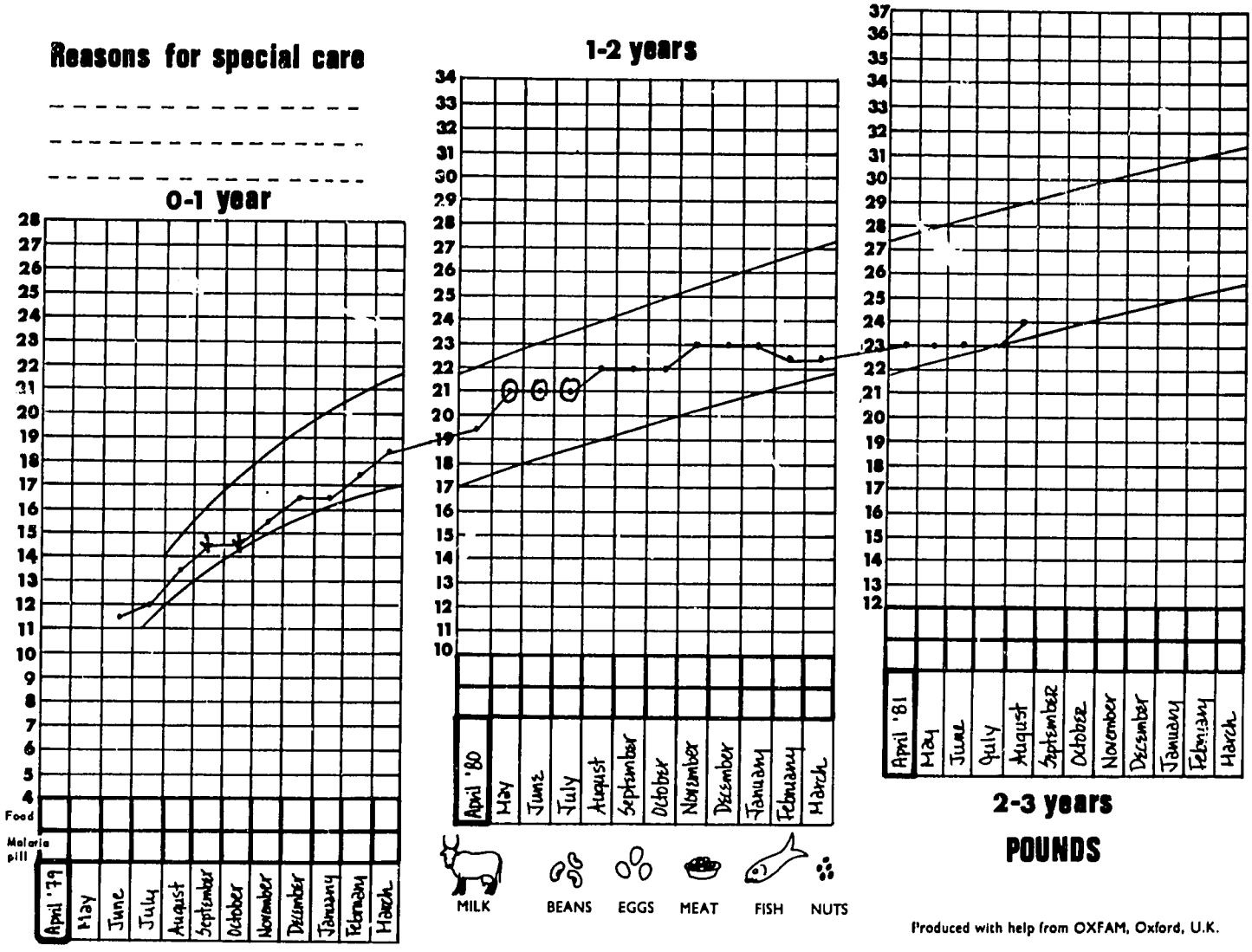
programs and has undergone revision based on implementation experience, each can serve as a potential model. Each record fulfills the major purpose of growth monitoring—recording the growth of the child over time and providing some classification system to enable the health worker to make a rapid judgment about the adequacy of growth. To varying degrees, the systems facilitate the other purposes of growth monitoring. Therefore, as stated earlier, the adoption of any system will depend upon: 1) the anthropometric indicator chosen as most appropriate for the project, and 2) the purpose of monitoring changes in this indicator within the scope of the project.

Recording Changes in Weight-for-Age

Perhaps the best known record for growth monitoring is the *Road-to-Health* card developed in the Ilesha Clinic in Nigeria by Dr. David Morley (93) (Fig. 1). The chart allows the health worker to judge the adequacy of growth by completing a graph that has age determinations along the horizontal axis and weight in *either* pounds or kilograms (never both) along the vertical axis. First the health worker completes the individual "calendar" for the child by filling in the first space on the horizontal axis with the child's birth date (month and year) and continuing to fill the boxes month by month until the child's sixth birthday. At each weighing session the health worker locates the box and column that correspond to the current month and year. If the calendar is completed the first time the child is seen, this procedure is not time consuming. The health worker then locates the child's weight along the vertical axis. Drawing a horizontal line into the middle of the chart, the health worker notes the child's current position with a dot where the weight lines cross the age line.

On this card two curves cross the graph to indicate the boundaries for adequate growth (see discussion in Chapter III on cut-off points). A record of growth during the child's first three years is printed on one side of the card (Fig. 1A); the other side (Fig. 1B) is used to keep a record of growth during the child's fourth and fifth years, of immunizations, and of fam-

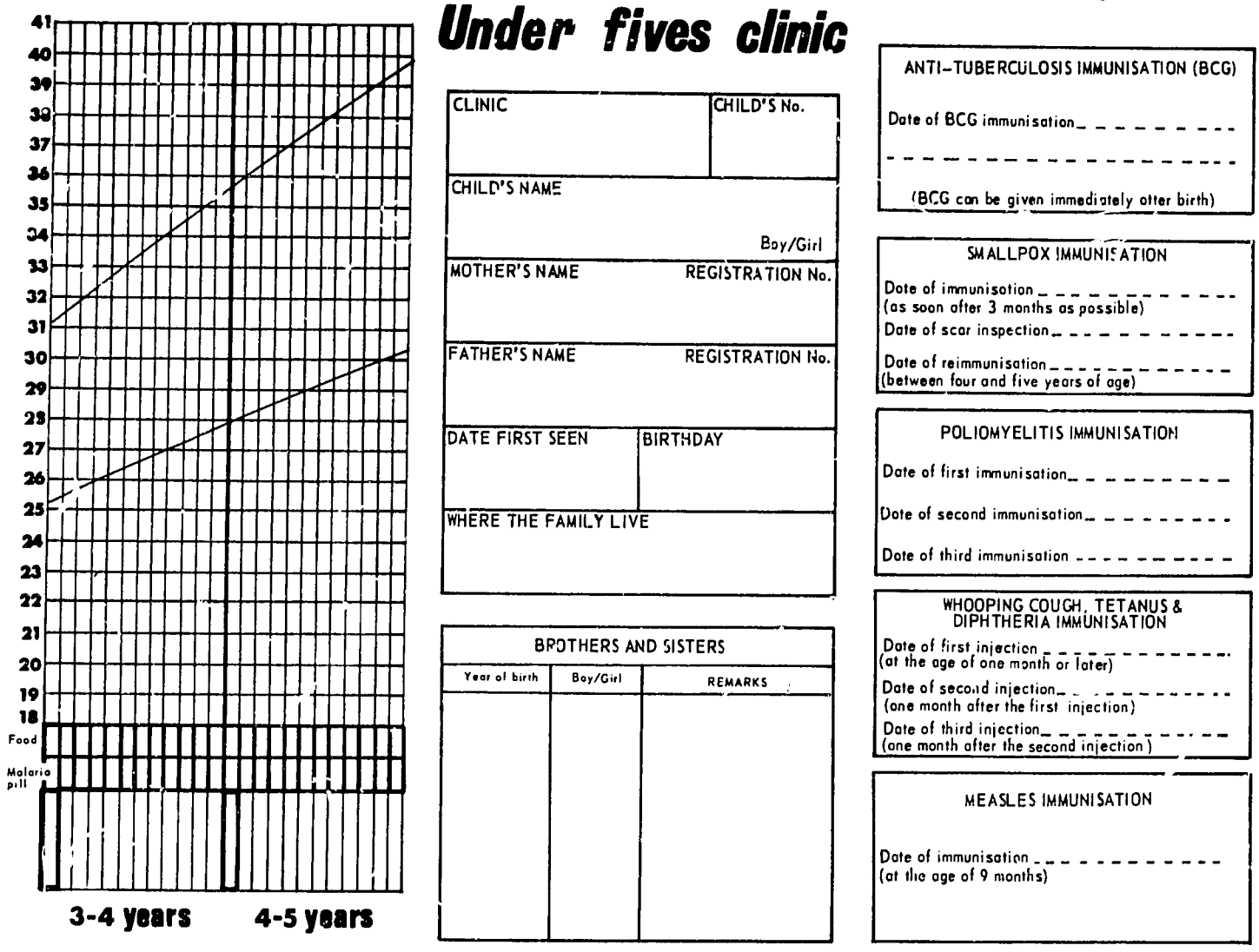
Fig. 1A. Road to Health Card, side one
Completed using an example of a child born in April 1979 who has attended a monthly monitoring session through August 1981. The weights marked with + and 0 are for comparison with the charts in Figs. 8 and 9A. Source: Teaching Aids at Low Cost



Produced with help from OXFAM, Oxford, U.K.

Fig. 1B. Road to Health Card, side two

Source: Teaching Aids at Low Cost



ily information. Samples of this card will be sent free on request from:

Teaching Aids at Low Cost Institute of Child Health
30 Guilford Street London, WC1N 1EH, U.K.

Variations on the growth curve card exist all over the world. Some charts add a sixth year; others, such as the World Health Organization chart (Fig. 2), place the entire graph for all years on one side of the card, and devote the other side to educational messages and to additional information about the child. The number of cut-off lines and the space between them may vary: there may be between one and five cut-off lines on a chart (see Chapter III). The place where cut-off lines begin may also vary: on some they begin at birth, while on others they begin in the third or fourth month.

When this type of card was first used, health workers evaluated the adequacy of growth by the position of the last dot on the child's growth curve, i.e. the relationship between the dot and the cut-off lines. Currently, this is changing, as health workers realize that some small children who may fall along the bottom line on the graph are small for their age rather than severely malnourished. As long as the children continue to gain weight (their line on the graph ascends), they are not in need of immediate attention. Therefore, health workers currently are being taught to look at the change taking place between weighings in addition to the relation of the dots to the cut-off lines. A growth line that flattens or descends is a warning sign, as is the presence of edema.*

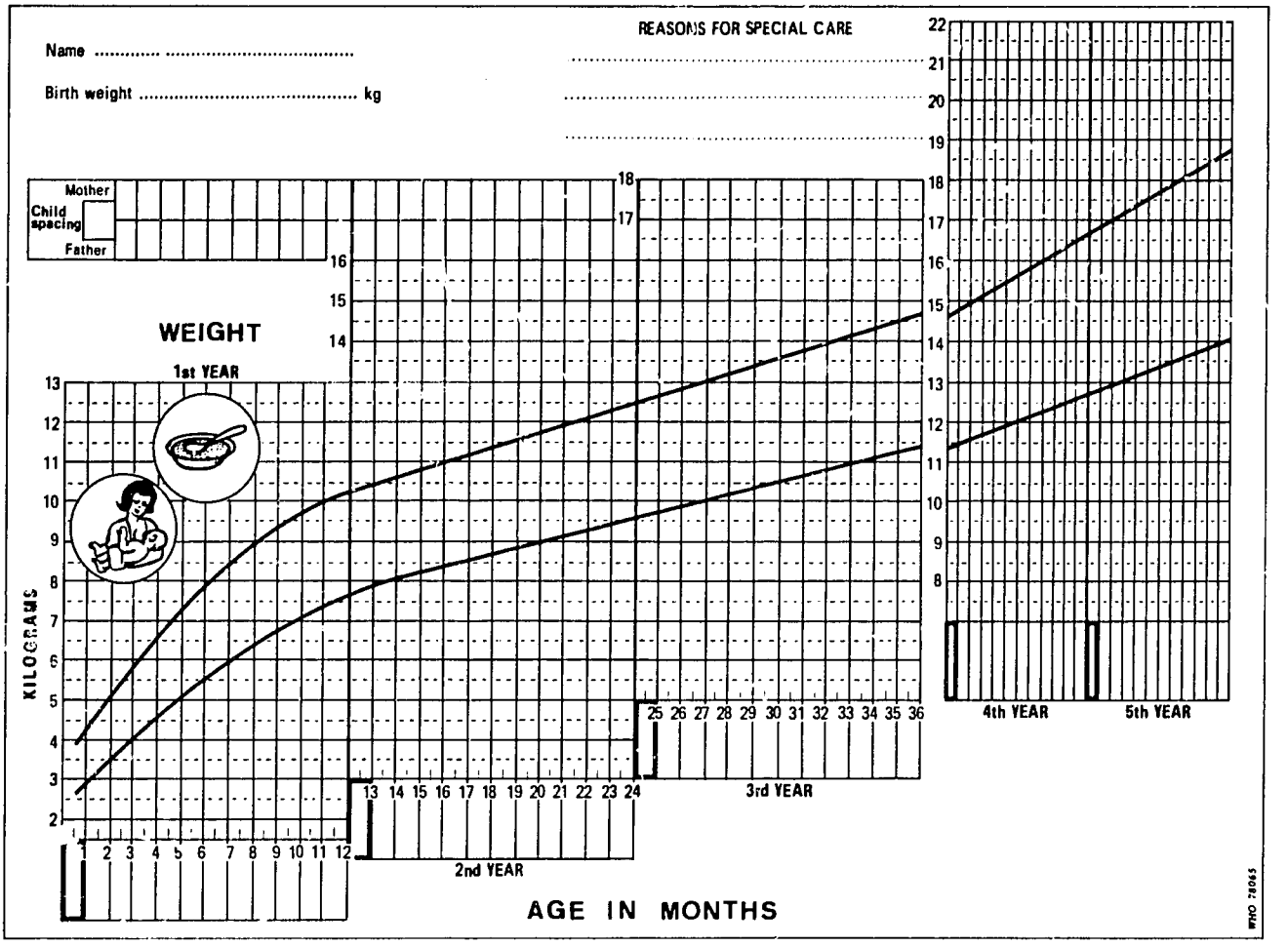
On the whole, few problems have been associated with the use of this type of card. Some problems have been noted when the calendar system is not completed correctly or when it is filled out at each weighing session rather than in one sitting. If it is filled out at each session, a month is often omitted, making subsequent results inaccurate (74). Additionally, some field workers have commented that the graph and the slowly ascending curve are difficult for the mother to understand.

Attempts have been made to improve these two aspects of the Road-to-Health chart. One is the *Growth Surveillance System* used in Catholic Relief Services'

*edema: an accumulation of fluid in cells, tissues or cavities of the body resulting in swelling—often noted first in ankles and lower legs.

Fig. 2 World Health Organization Chart

A. side one



B. reverse of chart

APPOINTMENTS

GROWTH CHART

Health centre	Child's No.
Child's name	
Date first seen	Birthday
Mother's name	Registration No.
Father's name	Registration No.
Where the family lives (address)	

BROTHERS AND SISTERS

Year/birth	Boy/Girl	Remarks	Year/birth	Boy/Girl	Remarks

IMMUNIZATIONS

ANTI-TUBERCULOSIS (BCG) Date of immunization	SMALLPOX Date of immunization Date of scar inspection Date of reimmunization
WHOOPING COUGH, TETANUS AND DIPHTHERIA Date of first injection Date of second injection Date of third injection	POLIOMYELITIS Date of first immunization Date of second immunization Date of third immunization
MEASLES Date of immunization	

WHO 72044

Source: WHO

Africa projects (see the final section of this chapter). The other, the *Growth Table* developed in the Philippines, was designed to be easier for health workers and mothers to use and understand (Fig. 3). On this table the calendar of months, beginning with the child's birth date, runs along the top of the card and a space for recording the weight each month is provided directly underneath. Under each month is a column marked in kilograms to indicate the range of weight for a child of that age. The health worker places an *X* in the box representing the range in which the child's weight falls. Four colored areas divide the chart horizontally (not in a curve) to indicate to the mother and the health worker the relative adequacy of the growth achieved.

One of few studies that evaluate the ease and accuracy with which weight charts can be completed and interpreted was conducted in the Philippines. It compared the performance of nutritionists and nutrition aides using three different charts (72). The first was the Growth Table just described. The other two have growth curves: one is illustrated in Fig. 1, and the other is a Philippine adaptation, which has a smaller grid that records the entire six years on one side of the card. Although the nutritionists had better scores than the aides, the results of both groups correlated closely.

There was no difference in the ease of plotting or the ease of interpretation among the charts. However, there was a difference in the accuracy of plotting

Fig. 3 Philippine Growth Table Source: USAID mission, Philippines

PHILIPPINE NUTRITION PROGRAM

Name _____ Date of Birth _____

NUTRITION HEALTH CHART FOR BABIES

PROVINCE: _____ MUNICIPALITY: _____ BARANGAY: _____

MONTH	Birthmonth	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
WEIGHT (Kg)																			
NUTRITION LEVEL	(PLOT MONTHLY WEIGHT IN CORRECT BLOCK TO DETERMINE NUTRITION LEVEL)																		
GREEN ZONE 1 HEALTHY	3.1	3.8	4.5	5.1	5.7	6.2	6.7	7.1	7.6	8.0	8.3	8.6	8.9	9.1	9.3	9.5	9.7	9.9	10.1
WHITE ZONE 2 MILDLY MALNOURISHED	2.9	3.6	4.2	4.8	5.4	5.9	6.3	6.7	7.1	7.6	7.8	8.2	8.4	8.6	8.8	9.0	9.2	9.4	9.5
WHITE ZONE 3 MILDLY MALNOURISHED	2.7	3.4	4.0	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.4	7.7	7.9	8.1	8.2	8.5	8.6	8.8	9.0
WHITE ZONE 4 MILDLY MALNOURISHED	2.6	3.2	3.8	4.3	4.7	5.2	5.6	5.9	6.3	6.7	6.9	7.2	7.4	7.6	7.7	8.0	8.1	8.2	8.4
YELLOW ZONE 5 MODERATELY MALNOURISHED	2.4	2.9	3.5	4.0	4.4	4.8	5.2	5.5	5.9	6.2	6.4	6.7	6.9	7.1	7.2	7.4	7.6	7.7	7.8
YELLOW ZONE 6 MODERATELY MALNOURISHED	2.2	2.7	3.2	3.7	4.1	4.5	4.8	5.1	5.5	5.8	6.0	6.2	6.4	6.6	8.7	6.9	7.0	7.2	7.3
YELLOW ZONE 7 MODERATELY MALNOURISHED	2.0	2.5	3.0	3.4	3.8	4.1	4.4	4.7	5.0	5.3	5.5	5.8	5.9	6.1	6.2	6.4	6.5	6.6	6.7
RED ZONE 8 SEVERELY MALNOURISHED	1.9	2.3	2.8	3.1	3.6	3.8	4.1	4.3	4.6	4.9	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.1	6.2
RED ZONE 9 SEVERELY MALNOURISHED	1.7	2.1	2.2	2.8	3.2	3.4	3.7	4.0	4.2	4.6	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6
RED ZONE 10 SEVERELY MALNOURISHED																			

2 – 3 YEARS BETWEEN BABIES MEANS HEALTHIER FAMILIES

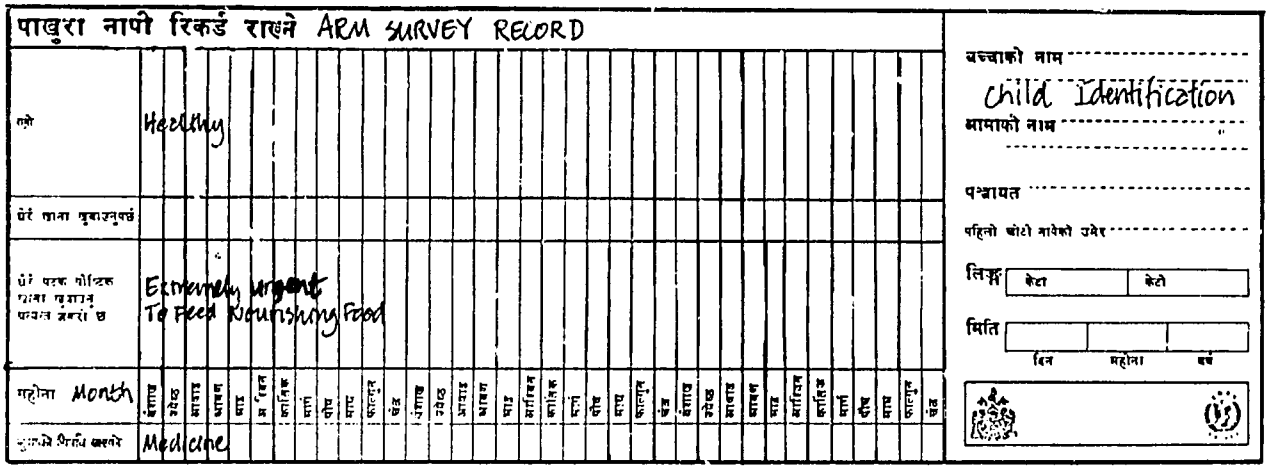
The mother needs to know that the *X*'s representing her child's weight should follow a straight line across the chart or should increase. If the *X*'s are in the upper portion of the table and a horizontal line can be maintained, the child is gaining weight at the proper rate. If the *X*'s are along the bottom of the chart, an effort should be made to help the child gain weight. If the *X*'s begin to descend, the health worker and the mother should heed the warning that the child needs special attention. Health workers believe that this system interests mothers and is easy for them to understand, since even with a small change in weight, the progress or decrease is clearly seen in the Table's large boxes (38).

and interpretation and in the overall preference for the charts. The Philippine weight curve received the best scores for plotting accuracy, while the Growth Table was the most accurately interpreted and the most preferred. After the evaluation the mistake made in completing the Growth Table was easily corrected by a minor change in the enumeration of the months; its accuracy then equalled that of the weight curve. This study indicates that the Growth Table should receive more attention and field testing.

Recording Changes in Arm Circumference

The arm circumference tape is usually employed as a screening tool rather than a monitoring tool. How-

Fig. 4 Arm Survey Record (Nepal) Source: Ministry of Health or UNICEF, Kathmandu, Nepal



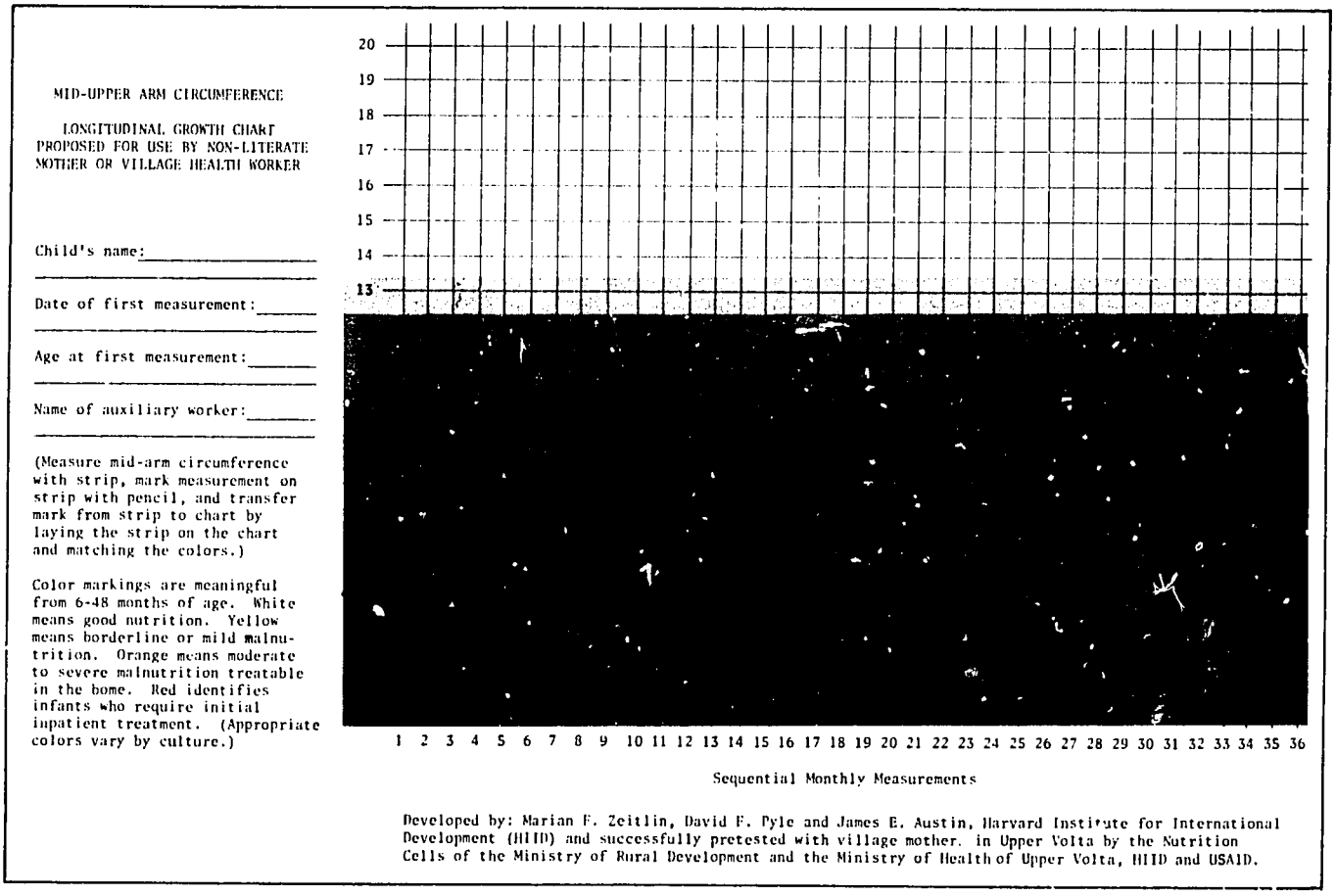
ever, several programs use the arm tape as a monitoring tool and have devised cards to record monthly measurements. Two cards are described below.

The card from Nepal (Fig. 4) has 36 thin columns for each month of a child's first three years. The columns are cut horizontally by three colored areas that correspond to the divisions on the arm tape. These areas indicate good nutrition, borderline or mild malnutrition, and severe malnutrition. Each month the health worker puts an *X* in the colored area of the chart that matches the result on the arm tape to compare the child's status over time.

The second system (Fig. 5) has been innovatively designed for use by both literate and non-literate health workers.* Again, the chart has thin columns for each month. Each column is equal in length to the arm tape. The horizontal color bands on the chart correspond to the bands on the arm tape. The worker measures the child's arm and marks the place on the

* This same type of recording system has been designed for thigh circumference measurement. Thigh circumference has not been included in this paper because it is new and only tested in one project (134). However, it may be of interest to program planners, particularly where workers are non-literate.

Fig. 5 Arm Circumference Card (Upper Volta) Source: Harvard Institute of International Development, Cambridge, Massachusetts



tape. The tape is laid on top of the child's chart, matching the colors, and the mark on the tape is transferred to the chart. Since this procedure only requires matching colors and transferring the mark, users need not know how to read or write (135). Also, the exact month is not important because the arm circumference is independent of age for children between one and five years old. The health worker simply places the marks consecutively regardless of the time between monitoring sessions.

Recording Changes in Weight-for-Height

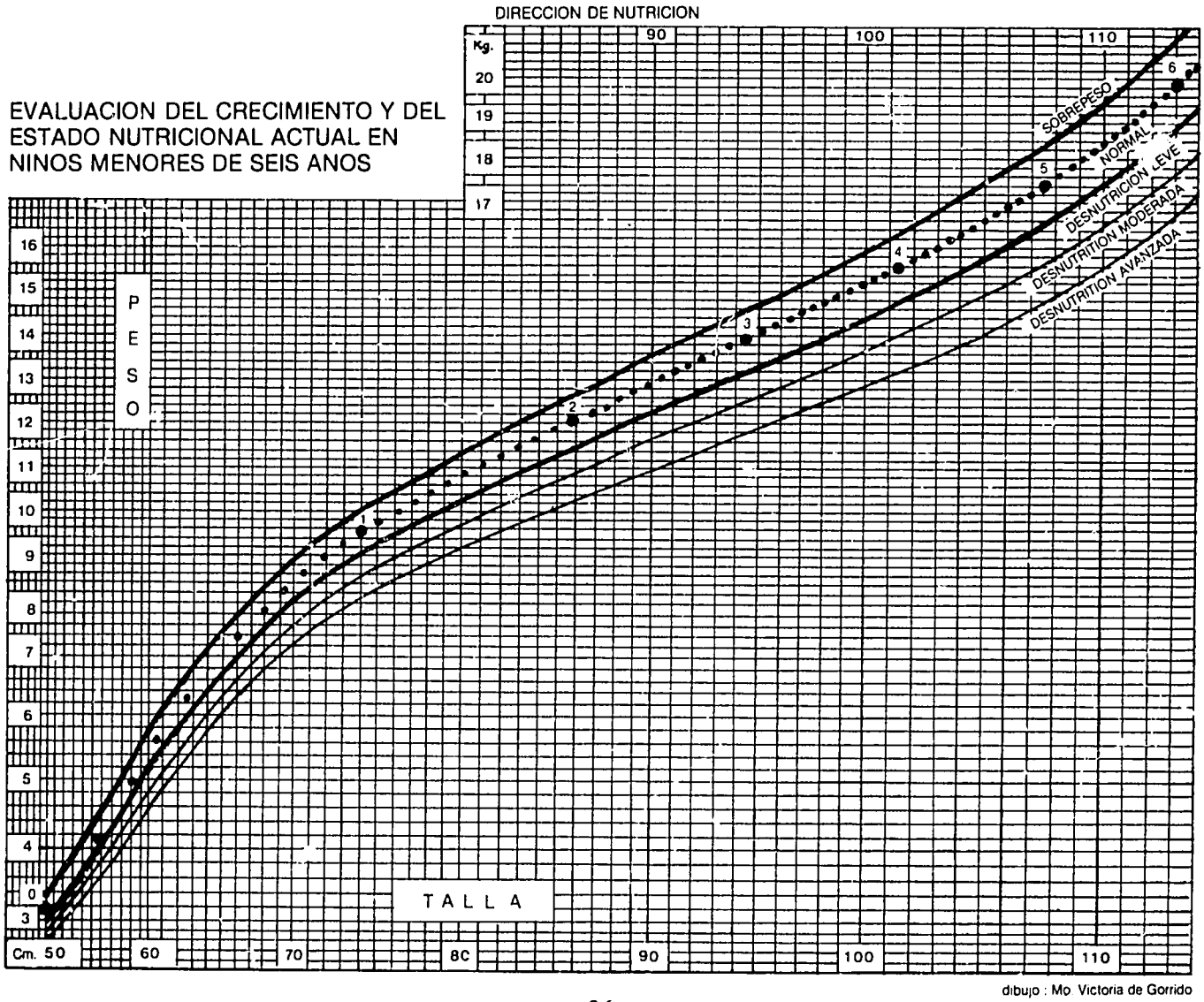
In community growth monitoring projects, height is usually compared to weight and not to age. There are two types of cards currently in use. One resembles the weight-for-age graph, and the other is similar to the arm tape card used in Nepal. An example of the first type is from the Colombian Institute of Family Welfare (Fig. 6). This chart places height in centimeters along the horizontal axis and weight in kilograms on the vertical axis. Reference curves are then drawn across the grid. For ease of plotting and interpretation by health workers and mothers, the advantages and disadvantages of this system are similar to those of the weight-for-age curve.

The other type of card (Fig. 7) is used with the *Thinness Measure* wall chart explained in Chapter V. This card, like the arm-circumference card, is easy for the health worker to complete. The health worker marks the card in the colored box corresponding to the color on the wall chart where the child is measured.

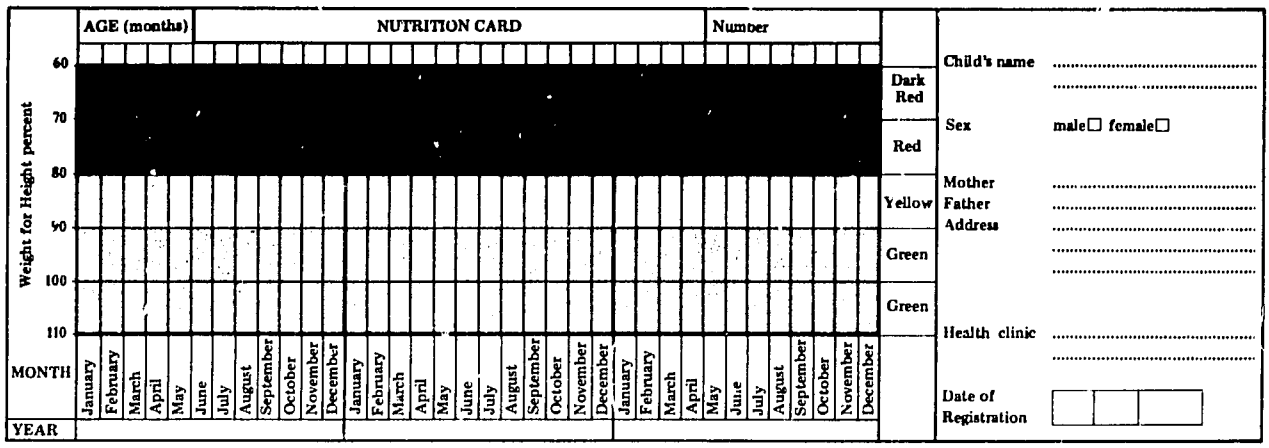
A System Adaptable to Several Anthropometric Indicators

The Growth Surveillance System (GSS) used by the Catholic Relief Services/Africa program can be used for weight-for-age, height-for-age, or weight-for-height. The system uses two records. One, the Master Chart (Fig. 8), is a graph on which the weight or height of all area children is plotted after measurement. The graph is divided by curves that represent percentage ranges of the median figures for a given reference population. The health worker notes the area and percentage in which each child's measurement falls and records the percentage on the second card—the

Fig. 6. Weight-for-Height Card (Colombia) Source: Instituto de Bienestar Familiar, Bogotá, Colombia



dibujo : Mo Victoria de Gorrido



individual record, which is given to the mother to keep (Fig. 9). The individual record has space for recording the date of the measurement along the horizontal axis and the percent of the median achieved along the vertical axis. The blank individual record is independent of time, age, type of measurement, and reference population. According to Dr. C. Capone, this system of recording the percentage of the median achieved is more sensitive than plotting actual weight:

Since the child could gain weight without gaining in standard (or not gain weight and lose standard), the deterioration of the child is evidenced by a far steeper downward curve than the Ilesha chart [the Road-to-Health card discussed earlier.] This is extremely helpful in alerting the mother to the fact that the child is not growing adequately. (pp. 3-4, 22)

A comparison of the graph of the same child's weight on both charts tests the usefulness of this system. Here, the weights plotted on the Road-to-Health card in Fig. 1A have been duplicated on a GSS Master Chart (Fig. 8) and transferred to the individual record in Fig. 9A. The first weights to examine are those marked with +. They are identical, although when plotted on the two charts, they look different. On the Road-to-Health card, the weights create a flat-

Fig. 8 Growth Surveillance System. Master Chart Source: Catholic Relief Services, Africa Office, Nairobi, Kenya

Completed with an example of a child born in April 1979 who has attended a monthly monitoring session through August 1981. The weights marked with + and 0 are for comparison with the chart in Fig. 1A.

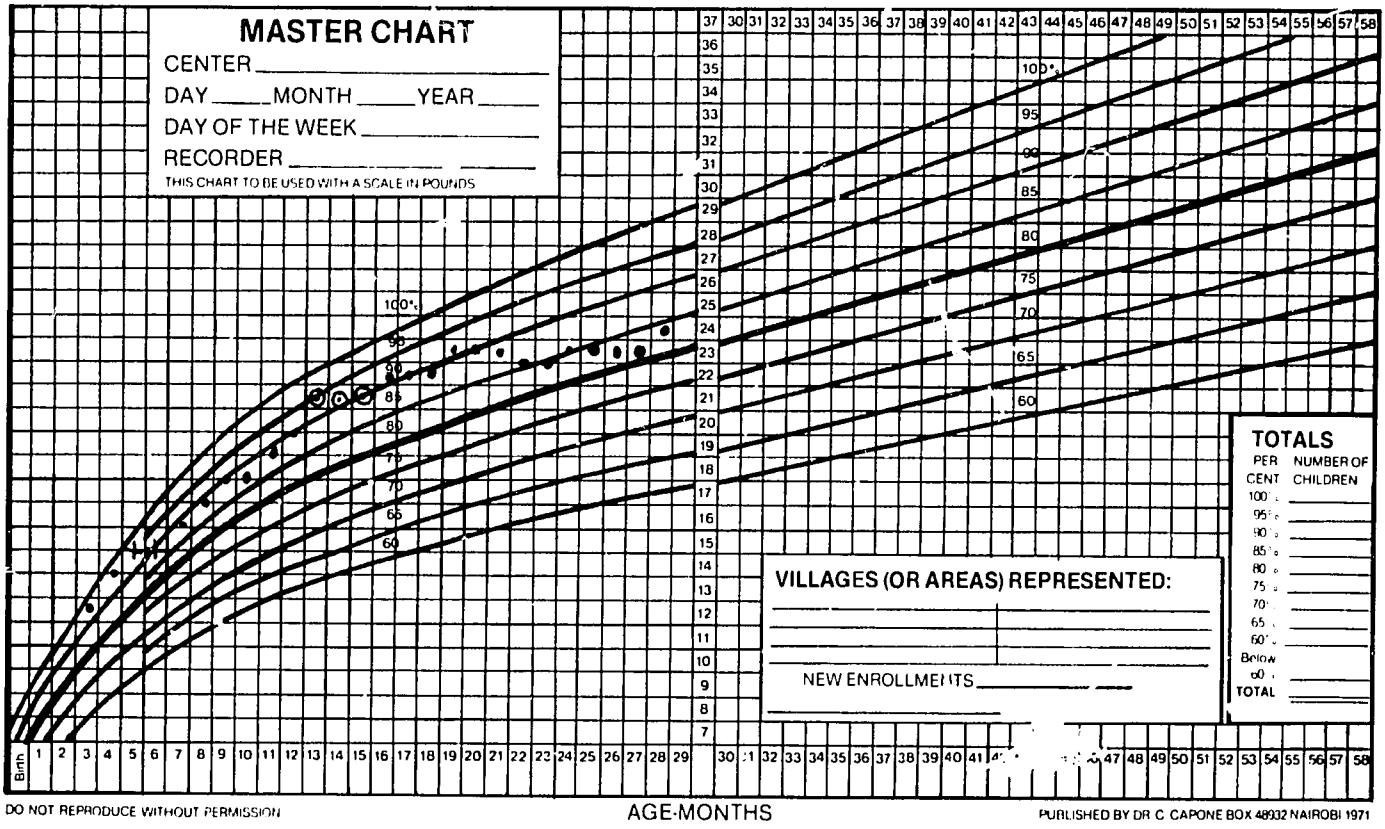
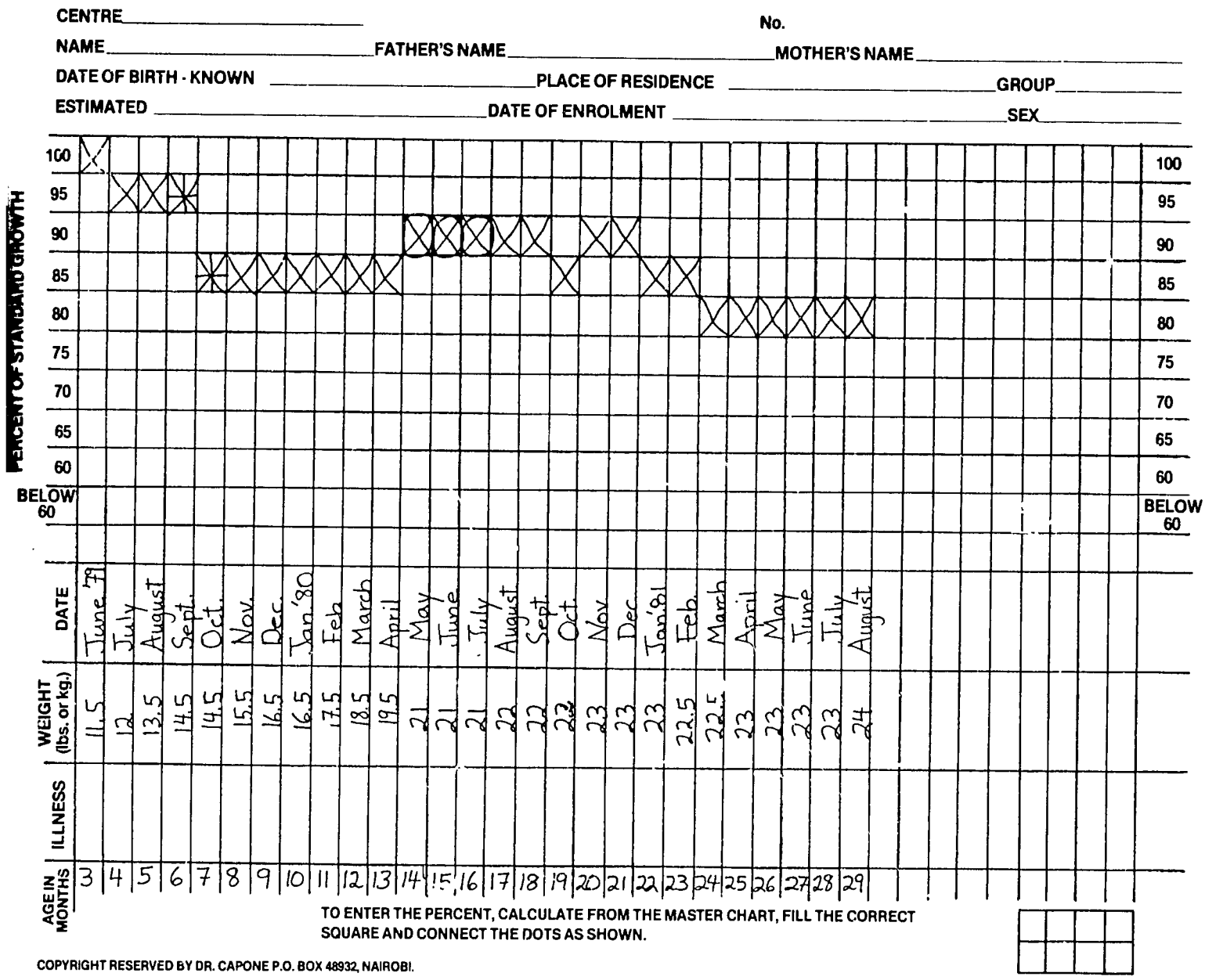


Fig. 9A Growth Surveillance Chart (Side One) Completed with weights of child from Fig. 8

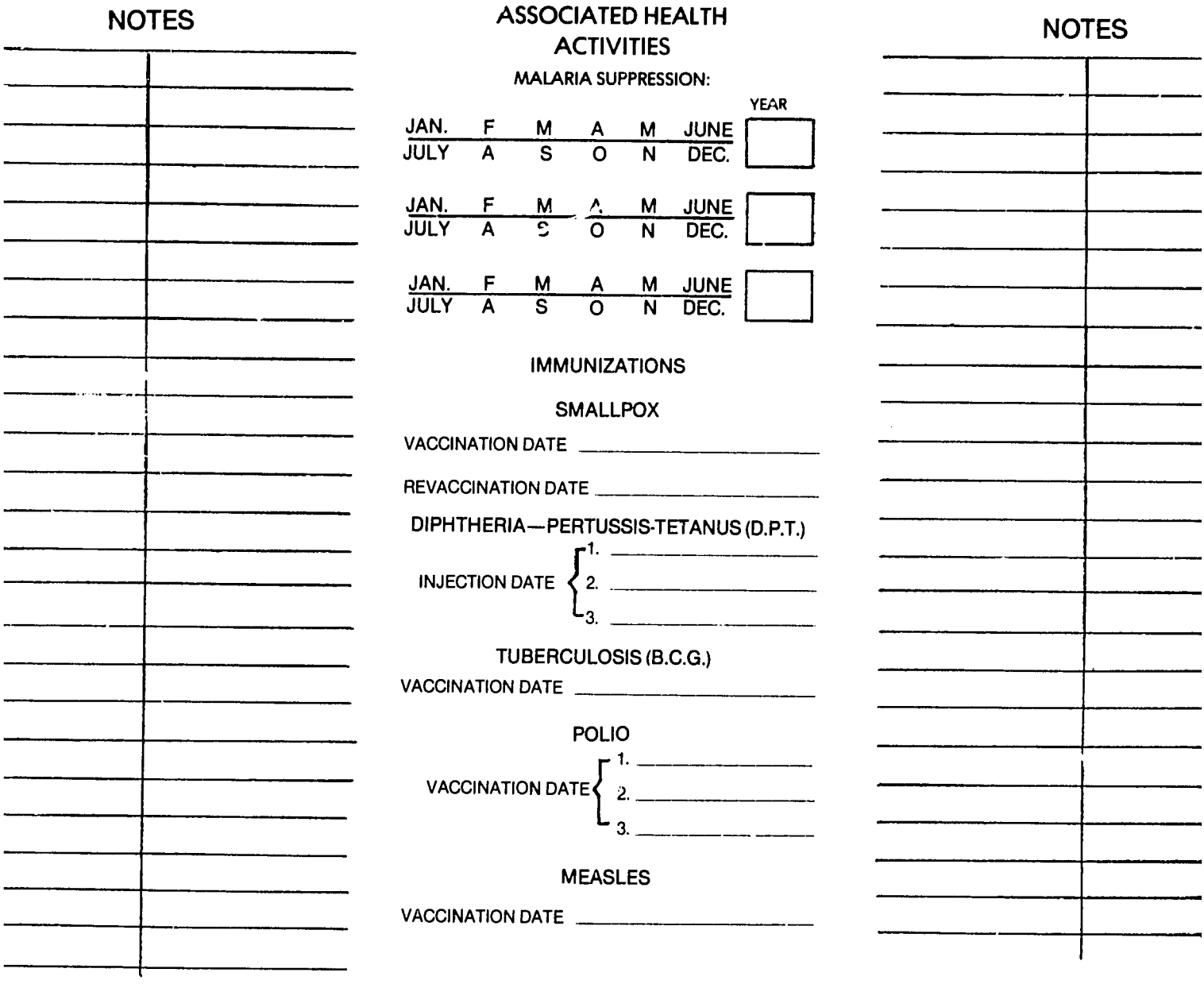


tening of the growth line. On the individual GSS record, the line connecting the weights drops steeply. In this instance the GSS record gives a stronger warning to the health worker and mother of a potential problem, either medical (diarrhea, parasites, or other illness) or nutritional.

However, another example to the contrary is the second series of weights marked with 0. Here again the child fails to gain weight for three consecutive months. On the Road-to-Health card this should be clear to the health worker by the second or third month. But unless the worker is extremely acute, it is not as obvious on the GSS individual record, because the child continues in the squares at 90 percent. Because the child has recently increased to the 90 percent line, the arrest in growth may go undetected. In this case the GSS is confusing. Unless the health worker carefully notes the weight written below, (s)he will not notice that instead of maintaining proper weight gain, the child has failed to gain weight for several months.

An additional advantage of the system cited by Capone is its ability to correct mistakes caused by an incorrectly recorded birth date, so that the GSS weight record does not build on past mistakes. On the Road-to-Health card, if a mistake is made in the birth date or a month is missed in completing the calendar on the horizontal axis, the mistake seldom is corrected, so the child is classified incorrectly each month. With the Growth Surveillance System, the health worker can calculate the child's age each month and, at least for the current month, classify the child correctly. However, this aspect of the system needs further evaluation to discover the frequency with which these mistakes occur and the time needed by the health worker to determine the children's ages

Fig. 9B. Growth Surveillance Chart (side two) Source: Catholic Relief Services, Africa Office, Nairobi, Kenya



at the monitoring session each month.

Reports on this system differ, and to date there has been no comprehensive independent evaluation of it in the different countries where it is being used. Some say that health workers have no problem completing the Master Chart and transferring the percentage to the individual charts (127), while others have said that there is confusion (74,14), often to the point that these charts do not get used if there is another system in place (69).

This review of the major recording systems shows how much they vary and points to some of the advantages and disadvantages of each.

With every new program, a new or modified recording system emerges. Table 1 provides a sample of the variety of systems in use around the world. Some countries use five or more different systems within their boundaries (128). Although different systems may be necessary because of varying program objectives, one system should be used in a single clinic or village and preferably throughout a country, particularly if the population is mobile. If more than one system is in use, it is recommended that program implementers re-evaluate needs and unify systems to avoid duplication of forms and an extremely confusing situation for the health worker. What is crucial in deciding which system to use is its ability to provide the necessary information to those working within the program.

TABLE 1 SAMPLES OF RECORDING SYSTEMS CURRENTLY IN USE

AFRICA Generally, African child health programs monitor growth by comparing weight-for-age (wt/age) values to either U.S. or English reference population values. Two major recording systems are used: 1) the Road-to-Health card with two cut-off lines and 2) the Growth Surveillance System.

country	*program*	*measure*	*record*	*reference population*	*classification system*	*space for medical information*	*educational messages*
Botswana	MOH*	wt/age (in pilot project they measure height-for-age (ht/age) and compare weight-for-height (wt/ht). In isolated areas they use arm circumference (AC).	Growth curve	Boston	Three divisions: • Normal: 100%-75% of reference population median • Undernourished: 74%-60% of reference population median • Severely undernourished: <60% of reference population median	Yes	Yes
	CRS**	wt/age	Growth curve-Master Chart and linear individual card	Boston	Every 5-10% interval using reference population values	Yes	No
Gambia	MOH	wt/age	Growth curve	Tanner	Two divisions: • Normal (Road-to-Health): 50th percentile-3d percentile reference population median • Undernourished: <3d percentile reference population median	Yes	No
	CRS	(same as above)			(has dashed lines within Road-to-Health channel)		
Kenya	Medical Research Center	wt/age ht/age AC	Curves for each measure	N.A. (not available)	Chart has months on horizontal axis, weight on lower, height on upper vertical axis, and arm circumference in upper corner. One cut off pt. on each curve: 80% reference population median wt/age 90% reference population median ht/age 80% reference population AC.	No	No
Lesotho	MOH	wt/age	Growth curve	Tanner	Two divisions: • Normal (Road-to-Health): 50th percentile-3d percentile reference population • Undernourished: <3d percentile reference population	Yes	Yes
	CRS	(same as description of Botswana chart)					
Malawi	MOH	wt/age	Growth curve	Boston	Three divisions: • Normal (Road-to-Health): 100%-75% of median reference population • Undernourished: 75%-60% of median reference population • Severely undernourished: <60% of reference population	Yes	Yes
Upper Volta	MOH	wt/age	Growth curve	Tanner	Two divisions (see description of Lesotho's chart)	Yes	Yes
	CRS	(same as description of Botswana chart)					
Zaire	MOH	wt/age	Growth curve	Boston	Three divisions: • Normal (Road-to-Health): 100%-85% of median reference population • Undernourished: 85%-75% of median reference population • Severely undernourished: <75% of median reference population	Yes	Yes
Zimbabwe	MOH	wt/age	Growth curve	N.A.	Three divisions: • Road-to-Health zone (% NA) • Undernourished zone (% NA) • Severely undernourished zone approximates that of <75% of Boston reference population median.	Yes	No
	CRS	(same as description of Botswana chart)					

*MOH—Ministry of Health. **CRS—Catholic Relief Services.

ASIA

A variety of recording systems is being used in Asian child health programs. While weight-for-age measures predominate, arm circumference is used in programs with limited resources. Growth curves generally use Boston reference population values with three or four cut-off lines for nutritional status categories.

country	*program*	*measure*	*record*	*reference population*	*classification system*	*space for medical information*	*educational messages*
Bangladesh	Save The Children	wt/age	Growth curve	Boston	Four divisions: (chart in local weight units) Normal—110%-90% of reference population median • Mild undernutrition—90%-81% of reference population median • Moderate undernutrition—81%-61% of reference population median • Severe undernutrition—<60% of reference population median	Yes	Yes
	MOH	wt/age	Growth curve	Tanner or Boston (unclear)	Four divisions: • Road-to-Health (normal)—100%-75% of reference population median • Two categories for under nutrition between 75% and 60% of reference population median • Severely undernourished—<60% of reference population median	Yes	Yes
Burma	MOH	wt/age	Growth curve	N.A.	Three divisions difficult to interpret because chart written with local numbers	Yes	Yes
India	Voluntary Health Association of India	AC			No card—provide table with three cut off lines 100%, 90% and 80% of reference population	—	—
	Voluntary Health Association of India	wt/age	Growth curve	Unclear if Boston or Tanner	Four divisions: (see description of MOH Bangladesh card).	Yes	Yes
	World Bank assisted Tamil Nadu project	rate of growth for age	No card	Indian Medical Research Council	One cut-off point: • 6-11 months: normal: 500gm/month • 12-35 months: normal: 500gm/3 months • Anything less is inadequate		
Indonesia	MOH	wt/age	Growth curve	Boston	Three divisions: • Normal—100%-75% of reference population median • Undernourished—75%-60% of reference population median • Severely undernourished—<60% of reference population median	Yes	Yes
Nepal	MOH	AC	Linear recording	N.A.	Three divisions	No	No
Philippines	MOH (Operation Timbang)	wt/age	No card—record in a ledger—provides a table for health worker to use to identify nutritional status of child	Boston	Four divisions: • Normal—110%-85% of reference population median • Mildly undernourished—85%-75% of reference population median • Moderately undernourished—75%-60% of reference population median • Severely undernourished—<60% of reference population median	—	—
	Nutribus activities	wt/age	Growth curve	Boston	Four divisions (see description above):	Yes	Yes
	Pilot project with USAID	wt/age	Growth Table	Boston	Four divisions: • Normal—>90% of reference population median • Mildly undernourished—90%-75% of reference population median • Moderately undernourished—75%-61% of reference population • Severely undernourished—<60% of reference population median	Yes	No

country	program	measure	record	reference population	classification system	space for medical information	educational messages
Sri Lanka	MOH	wt/age	Growth curve	Sri Lanka well nourished children	Four divisions	Yes	No
Thailand	MOH	wt/age	Growth curve	N.A.	Four divisions	Yes	No
LATIN AMERICA	Child health care programs in Latin America generally monitor weight-for-age. The standard growth card was designed at the Institute of Nutrition for Central America and Panama (INCAP) although most countries have made adaptations in the basic design. The card uses the Harvard reference population and four cut-off lines.						
Brazil	MOH	wt/age	Growth curve	Boston	Four divisions (variation of INCAP classifications—see Guatemala MOH)	No	No
Colombia	Colombian Institute of Family Welfare (ICBF)	ht/wt	Growth curve	Colombian	Five divisions details—N.A.	No	No
	National Food and Nutrition Plan—MOH	AC/age	No chart	Colombian	Three divisions details—N.A.	No	No
	Candelaria Project	wt/age	Growth curve	Boston	Four divisions: • Normal— >90% of reference population median • Mildly undernourished— 90%-75% of reference population median • Moderately undernourished—75-61% of reference population median • Severely undernourished— ≥60% of reference population median	Yes	Yes
Costa Rica	Social Security/ MOH	wt/age ht/age wt/ht	Growth curves—separate by sex	NCHS	Five divisions from 95%-5% of reference population values on each curve	Yes	No
Guatemala	MOH	wt/age	Growth curve	Boston	Four divisions: • Normal— >90% of reference population median • Mildly undernourished—90%-75% of reference population median • Moderately undernourished— 75%-61% of reference population median • Severely undernourished— ≥60% of reference population median	No	No
	Patulul	wt/ht	N.A.	Boston	Three divisions: • Normal— >90% of reference population median • Moderate malnutrition— 90%-81% of reference population median • Severe malnutrition— ≤80% of reference population	—	—
	SINAPS	AC	N.A.	N.A.		No	No
Honduras	SAPLAN and MOH	wt/age	Growth curve—cards of each institution have different layout but information equal	Boston	Four divisions (see description of Guatemala MOH card)	Yes	No
	Social Welfare (JNAPS)	wt/age	Growth curve	Boston	Two divisions: • Normal— 50th-3d percentile of reference population • Undernourished <3d percentile of reference population	No	No
Jamaica	MOH	wt/age	Growth curve	N.A.	Four divisions details N.A.	No	No

country	program	measure	record	reference population	classification system	space for medical information	educational messages
Panama	MOH	wt/age	Growth curve	Boston (soon may change to NCHS)	Four divisions (see description of Guatemala MOH card)	Yes	No

NEAR EAST Generally Near East child health programs monitor weight-for-age. The recording systems vary, but often use the "Road-to-Health" pattern. Within one country, two systems usually exist, one designed by the Ministry of Health and the other by the Ministry of Social Affairs.

Egypt	CRS	wt/age	Growth curve	Boston	Two divisions: • Normal (Road-to-Health)—100%-80% of reference population median • Undernourished <80% of reference population median	Yes	No
	Strengthening Rural Health Care	wt/age	Growth curve	Boston	Two divisions: • Normal—95th-5th percentile of reference population • Undernourished—<5th percentile of reference population	Yes	No
	Belena—Upper Egypt	wt/age	Growth curve	Boston	Two divisions: • Normal—above 80% of reference population median • Undernourished—less than 80% of reference population median		
Morocco	Min. of Social Affairs—CRS	wt/age	Growth curve	Boston	Two divisions (see description of Egypt CRS card)	Yes	No
	MOH	wt/age	Growth curve	N.A.	Two divisions details N.A.	Yes	No
Tunisia	CRS	wt/age	Growth curve	Boston	Two divisions (see description of Egypt CRS card)	Yes	No
	Tunis Medical School	wt/age	Growth curve	NCHS	Two divisions: • Normal—between 50th-3d percentile • Undernourished—below 3d percentile	Yes	No
	Tunis Mother Child Program (PMI)	wt/age	Growth curve	Boston	Four divisions: • Normal—>90% of reference population median • Mildly undernourished—90%-75% of reference population median • Moderately undernourished—74%-60% of reference population median • Severely undernourished—<60% of reference population median	Yes	No

Photo: WHO/8816 by P. Boucas

CHAPTER V

tools for measuring

Tools that can be *standardized,** that maintain *accuracy*, and that can be *easily* and *correctly used* are essential for growth monitoring projects. Other criteria for choosing instruments include: *low cost, sturdiness, durability, ease of repair, readability,* and an *appearance* that is not threatening to mother and child (1). For some projects *portability* will also be important.

Consideration should also be given to the *cultural appropriateness* of the instrument and measurement method. For example, in areas where a beam scale (see Figure 7) is commonly used at the market, the adaptation of this scale for child weighing may be more appropriate than using the unfamiliar spring scale. In regions where mothers may object to hanging their children from a hook "like a piece of meat," (81) it is necessary to use a basket or box for suspending the child if the suspension method of weighing is feasible at all.

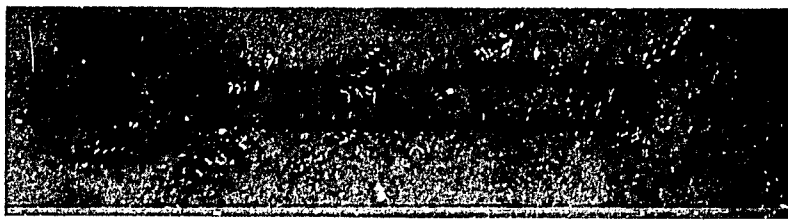
Measuring devices suited to the varying needs of monitoring programs are discussed below. A brief description of each instrument along with sources of directions for making tools and the addresses of manufacturers are listed in Appendix A. At the end of this chapter, Table 2 rates different instruments by the criteria mentioned above. Besides consulting these sources, the user should carefully examine the set of step-by-step illustrated instructions on the use and handling of each instrument which should accompany it.

METHODS TO MEASURE ARM CIRCUMFERENCE

The arm band can be made inexpensively by program personnel. The material chosen for the band should be durable and resistant to shrinking or stretching. Suggested materials include strong cord, plastic-coated cloth measuring tape, used photographic film (107), and paper covered with see-through plastic tape. Each strip must be checked periodically against a standard, in this case a ruler.

The beginning of the tape should be marked clearly on arm bands. To avoid confusion, "zero" should be recorded at the lead edge of the tape and should not be preceded by a blank portion (132). Or, at the zero end of the tape, a slot can be cut and the other end

Fig. I Example of the "Insertion" Tape Source: A. Zerfas (138)



inserted through it. The measurement can be read at the point where the tape comes through the opening (138); this is a simple method to avoid incorrect reading.

The band can be marked in centimeters, if the exact measurement is needed, or it can be marked in zones (normal, sub-optimal and danger) usually indicated by culturally appropriate colors. (The exact ranges used to mark the zones are discussed in Chapter III, Table 5). Using an "insertion" tape with colored zones assures easy reading, reduces error, and makes arm circumference an appropriate measure for programs employing non-literate health workers.

A second method to measure arm circumference, the Laugesen test for malnutrition, is being tried with village health workers in India, Bangladesh, and West Africa. To perform this test, the health worker gauges the relative thinness of a child's upper arm by noting the distance between the worker's index finger and the ball of the thumb. No tools are necessary for the test, but training tools are essential. These can be pieces of wood or tubes for the health workers to practice detecting different diameters before they work with children (88).

CHOICE AND USE OF A SCALE FOR WEIGHING

In addition to applying the general criteria for selecting measuring instruments, the choice of a scale should be based on:

- the accuracy of the scale to the nearest 250 grams (9), but preferably to the nearest 100 grams or quarter pound, because children make small weight gains during the second year (3);
- a total weight capacity of at least 25 kilograms, or 50 pounds, for programs weighing children under six years old (3);
- the ease of reading the numbers: there should be no confusion between a pound or kilogram gradient if both are on the same scale, and a direct interpretation of the result should be possible without mathematical calculations (3);

* Standardization is the comparison of the results given by an instrument to a known measure (a known weight or a length on a measuring tape). An instrument that can be adjusted to agree with the known measure can be "standardized."

- an adjusting mechanism that will allow the scale to be tared.*

Models now exist for scales that can be manufactured locally from low or no cost materials, and a variety of scales are available for purchase. The advantages and disadvantages of scales that are often moved or subjected to rough handling are reviewed below. (Bathroom scales have not been included because they are known to become inaccurate over time, especially when moved frequently.)

Locally Manufactured Scales

Four different designs have been proposed (9): a single beam scale (Fig. 2), a folding scale (Fig. 3), a quadrant scale (Fig. 4), and a tubular spring scale (Fig. 5).

Fig. 2 Beam Scale

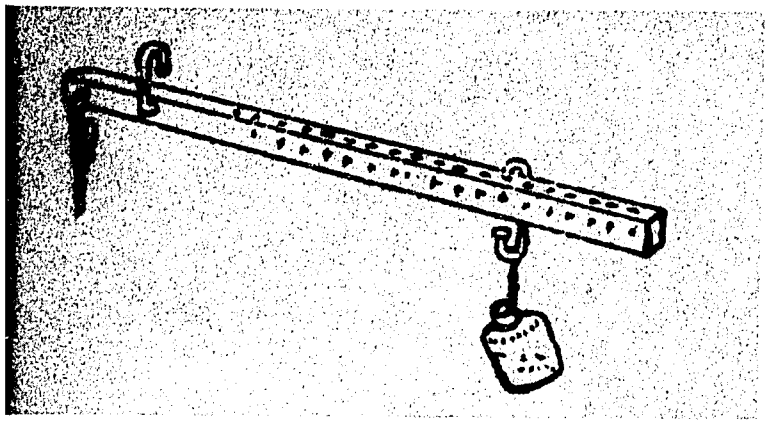
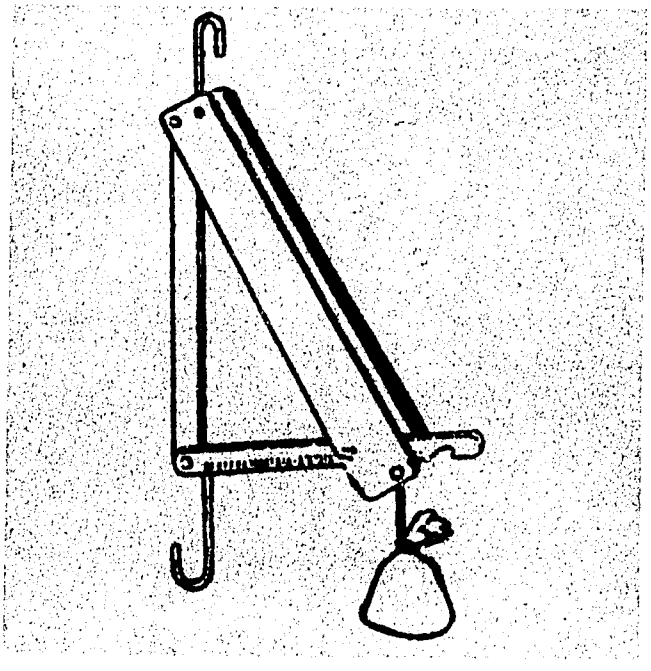


Fig. 3 Folding Scale



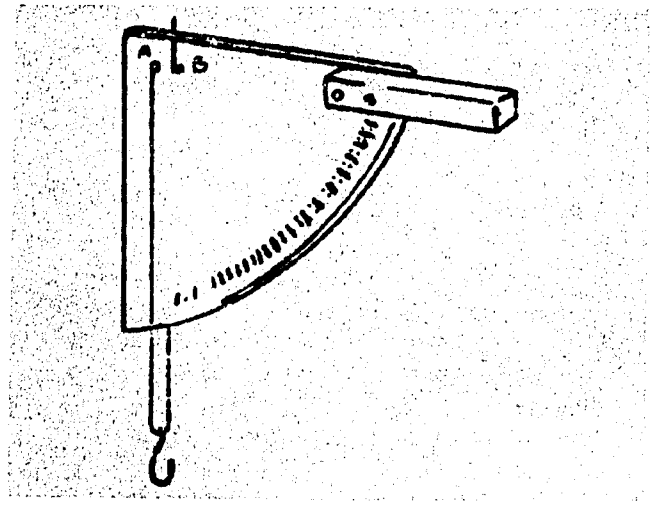
*Tare: to return the needle of the scale to zero. If the needle rests slightly on one side or the other of zero, the scale is difficult to read correctly. In the case when something like a basket is hung on the scale, this weight needs to be subtracted before the child is weighed. If the scale can be tared, these situations can be accommodated.

Close attention must be paid to accuracy by standardizing the scale during all phases of construction with both light and heavy weights. Known weights in increments suitable for the scale must be obtained before construction begins. After completion, the scales must be standardized each day they are used or at each location if moved.*

Although these scales may be more difficult to use than commercially constructed instruments, there are several advantages of locally made scales (126):

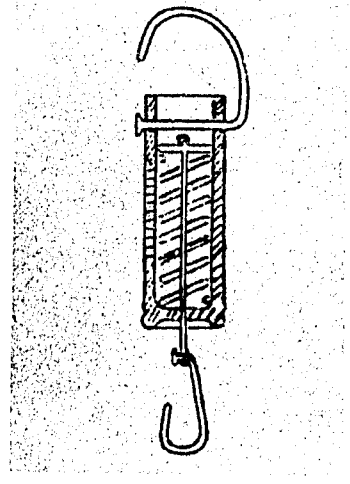
- expense is less;
- health workers gain new understanding and skills;
- community members can become involved;
- local manufacturing demystifies the process of weighing babies;

Fig. 4 Quadrant Scale



Source: Appropriate Health Resources and Technologies Action Group (AHRTAG), London, U.K.

Fig. 5 Spring Scale



- participation in the construction process elicits inventiveness, imagination, and problem solving from the "manufacturers," encouraging self-reliance;
- local weight units can be used.

* If the results of the weighing program are to be used in a study, the scale should be purchased rather than homemade.

Commercially Manufactured Scales

Single Beam Scales. Single beam scales are easily maintained and remain accurate over time. Two types of single beam scales are used in growth monitoring projects.

One type, commonly used in clinics (Fig. 6), is a table or small floor model on which the child can sit or stand. While this type of scale eliminates the problem of suspending the scale and usually is not threatening to the child, it cannot be transported without a vehicle. Also, these scales are generally the most expensive. Since so many models are available, specific scales have not been reviewed, although addresses of distributors are given in Appendix A.

Fig. 6 A Single Beam Scale for Clinic Use
Source: CMS Weighing Equipment, Ltd., London, U.K.

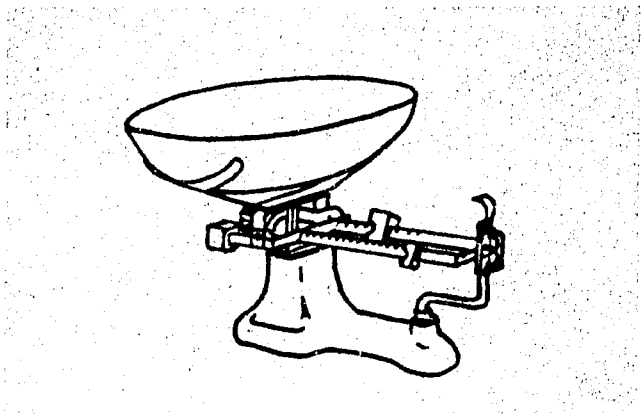


Fig. 7 Indonesian Scale—DACIN
Source: Nutrition Division, Ministry of Health, Jakarta, Indonesia

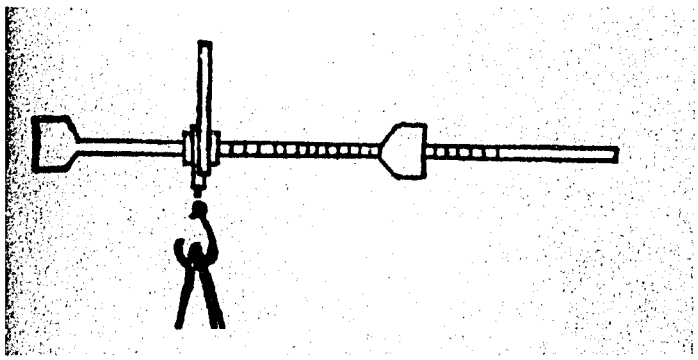
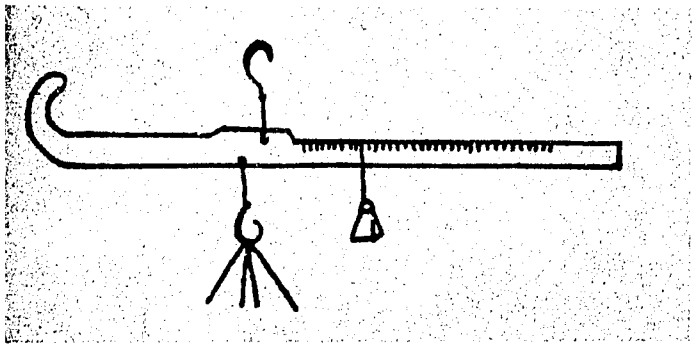


Fig. 8 Philippine Bar Scale
Source: Nutrition Center of the Philippines, Manila, Philippines



The second type of single beam scale is called a bar scale because the beam is free hanging. An individual can easily transport these scales if they are made from light materials. Such scales are widely used in Asia. Some countries (e.g., Indonesia) have adopted the scale used in the local markets (Fig. 7), while other programs (e.g., in the Philippines) have made minor alterations on the traditional scale (Fig. 8). See Appendix A for a description of the following scales and ordering information:

- Philippine Bar Scale
- Kumudini Bar Scale (Bangladesh)
- Chinese Wood Bar Scale (Thailand)
- Tansi Bar Scale (Tamil Nadu, India)
- Detecto "Machete" Scale.

Dial-faced Spring Scales. Two types of spring scales are commonly used: one is tubular (Fig. 5) and the other is dial-shaped (Fig. 9). Outside Southeast Asia the dial-shaped scale is probably the most popular. It is light (2.75 pounds or 1.25 kilograms), durable, compact, and easily transported. In the past, field-workers complained that the springs inside the scales rusted and that within a few years the parts or the entire scale needed to be replaced (50, 67). The scales currently available have gone through a number of changes and are much more durable. Internal springs now have teflon coating, and a plastic face protects the needle on the front of the scale. The scale case is either stainless steel or enamel. These scales are accurate and easy to use; on the other hand, they are the most expensive among the easily transportable models.

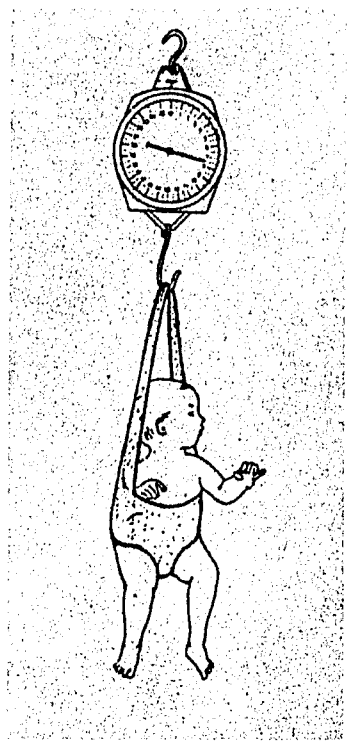


Fig. 9. Dial-Shaped Spring Scale
Source: Teaching Aids at Low Cost

A description of the following scales and ordering information is found in Appendix A.

- ITAC Model 800
- CMS Baby Weigher
- Salter Model 235

Tubular Spring Scales. These scales are extremely light, easy to transport, and convenient for weighing newborns (Fig. 5). However, they have not proved durable over years of use, and they are not as easily read as the dial or beam scales because both the marker and the space between units are small. Appendix A describes and gives ordering information on the most durable scales:

- Chatillon IN-50
- AHRTAG Super Samson

Methods of Suspending Both the Scale and Child

All of the scales described above, except for the table or floor models of the single beam scale, must be suspended so that the face of the scale or the beam is at the measurer's eye level. Health workers must plan how the scale will be suspended before arriving at the weighing site. Usually a place can be found at the weighing site to secure the scale: a tree branch, a house beam, or a beam on a drying rack. If suspending the scale presents a problem, a tripod can be constructed at each locale. Weighing should never be undertaken if the scale is not absolutely secure.

Fig. 11 Hanging the Scale Using the "Wilkensen Damper" Source: Dr. D. Morley

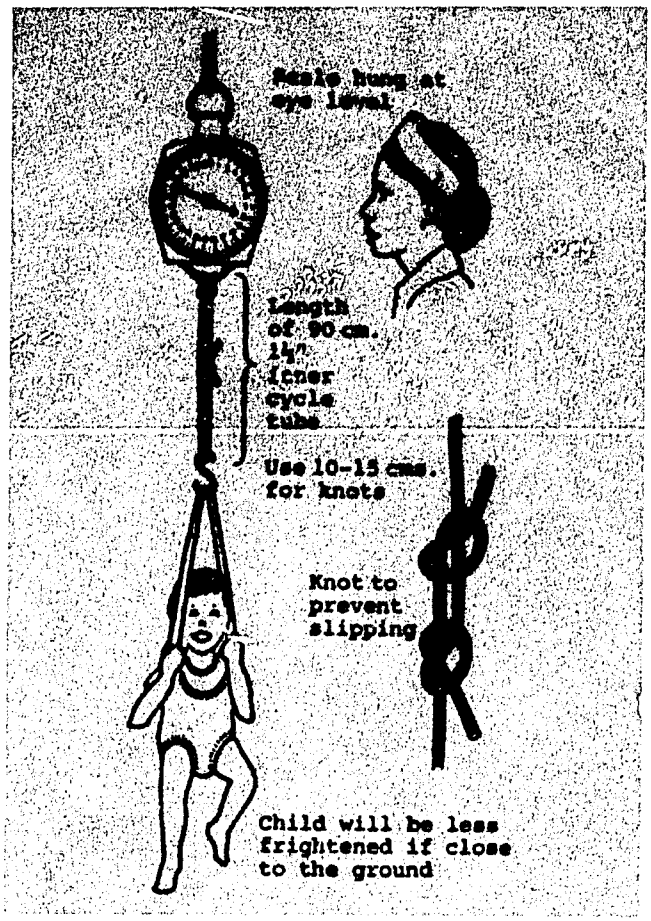
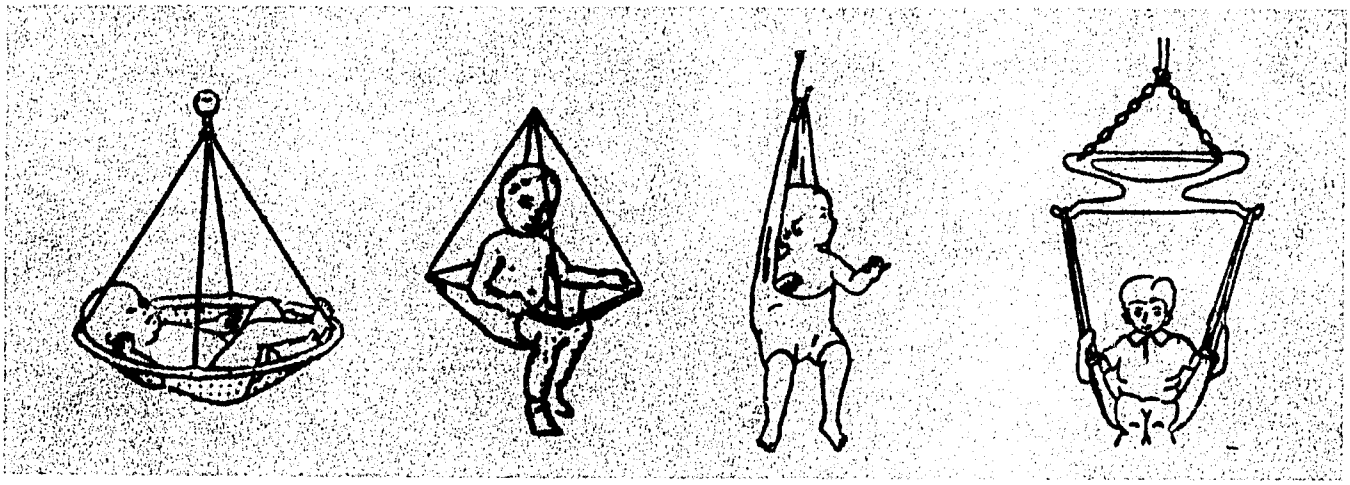


Figure 10. Suspension Methods
Source: Dr. D. Morley and M. Woodland (89)



Locally made hangers can be used for suspending the child. It is best to have a sling that will envelop extremely young children and hold them horizontally, so there is less chance that they will be uncomfortable and cry. For older children, pants with a suspension strap have been recommended as well as seats or boxes constructed to hold the child as comfortably as possible. The difficulty of fitting the child into the pants often undercuts the portability and storage advantages of this method. Figure 10 shows examples of different suspension methods (89).

A recent innovation in suspending the child from the scale is the "Wilkenson Damper" (88). A piece of inner tube is placed between the scale and the child to help reduce the swing of the needle caused by an active child (Fig. 11).

Standardization of Instruments

It is crucial that all instruments be standardized each time they are moved or before each day of heavy use. This is especially true for scales that receive rough treatment and that are occasionally overloaded. Scales can be standardized one against the other to ensure

that with the same weight they all read identically, or that one scale continues to record the same weight when the same object is weighed.

No well-tested method exists for standardizing when standard weights are not available. One recommendation is to use *sturdy* plastic bags that can be marked and filled with water (62). The bags are easy to carry and fill in villages during supervisory visits. Any readily available object can become the standard for testing a scale that remains in one place.

Additionally, if the health workers come to a center for periodic training, they should bring their scales for maintenance and standardization.

BOARDS FOR MEASURING LENGTH AND HEIGHT

Measuring height requires an instrument for each of two measurements: for children under two, recumbent length (the length lying down), and for older children, standing height. A well designed measuring board can be used for both. There is a temptation, when measuring length and height, to place the child against a measuring tape and to glance at the top of the head and read the measurement. To obtain an accurate reading is more difficult and requires a board 175 centimeters long with a sliding piece perpendicular to the backboard on one end and a fixed piece perpendicular to the backboard on the other end (Figs. 12 and 13).

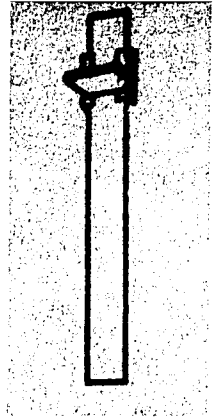


Fig. 12. Simple Height Board
Source: CMS Weighing Equipment, Ltd., London, U.K.

Figure 14. Side View of Measuring Board

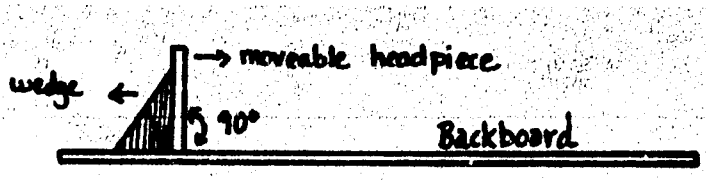


Figure 15. Top View of Measuring Board

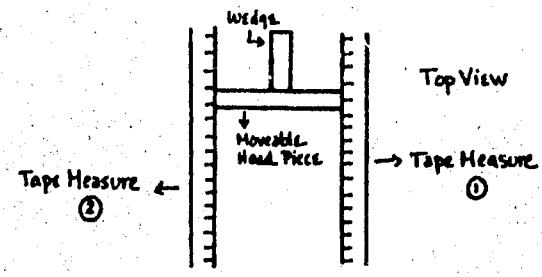
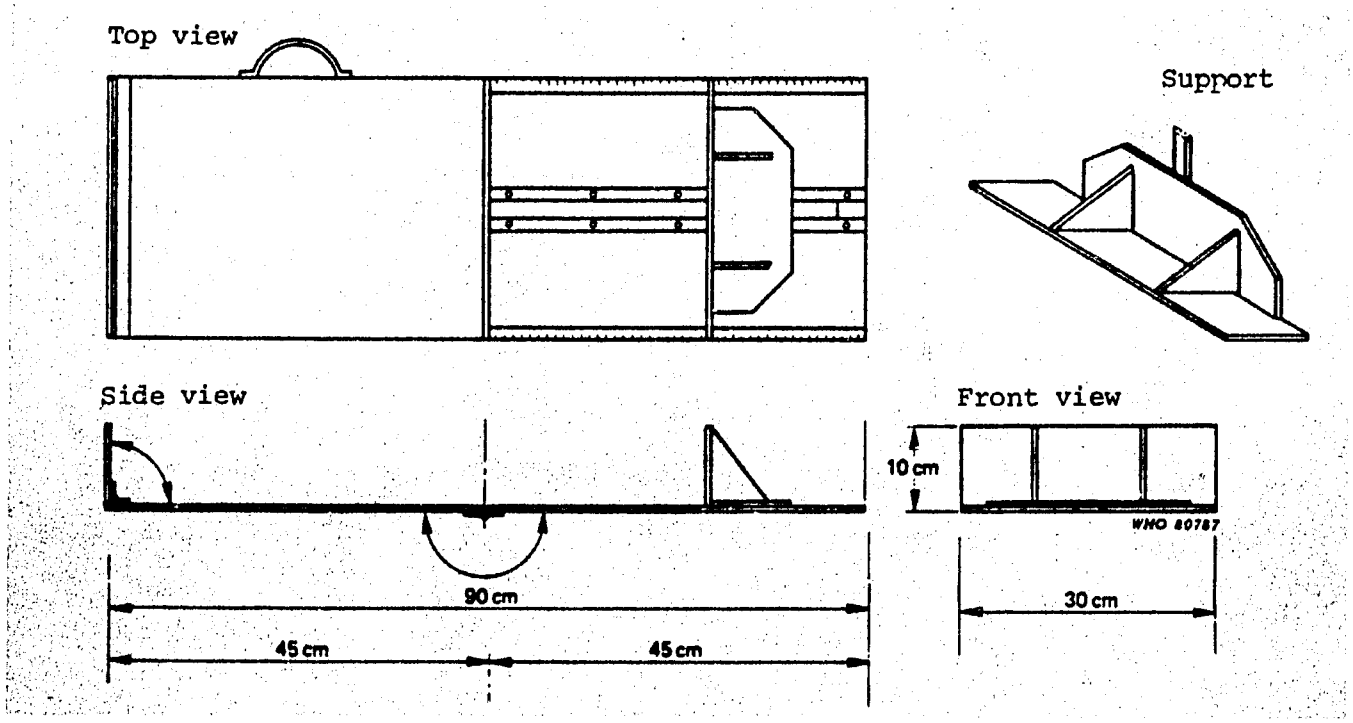


Fig. 13 Measuring Board for Height or Length Source: Prof. O. Koksal for WHO (36)



Boards can be made locally out of wood, although these tend to be heavy. Many designs have been tried. The important features of the designs are listed below.

- The moveable piece should have a wedge on one side to ensure that it is held perpendicularly to the backboard, whether it is part of the instrument, a wall, or a table (Fig. 14).
- Two tape measures attached to the backboard (boards, wall, or table) ensure that the moveable piece

will be held level, and will read the same on either side. (Fig. 15).

Sources of commercially available tools for measuring height are found in Appendix A.

"THINNESS MEASURE" WALL CHART MEASURES WEIGHT-FOR-HEIGHT

A relatively new tool is the weight-for-height wall chart, or "thinness measure," developed in Nepal by Save the Children Fund and the London School of Hygiene and Tropical Medicine. The chart is large (140 centimeters by 100 centimers) and printed on plastic-coated paper, so that it can be folded and easily transported. It should be taped or nailed to the wall with the bottom of the chart at ground level. Use of the chart does not preclude weighing, but the task of measuring height is slightly easier. After being weighed, the child stands against the column corresponding to his or her weight. The health worker then notes the color band at the top of the child's head. The color indicates the nutritional status or risk category for the child. (Fig. 16).

Fig. 16. Health Worker and Mother Measuring Child on Thinness Chart Source: London School of Hygiene and Tropical Medicine, London, U.K.

The advantage of this wall chart is that it allows a direct reading of the result and does not require plotting or transposing results from other charts. A "thinness measure" length board is being developed, since the wallchart is only for children over two years of age. Additionally, life-size cut-outs of children are available for use in training. References on the "thinness measure" are given in Appendix A.

CHILD DEVELOPMENT CHARACTERISTICS AND LOCAL EVENTS CALENDARS HELP DETERMINE AGE

In areas where birth certificates or other official records are not available, several techniques can help health workers and mothers estimate the birth date or the age of a child.

- The mother should be asked which children in the village were born at approximately the same time as her child. If these children have known birth dates, then the unknown birth date can be estimated.

- The child's approximate age can be gauged by counting the number of teeth present and noting other developmental characteristics. In Malawi health workers are taught to estimate the child's age in months by adding six to the number of teeth the child has (14). If the child has three teeth, (s)he is probably about nine months old. Below is another method taken from *Finding the Causes of Child Malnutrition* (19).

TABLE 1 A Method of Estimating a Child's Age

The child is like this:	So he is this old:
No teeth Can't sit alone	0-5 months
Has 1-6 teeth Can sit alone Can't walk alone	6-11 months
Has 6-18 teeth Can walk Knows a few words	12-23 months
Has 18-20 teeth Walks well Starting to talk well	24-35 months
Walks and runs well Talks well Has not yet lost first baby tooth	36-59 months

Be careful: You should never look at the size of a child when you are guessing his age. If the child is malnourished, his small size will make you think he is younger than he really is.

- A local events calendar has proven useful in helping mothers remember more precisely when their children were born by associating births with a local festival, harvest, planting or disaster. The under-fives clinics in Malawi use local calendars (14). In India events calendars are printed centrally by the Voluntary Health Association of India and distributed to health workers who complete the calendar with local or regional events (83). The completion of a local events calendar might be a useful activity to introduce during health worker training.

Brown (19) recommends that before using a local calendar, the health worker approximate the child's age and birth date using developmental characteristics. The range in the possible birth dates then can be narrowed by using the local events calendar.

A conversion table should be established for regions that do not use the twelve month calendar. In Indonesia, for example, it was necessary for Javanese mothers to translate their children's birth dates from the Javanese calendar before they could complete the growth charts, which are printed for use in the entire country. A conversion table was printed centrally and distributed to all village workers in Java (113).

TABLE 2 Comparison of Different Types of Measuring Tools

	Accuracy/ standardization	*Ease of use*	*Taring*	*Sturdiness/ durability*	*Ease of repair*	*Readability*	*Non-threatening appearance*	*Portability*	*Cost (US$)*
Arm circumference tape	Subject to observer error. Pulling tape too tight	Use of strip easy but often difficult to take mid-arm measure	N.A.	2	3	3	3	3	Very reasonable
Locally manufactured scales	Scale may not be as accurate as commercially manufactured scales; maintenance may be a problem	Depends on construction, but after training not difficult	Usually no mechanism	2	3	2	2	2	Reasonable
Single beam "clinic" scales	Accurate and can be standardized	After training not difficult	Yes	3 (if stationary)	2	3	3	1	50-100
Single beam—free hanging scales	Accurate and can be standardized	After training not difficult	May not have taring screw	3	3 (if local) 2 (if imported)	3	2	3 Depends on weight	20-30
Dial spring scales	Accurate and can be standardized	After training not difficult	Yes	3	2	3 (although a problem with swinging needle)	2	3	40-50
Tubular spring scales	May lose accuracy quickly	After training not difficult	Yes	2	2	2	2	3	11-37
Length/ height boards	Should be accurate and easy to standardize	After training not difficult, but needs two people for accurate measure	N.A.	3	3	3	3	2 Depends on weight	Can be locally manufactured or purchased 7-50
Weight/ height chart	As accurate as scale and method of taking height	After training not difficult, but needs two people for accurate measure	N.A.	2	Need to order new chart or redraw old chart	3	3 Scale may be problem	3	Chart and scale, 50-60

Key: 3-excellent 2-mediocre 1-poor N.A.-not applicable

Photo: ICEF/6889 by M. Diaoate

CHAPTER VI

program organization

Ideally, growth monitoring programs form part of continuing health care services operating in all communities. A broad health care strategy that integrates growth monitoring and allows the different administrative and care levels to cooperate can make optimal use of growth monitoring in providing comprehensive services. In such a strategy, the central level provides program guidelines, logistical support (records, measuring tools, necessary transportation), training, and supervision. The community supports its local growth monitoring project and village workers and ensures that the children in need of help receive it, either in the community or through referral to a facility offering more services. Program organizers should remember that the scale of a project will influence the interaction between communities and the central office. Project dynamics often change when small projects expand to regional or national scope.

ROLE OF THE CENTRAL LEVEL

Program goals are reflected in guidelines produced at the central level, which specify measures, reference population, cut-off points, recording system, and tools.

Other policies to be established centrally, but based on local conditions, include those concerning periodicity of the monitoring, children to be included, structure and staffing of monitoring sessions, and use of the results to decide appropriate interventions.

Establishing Periodicity and Selecting Children to be Included

The sensitivity of the indicator to small fluctuations and the time commitment of community level workers will influence the frequency with which a measure is taken. Because weight changes much more rapidly than height or arm circumference, programs monitoring weight can weigh a child as frequently as every month, while height and arm circumference do not need to be measured more often than once every three months. Community workers generally spend a minimum of one day a month on growth monitoring activities if the measure is taken monthly. If multiple measures or house-to-house visits are required, the amount of time will increase substantially.

It may be necessary to minimize the amount of time spent in growth monitoring activities, particularly when health workers are volunteers. Some alternatives:

- *Structure the sessions so that the children can be weighed or measured at a central location.* Home visits for individual consultations can be made another day. When the worker only needs to set up the scale or height board once, substantial time is saved.
- *Establish priorities by age or nutritional status for monitoring frequency* (15). If resources are scarce, the priority age group to include for growth monitoring would be those three years and younger; perhaps older children can be monitored, but less frequently. The World Health Organization suggests that healthy children under three be weighed every three or six months (129). In the Patulul Project in Guatemala, children under three are weighed and measured every three months, after which they are weighed every six months until the age of five, and annually after age five (34). The Nutrition Intervention Pilot Project in Indonesia monitors only children under the age of three, but they are weighed every month, like children in the national program, and height is measured every three months (113).

Nutritional status determines the frequency with which children are monitored in other projects. In the Philippines only severely malnourished children are weighed every month; others are weighed every three months (108). Similarly, in the Kasa Project in India the children who are nutritionally "at risk"—those who have low nutritional status, fail to gain weight over three months, lose weight over two months, or are sick—are weighed every month. Other children are weighed every three months (105).

The guidelines for periodicity and selection of children to be monitored should be based on the nutrition profile of the local population by age as well as on an assessment of local resources for supervising the program, for providing growth charts, and for carrying out the interventions indicated by monitoring results. The time constraints on community workers and the logistics of families bringing children to monitoring sessions should also be borne in mind when the guidelines are designed.

Whatever guidelines are established, they should be consistent with the twin goals of increasing community participation in monitoring sessions and of improving the nutritional status of the children. Program planners need to be aware of the repercussions of their decisions in the community. For example, what happens when programs ask mothers with well-nourished children to come less frequently? On the one hand, attending the sessions takes time needed

for other activities, so mothers may be happy not to have to bring their children. However, if mothers of healthy children are "rewarded" by not having to come, this may give the monitoring session an unwanted reputation as something only "problem" mothers have to attend. Sometimes, the latter case may be countered when the monitoring session is seen as a social occasion, and when being excluded is seen as a punishment.

Likewise, some programs give growth cards only to mothers with malnourished children to reduce program costs (91). Possibly, not receiving the growth card, which other mothers value, will not be easily understood by a mother who wants recognition for her healthy child. Or the card may lose its value if it becomes attached to having a sick baby.

Structuring the Monitoring Session

Planners with limited field experience assume that growth monitoring—weighing and measuring children—is easy. While it need not be complicated, it does require planning and supervision. Without this support, the result is chaos at the session, inaccurate measurements, errors in recording, and no participation by the mothers.

First, a sufficient number of cards and the proper measuring instruments in working condition must be available to prevent last-minute improvisations.

Second, village workers need training not only in weighing and measuring techniques, but also in managing the session (see discussion of training in Chapter VIII). Properly planned sessions flow in a way that minimizes the time the mothers wait, decreases confusion during the actual measuring and recording, and helps ensure that each mother is included in the process and involved in discussing her child's results.

Morley has outlined a series of steps or stations that should be established at each growth monitoring event at under-fives clinics (89). These stages have been adopted for sessions outside clinics, such as those conducted in villages in Indonesia (20). If the activity is done house-to-house, one worker is responsible for all of the steps; if the activity is done at community sessions, health workers can divide the work, and it will move faster. Depending on the ability of health workers, between 10 and 25 children can be weighed per half hour at a community session. The basic steps follow:

- *Registration:* The child is looked over for physical signs of illness. The card brought by the mother is checked, and the immunization status and completion of other health activities are noted. Other appropriate records are completed. The card should remain with the mother.
- *Weighing or Measuring:* The mother and child pass from a general waiting area to the place where the scale and/or height board are set up. This area should be away from the confusion of the registration area. The village worker and the mother weigh and measure the child.* The results are read and another health worker completes the card with the mother. The card remains with the mother.
- *Discussion of Results:* The mother and child then proceed to the area where the results are interpreted by a village worker and solutions or interventions needed to correct any problems are discussed. (More details on this step are provided in Chapter VII.)

Integrating Growth Monitoring with Other Project Activities

Growth monitoring should not be an isolated activity. Simply obtaining growth monitoring results solves nothing unless they are closely linked with some interventions. Decisions on which interventions should be tried and when they should begin and end should be based on the growth monitoring results and an assessment of the effectiveness of the interventions on the improvement noted in a child's nutritional status.

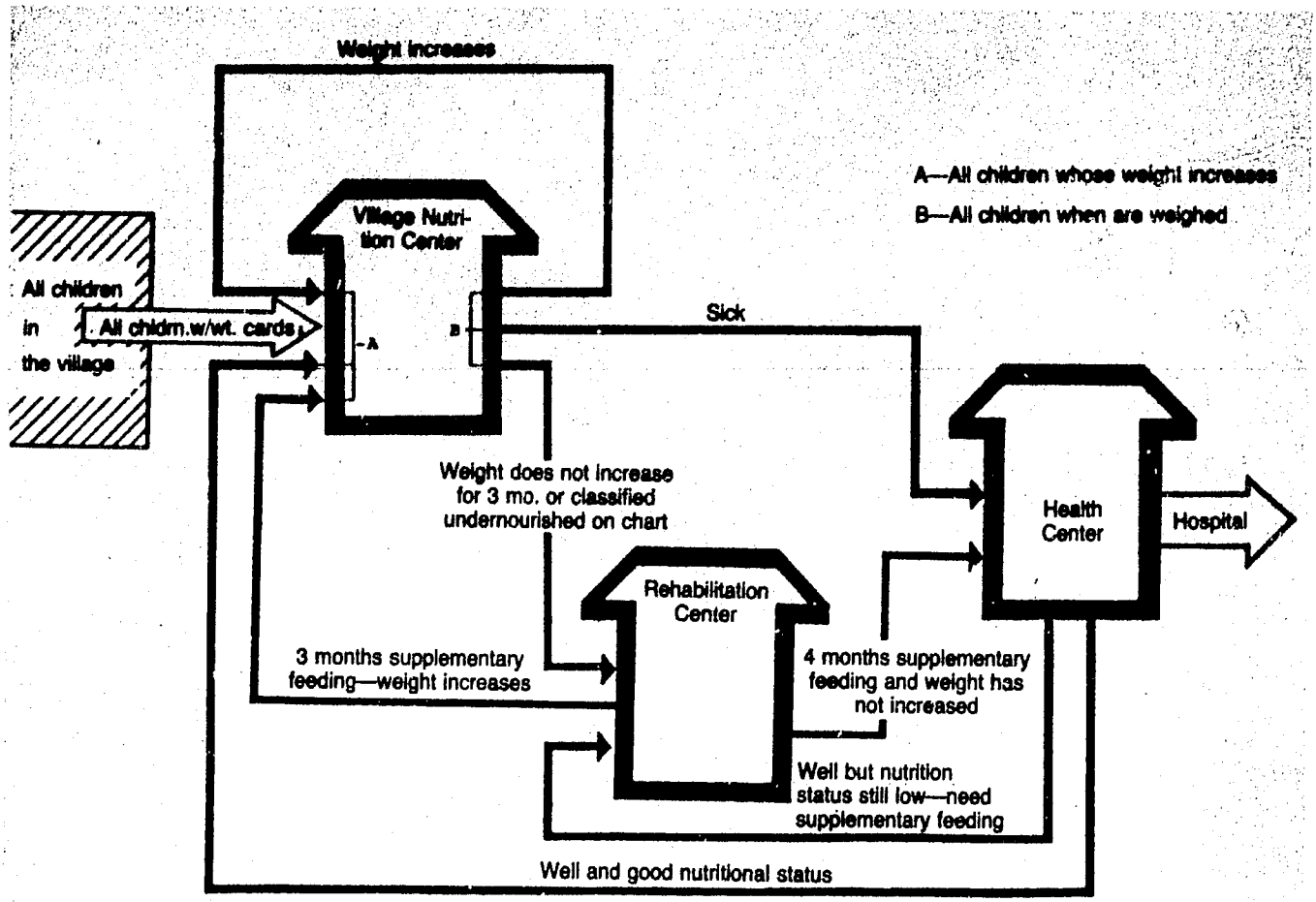
Some of the interventions are begun at the monitoring session. Usually, these are preventive medical activities carried out in primary health care programs. In most areas, particularly in Africa, the growth monitoring session provides a time to give the child needed immunizations. In the Philippines, vitamin A capsules and a ferrous sulfate preparation are given to the undernourished child. Additionally, deworming medicine is provided to some children, although not to the severely malnourished until they are rehabilitated (92).

At the monitoring session, mothers can be asked a few basic questions about the change in their child's growth pattern to determine if diarrhea, tuberculosis, an infection, or other illness is the cause of the growth failure. By repeating the questions and explaining their significance to the mother, the health worker can also alert her to particular danger signs. The health worker should look at both the child's diet as well as his/her physical state to decide on appropriate interventions and referrals.

Unfortunately, some programs do not have the support of an active primary health care program. In cases of minimal resources at the community level, the actions resulting from the weighing session are limited to education on nutrition and other health topics such as family planning and personal and household hygiene, and to referral to another facility or program. In Indonesia, for example, a referral system has been established as part of the community weighing program. Children stay in the village weighing program if their weight increases. Those whose weight has not increased for three months are sent to a village rehabilitation program where they receive food supplements. Those who are sick are

* A protocol for weighing and measuring is presented in Appendix B.

Fig. 1 Nutrition Referral System—Indonesian Family Nutrition Improvement Program (UPGK)
Source: Nutrition Division, Ministry of Health, Jakarta, Indonesia



referred to the health center. The complete system bases each move on the weighing results (See Fig. 1).

The link between monitoring results and food programs, whether they are community based or carried out in a clinic, has been stressed most recently in an evaluation of a Moroccan nutrition program in which food supplements were used (45):

> To improve targeting of the most vulnerable groups, it is essential that scarce food resources be allocated on the basis of nutritional status as well as income level . . . A unified and centralized record keeping and management system should be instituted in feeding programs so that progress can be properly monitored and impact fully documented. The additional resources and effort required are well worth it. (pp. ii and iii, 45)

Selecting beneficiaries based on need and keeping records of food distribution programs is a natural activity for primary health care programs and under-fives clinics with growth monitoring systems. Dr. C. Capone, who has extensive experience administering food programs for the Catholic Relief Services in Africa, stresses these points. He has designed a system that he describes not only as a monitoring tool for the individual child, but also as an administrative tool for food supplementation programs (23, 127). (See Chapters IV and IX for a discussion of this system.)

The integration of growth monitoring with other program activities needs careful analysis and continual supervision once implemented. An example of the importance of this is the association between growth monitoring and food distribution, which are often combined in one activity. Although some programs distribute food supplements as an incentive to everyone attending a monitoring session, other programs target food supplements to the undernourished. Program planners in some African programs have noted that when food is targeted, those receiving food feel stigmatized, and occasionally husbands will not allow their wives and children to attend the program (14). In Indonesia a similar phenomenon is observed, although the food is seen as a reward and therefore causes mothers with healthy children to feel cheated (55). The nutrition program in Indonesia separates monitoring from food distribution. Mothers with malnourished children must return to the village center to receive food and instructions about its use at another time (a tactic that is practical only if the center is close, and the extra session is not long).

Decisions that are made at a central level need to reflect local realities: the perceptions of program participants and the community in general should

be continually sought and evaluated. And while the plans for the actual monitoring activity are important, emphasis should be placed on how to use the results to screen children for inclusion in other program activities.

ROLE OF THE COMMUNITY

Enlisting the support of local leaders is a first step to ensure the success of a monitoring project in most countries (20, 92). Initial discussions with community leaders and/or community health committees should emphasize the value of using improvements in children's health and nutrition status, as measured by growth, as one sign of village progress (131). Later the specific arrangements for implementing the project can be discussed. When appropriate, active participation of community leaders should be sought: 1) to convince community members of the importance of participating in this project; 2) to locate a convenient place for the session; 3) to organize the village health workers to assure sufficient staff at the session; 4) to oversee compilation of the village results; and 5) to assist in organizing community activities that address problems discovered through the growth monitoring project.

A consistently important role for both male and female community opinion leaders is that of motivational agent to encourage participation in the project. In most cases their involvement must go beyond explaining the benefits of growth monitoring for potential health and nutrition improvement, to actually participating in the sessions and speaking with families on informal occasions. They also might assist in organizing community social events, such as lotteries, which serve to promote participation by all at the monitoring sessions. In this case, tickets for a lottery could be obtained only at the growth monitoring session. Additional tickets could be given to any mother whose child gained weight (52).

Other ideas for activities that can be organized on a community level to encourage participation in growth monitoring include giving each mother a card that is marked at each session she attends. After the card has been completed, she can present it to a local merchant for a prize (55). Also, the community can organize a small fair or bazaar at the time of the session, or hold the session on market day (110). Organizing a fair may be especially practical if there are small handicraft projects in the community that produce items useful to community members.

Besides participating in the monitoring sessions, community members should also take responsibility for examining the results (see Chapter IX) and planning their own response to the problems that are highlighted. For example, in Indonesia and Nepal, communities have begun their own supplementary feeding programs for malnourished children. These programs use local foods and are funded by money collected from the women who attend the monitoring sessions or local meetings (70, 80). In Nicaragua, women organized to obtain free or subsidized food from outside the community and then gave or sold it at cost to families with malnourished children (50).

ROLE OF THE FAMILY

Although the community can do a great deal to organize, promote, and act on the results of growth monitoring, the real involvement and commitment must come from each monitored household. This involvement and commitment is strengthened when family members can interpret monitoring results, decide on their own interventions, and witness changes in their children (67, 83). Although involvement of all families to this extent is not a simple or quick process, it is a necessary and basic goal for growth monitoring programs if they are to benefit the children who participate.

Two pilot projects (67, 98) have attempted, with some success, to place full responsibility for growth monitoring with the mothers: mothers weigh their children and help maintain growth cards. Although this may not be practical for all areas, even if mothers do not weigh and measure their children alone, they should be trained and share in the responsibility at each step.

All programs can use the growth card to begin encouraging participation. It has been reported that the mothers' enthusiasm and participation in a program increases when they are given the growth cards (60). Possession of the card is a clear indication to the mother that she shares in the responsibility for her child's health. Other advantages include decreasing the amount of time mothers wait for workers to find and refile records (101).

Health workers' major criticism of this policy, that mothers lose cards, has not been substantiated, since the cards are just as likely to be lost at a typical health center (109). The loss rates reported by several programs in which the mothers keep the cards are not alarming:

- At the close of Project Poshak (India) interviews were conducted with 375 mothers. Not one of the mothers had lost her child's weight card over a four year period (47).
- A study of four well-established under-fives clinics in Africa shows an overall loss rate for home records of eight percent (101).
- A report on the Ministry of Health/Catholic Relief Services Community Studies Project in Hanover, Jamaica notes that "not a single weight chart was ever lost." (p. 303, 43)
- In a randomly selected sample of homes in Indonesian villages with weighing programs, there was a loss rate of one percent. However, eight percent of the cards were left at home by mothers who took their children to be weighed regularly (51).

One potential problem noted by WHO is that although mothers have their cards, they may fail to bring them to the session. The WHO study (129) conducted in several countries found such failure to occur between five and fifteen percent of the time. The study attributed failure on the part of mothers to the centers' keeping of duplicate records, which made the mothers feel that their efforts were superfluous. Nonetheless, some experienced professionals feel that eliminating health-center records would be a mistake (14, 74, 127). Clinic records have proven especially valuable for project evaluation (2). But are they worth the expense and time to maintain for an occasional evaluation? This is another delicate situation for program planners because clinic records should not be perceived as lessening the family's responsibility for maintaining the card.

Families should be responsible for more than their cards; they should be encouraged to look for their own solutions to their children's health and nutrition problems. As Dr. Capone remarks on food supplementation programs, there should be a contract-like arrangement with the parents (23). The parents should be encouraged to alter some feeding practices, to take the child to the health center, or to give the child a particular medicine between weighing sessions. It is through family responsibility for particular behavioral changes that growth monitoring projects will become an integrated part of the health care services that the families feel are truly important for them.

It is only when all levels (central, community, and household) cooperate that the general goal of growth monitoring projects will be achieved—improvements in the nutritional status of all children.

Photo: M. Griffiths

Photo ICEF/3991 by G. Holton

CHAPTER VII

using monitoring results for family education

Often growth monitoring activities are not integrated into national primary health care programs because governments fear that a program that identifies undernourished children will require them to begin and maintain a massive feeding program. Although large feeding programs may be necessary during emergencies or in areas where subsistence is marginal, the majority of areas where growth monitoring activities could be implemented do not need massive feeding programs. Families can respond to identified growth deficits by reallocating their own resources to cover their needs if they are:

- offered the proper motivation,
- given clear and feasible alternatives, and
- given a role in deciding what practices they will try to change.

Many educational efforts fail because their underlying strategies overlook the importance of motivation, specific alternatives, and the involvement of the target families. Most manuals instruct health workers to educate families on a number of topics including the growth chart and infant feeding. The worker is given general guidelines but is seldom provided with examples to help adapt the large body of nutrition information to family needs or a scheme for linking growth monitoring results to infant feeding lessons. Without experience in interpreting monitoring results into dietary recommendations and without training in basic communications techniques, health workers will miss lessons that might be learned from the growth chart.

Although there is a shortage of information on the contents and strategies of education programs, it appears that few programs fully realize the potential of growth monitoring as an educational tool. For example, the U.S.-sponsored feeding programs have guidelines that emphasize both nutrition education and growth monitoring activities. However, a Catholic Relief Services evaluation of nine projects in Africa conducted between 1973-1975 found

> . . . the nutrition education promotion, instead of being associated with the supplementary food and the growth chart, was often interpreted as a lecture to the mothers on nutrition or some related topic. Nurses and health workers were expected to have, without any training, the same skills as a trained teacher. (p. 7, 24).

Moreover, the education program was evaluated according to whether the nurses gave a good lecture and the mothers listened, not on changes in growth patterns or infant feeding practices.

A review of 33 USAID-sponsored feeding projects in 21 countries (30) revealed that while 75 percent claimed to weigh infants, many did not keep growth charts, and even fewer carried out either activity with regularity. Even in projects with a regular growth monitoring component, the link between the growth chart and other educational activities was weak. The review cites two reasons for the minimal educational effort: 1) the staff was insufficiently trained for the work; 2) the number of topics to be covered with the mothers required more time than the staff could afford, and as a result education on growth charts was buried.

These problems, familiar to U.S. feeding programs and others, can be overcome in part with an education strategy based on growth monitoring results. Such a strategy neither precludes training the workers nor reduces the number of topics that a worker needs to understand. Rather, it offers workers and mothers a point of reference. Relating nutrition education to growth monitoring activities will make lessons less an abstract list of do's and don'ts: education will become more of a guide to practical action tied directly to the current nutritional status of a child or of the children in the community.

More importantly, this educational strategy strengthens one-to-one contact between the health worker and the mother. Using growth charts enables workers to employ the "seeing-is-believing" strategy shown to be effective in changing dietary practices, i.e., the mother modifies the diet, and change is detected on the growth record (11, 133). Additionally, meaningful counseling for those in need will take place at the most appropriate time, when the child is first identified rather than weeks later when the child's health has further deteriorated. Consider for a moment the mother's situation at the monitoring session: she has just helped weigh her child; something is recorded on her card; the card is returned to her. What does it mean? A few minutes of explanation at this time will take advantage of the mother's curiosity and reduce the need for lengthy and perhaps less productive group sessions later on.

CAN FAMILY MEMBERS UNDERSTAND?

Often health workers think that mothers cannot understand the significance of the growth chart, since it is sometimes difficult for the health workers themselves to understand. However, projects that have measured mothers' understanding of the chart *after*

orientation have concluded that mothers have little or no difficulty understanding the chart. (In this context, the chart is a weight-for-age growth curve where the adequate growth channel is between two curved lines drawn across the chart.)

Data gathered in Ghana (11, 95) indicate that while the educational level of the mothers was closely related to their readiness to learn about the weight chart, many virtually illiterate mothers had little trouble understanding the chart. Even though only 53 percent of the mothers had more than two years of schooling, after six months in the program, 66 percent of all mothers were able to interpret four different charts correctly. The four charts provided examples of good and insufficient growth. Mothers also had a chance to record on a blank chart their own child's position at the time of the initial interview and at the last weighing.

The experience of Project Poshak in India (47) confirms that mothers can interpret the charts. In this project mothers received weight charts and instructions about their use. By the time of the project evaluation, all mothers interviewed knew that a downward slope in the child's growth line meant illness. Seventy-six percent recalled the meaning of the three growth channels and were able to mark their own child's position and to identify the child's health status correctly.

TEACHING MOTHERS TO INTERPRET GROWTH CHARTS

There is general agreement that mothers and other family members need to recognize the importance of growth monitoring and to learn how to watch and interpret their children's progress on growth cards. This, however, is not enough. Interpreting the results must lead to improvement in their children's health status, whether by medical interventions or dietary change. Workers should focus on teaching mothers the relationship between good food in sufficient quantity and growth as an indicator of health.

Four educational objectives for family members have been identified (99):

- the ability to explain the line showing the child's growth in relation to the color pattern on the chart;
- the ability to discuss the child's growth in the past month based on change from the previous monitoring session;
- the ability to discuss how food consumption affects growth; and
- the ability to discuss how the child's health status affects food consumption.

To help mothers visualize this link between food consumption, growth and health and to provide motivation for continuing in a monitoring program, pictures or stories of children in the village are very useful. Children who are different in age but similar in size can be compared, or those who are the same age but different sizes. The mothers can discuss why these differences exist—why an older child is the same size as a younger one or why two children born at approximately the same time are different sizes. Another example can be found in the booklet entitled *Better Child Care* (73), which includes pictures of a child taken a few months apart. In the first picture, the child is badly malnourished. In the second, he is much improved by a better diet. Mothers can discuss whether they think this is the same child and what they think has made the difference in the child's appearance.

Another way to stimulate discussion on this point is to tell a story. One such story developed by the Moroccan Government was used in a Catholic Relief Services nutrition project in Morocco (25). The story compares the life of Rachid, a sick, malnourished child, and that of Ahmed, a healthy, lively, bright child. After telling the story, the health worker asks mothers to compare the growth patterns, behavior, and diets of the two children. The mothers are asked the same questions about their own children. This teaches the mothers to recognize the link between food intake, growth, and good health both in the abstract and in their daily practices.

The mothers also should be taught specific practices to keep their children on the "Road-to-Health." For example, Indonesia's Family Nutrition Improvement Program draws extensively on mothers' experience during the discussions at the monthly weighing sessions (20). The basic message of this program is, "A healthy child gains weight as he grows older" (80). A child's inability to gain weight becomes the warning sign for the health worker. The number of months the child has failed to gain weight and the age of the child determine which message is communicated to the mother. The message is discussed, and then the mother's ideas are used to define exactly how she will comply with the message. Examples of the Indonesian messages follow (20).

- For a child zero to three months old who has not gained weight over a one-month period of time: 1) the child should be breastfed three to five times more than usual every day; 2) the mother should drink a total of six glasses of water every day.
- For a child four to six months old who has not gained weight for two months: the child should eat a medium-sized plate of soft food five times a day.
- For a child 12 to 24 months old who has not gained weight for two months: 1) the child should eat adult food five times a day; 2) the child should be given food between meals.

The flipchart designed by the Indonesian Government that contains all of the dietary recommendations and the protocol for health center referral is being distributed by:

The Clearinghouse on Maternal and Infant Nutrition
American Public Health Association
1015 15th Street, N.W.
Washington, D.C. 20005 U.S.A.

MOTHERS' PARTICIPATION PERMITS WORKABLE MESSAGES TO BE FORMULATED

Specific messages similar to the ones above can be developed for any program and can offer valuable guidance to health personnel in counseling mothers. If they are to prove useful to village mothers, these messages should not be designed in an office isolated from the health workers and mothers who will use them. Instead, the intended audience for any message should be invited to help formulate it (51). This participation goes beyond the usual surveying by most educators to understand the target audience before designing educational contents.

The community participates in message design through trials in which the mothers or families actually test, comment upon, modify, and retest a recommendation. The original recommendations are made because they appear practical and because they are nutritionally sound. The testing and retesting assures that they mesh with villagers' perceptions and practices. What emerges after intense work with carefully selected participants is a synthesis of traditional practice and a new technique—a message that can affect daily feeding practices or actions taken during illness. This synthesis is impossible to formulate without the participation of the village family, especially the mother, no matter how well persons designing the recommendations may believe they understand village families.

HOW SHOULD EDUCATION BE UNDERTAKEN?

Explaining growth charts and monitoring results can be done in either group or one-on-one sessions. The most common setting is the group lecture conducted during or after the monitoring activity, although the most effective may be individual counseling. Regardless of the setting, some basic points about the education or training sessions should be considered:

1. *Mothers should have an explanation of the results of the weighing or measuring as soon as possible.* The mother should not have to wait until everyone is finished or until a health worker comes to her house. As described in Chapter VI, a health worker should be stationed in an area where the mother can go immediately after her chart is completed. If detailed instruction is not feasible at that time, the mother can be given the result and referred to a small group session for further discussion. The group sessions can be conducted as a few mothers finish so that no one has to wait hours after the weighing for an explanation.

2. *Community leaders should be invited to attend the monitoring session or to open an educational discussion.* Often this gives more credibility and importance to what will follow (56, 133).

3. *The mothers should be engaged in open discussion rather than be lectured to.* Mothers are more likely to resolve their own doubts or misunderstandings if they actively participate in the discussion (133). Mothers should be encouraged to air their beliefs about the signs and origins of illness or malnutrition, as well as other ideas concerning health. The use of open-ended questions* will promote this type of discussion. (Special communications training for health workers, particularly in the use of open-ended questions, may be well worth the time. A Philippine project reportedly increased the effectiveness of its education program with just one day of communications training for field staff (6).

4. *Examples from the mothers' experience should be used to illustrate specific points.* Women with healthy children can discuss how they feed their children and at the same time can receive positive reinforcement for their current practices. Also, women who have tried to alter recommended feeding practices should be called upon to discuss their experiences: how they felt, what modifications they made on standard recommendations, and what the result was on their children's growth. Whenever culturally appropriate, traditional ideas about food and growth should be enlisted to explain or reinforce the principle of the growth chart (3, 51).

5. *Mothers with malnourished children should not be singled out or embarrassed* (56). Reference to a child who is not growing well should be made by using a fictitious name, by telling a story, or by showing an unidentified growth chart. Mothers with malnourished children sometimes will not attend weighing sessions because they are afraid of being identified as bad mothers (51).

6. *Sessions should be brief.* Particularly when mothers bring all of their children along, it is difficult for them to focus full attention on the discussion for more than ten to fifteen minutes (56). For this reason, only one point should be discussed during an individual or group session.

7. *Whenever possible, visual aids should be used to illustrate the points in the discussion* (56). An effective technique is to ask mothers what they see in a picture or graph before it is explained. The mothers' perceptions can then be incorporated into the explanation of the picture, and the health workers need only reinforce particular concepts.

* An open-ended question is one that cannot be answered with only "yes" or "no." It requires that more information be given, in this case a description of the mother's experience or thoughts about a particular practice. An example of an open-ended question for the discussions described above: "How often do you feed your child?" "What is your opinion about feeding your child four times each day?"

8. *Mothers whose children require dietary changes should leave the session with a clear idea of what they are going to try between this session and the next.* The best way to reach a decision is through individual counseling. At that time the health worker can find out what foods the mother feeds the child and make specific recommendations. The mother discusses what she can do practically, given family size, time, income, and food available. The recommendation with modification becomes a mutual decision about what she will try. If there is space on the growth card, this decision can be noted for follow-up. In a group session, tailoring recommendations becomes much more difficult. If there is no alternative to the group session, it is best to keep the group small and have everyone agree to try something, such as feeding an extra four large spoonfuls of rice at each meal to all children between nine and eighteen months.

The opportunity provided by growth monitoring to offer the mother specific, behaviorally oriented messages to help her child should be utilized. Mothers can understand how to interpret their child's position on the chart, but this is not enough. Referring her child for more medical treatment, while important, does not involve her in her child's recovery. Involving the mother in the improvement of the child's daily dietary pattern provides the opportunity for the mother to participate actively. The dietary change messages should be designed by project staff along with the mothers (or those who will implement the messages). This assures that messages will be practical and within the cultural patterns of infant feeding, so that if sufficiently motivated, mothers will try to follow the advice. Whenever possible, mothers should participate in the ultimate decision about what they will try. If the mothers do participate, the positive reinforcement offered by watching changes in the growth curve cannot be equalled for its power of persuasion or its ability to boost their self-confidence.

Photo: M. Griffiths

CHAPTER VIII

training primary health care workers

As growth monitoring activities from small or pilot projects are adopted by national programs, community health workers are expected to carry full responsibility for growth monitoring activities, even though their field supervision is often reduced. Therefore, how well they are trained on growth monitoring rationale and techniques is crucial to program success. Participatory instruction and on-site practice in the necessary skills will ensure that community health workers are able to carry out all phases of monitoring. This training need not be lengthy and will serve to reinforce training in other health concepts or community participation.

TRAINING THE TRAINERS

Health professionals responsible for training and supervising community workers often need inservice orientation on the nutritional goals of primary health care projects and a realistic appreciation of the community health worker's nutrition-related role. Such a course for health center personnel has been designed by Dr. Jon Rohde *et al.* and reprinted in *Tropical Pediatrics and Environmental Child Health* (100). Other manuals are also available:

- The World Health Organization's *Guidelines For the Training of Community Health Workers in Nutrition* (130) has a chapter on growth monitoring.
- A forthcoming publication by David Werner, *Helping Health Workers Learn: A Book of Methods, Aids and Ideas for Instructors at the Village Level* (126).
- An Indonesian publication with useful information for weight monitoring programs, *Manual for Community Based Under-Fives Weighing Program*, by Hendrata and Johnston (56).
- *Weighing and Measuring Children: A Training Manual for Supervisory Personnel* (26). This manual can be obtained free by writing:

Center for Disease Control, Nutrition Division
Atlanta, Georgia 30333, U.S.A.
or
Health Services Administration, Bureau of Community Health Services, 5600 Fishers Lane, Rockville, Maryland 20857, U.S.A.

IDENTIFYING SKILLS TO BE TAUGHT

Identifying the knowledge and skills necessary for health workers to carry out growth monitoring activities is the first step in planning a training session. Some programs, like the Indonesian Family Planning Program (12), have outlined specific objectives for their workers. The list below is a composite of health workers' responsibilities in several growth monitoring projects. Skill objectives have been enumerated for each responsibility.

Table 1—Training Objectives

Responsibility	*Skill Objective*
1. Establishes a growth monitoring activity in the community	1.1 Knows value of growth monitoring and can explain it meaningfully to community members
	1.2 Interests and involves community leaders in the activity
2. Weighs and measures children	2.1 Can structure monitoring procedure to minimize confusion
	2.2 Can set up and use tools correctly
	2.3 Can accurately weigh or measure children
3. Completes growth chart	3.1 Can interview the mother
	3.2 Can calculate child's age or birth date if required
	3.3 Can graph or mark card correctly
4. Offers advice or education to mothers	4.1 Can correctly interpret chart
	4.2 Can communicate effectively with and involve mothers
	4.3 Can offer proper dietary advice for child not growing adequately and can refer child in need of additional assistance
5. Stimulates community to work together to help malnourished children	5. Can discuss the community nutrition profile given by monitoring results and recommend community actions to alleviate the situation
6. Keeps information that will help evaluate the program or the progress of the community	6. Can compile a community record for each session or keep a simple tabulation

TEACHING GROWTH MONITORING TECHNIQUES

The training session has two purposes:

- to provide knowledge and skills; and
- to foster a belief in the usefulness of growth monitoring, a commitment to community action, and a desire to transmit these attitudes to communities (126).

To accomplish these goals, educators must teach not only technical skills but also skills for communicating with the community. Although specific techniques taught will vary according to program requirements and choice of measurements, there are some general guidelines to be followed.

Since the learning environment and teacher-student relationship experienced by health workers during their training will likely be reproduced when they teach in the community, techniques employed during community health worker training should exemplify teaching and communication practices. Formal presentations have not proven conducive to the open and active discussions that health workers should aim to create in their communities. Instruction should be action-oriented, should emphasize practical aspects, and should avoid complicated theory. Moreover, the learning environment should be similar to the one in which the student eventually will work (11). Initially, students should learn to handle the equipment and structure a monitoring session within the typical household or clinic. Later training can take place during an actual monitoring session.

The duration of the training session will vary depending on the number of responsibilities given to the health workers and their previous exposure to the subject matter. Two or three full days, or several half days, should be scheduled to assure sufficient practice time and a trial in a community.

Practice in the community is essential. The trainees should have a chance to go through the entire process, from convincing local officials to support the program, through the actual growth monitoring, to presenting the results at community meetings. Every step of the practice should be accompanied by discussion about the experience and constructive comments about how the health workers can improve activities in their own communities. If possible, these different activities should be carried out on different days since this allows time to discuss what happened and to plan for the next activity. If time does not permit this schedule, an entire day in the community should be planned to complete all activities.

Suggested techniques for the different segments of a training session follow.

Explain the principle behind growth. One technique to illustrate the relation between age and growth is to show health workers pictures of healthy village children of different ages. Ask the health workers to order the pictures by the children's age and explain how they decided the age, noting that body size is one criterion. Next, to illustrate the importance of knowing both age and body size, pictures of children who are the same weight but different ages can be compared.

To demonstrate the links between growth and food intake and between growth failure and illness, the health worker can use a doll made out of a gourd or a clay pot with top and bottom openings that can be corked (126). The doll can be filled with water or objects representing the intake of breast milk or food and weighed to show that weight will be gained as more is added. Similarly, a diarrheal episode can be demonstrated by unstopping the full vessel, releasing the fluid it contains, and weighing it to show rapid weight loss.

Illustrate why measurements are recorded. Once the health workers see the relationship between increasing age and body size, and the effects of food intake and illness on growth, they can discuss monitoring growth. Again, pictures of children can be used to illustrate the importance of measuring and completing growth charts and the need to follow a child's growth over time. First, the health workers are shown a series of pictures and asked to determine if the children are healthy. Then the results of weight or height measurements are given. Some results confirm and others disagree with the health workers' estimates. The health workers can examine completed growth charts for these same children, some charts indicating children recovering from a long illness, others indicating children just beginning to get sick. These records explain why some of the health workers made incorrect estimates of the child's health status and emphasize the importance of completing growth records.

Teach health workers how to weigh and measure through practice. The sequence of steps the students will follow each time they weigh or measure should be specified clearly. (Appendix B presents a weighing and measuring protocol.) One exercise, for small classes, is to have all the health workers weigh or measure the same child or object and write down the results. The answers can be compared and the variance between results discussed in terms of commonly committed errors. (This same procedure should be continued during supervision visits, when the supervisor and health worker weigh and measure the same child, and then compare results and discuss the source of any errors (33).

Train health workers to complete the growth chart by example and practice. A great deal of training is dedicated to teaching community health workers how to complete the growth chart, especially the weight charts that have a calendar system. For the initial explanation and group exercises, an enlarged, eras-

able growth chart is useful. In one project, large weight graphs were drawn and the paper was coated with plastic. Marks could then be made on the plastic with an erasable grease pencil (50). Flannelgraphs of the Road-to-Health weight chart or transparencies for an overhead projector can be ordered from:

Teaching Aids at Low Cost (TALC)
Institute of Child Health
30 Guilford Street
London WC1N, 1EH, U.K.

The flannelgraph costs £ 4.00 (U.S. $8.32), and the transparencies sell for £ 1.20 (U.S. $2.50). Project personnel also can use their sewing skills to make a flannelgraph identical to the chart used in their program (126).

For individual exercises, health workers need cards to complete. Often it is too expensive to practice on the actual cards, but a stencil of the card can be made and reproduced on cheaper paper. Stencils of the Road-to-Health card are available from TALC for £ 1.50 (U.S. $3.12).

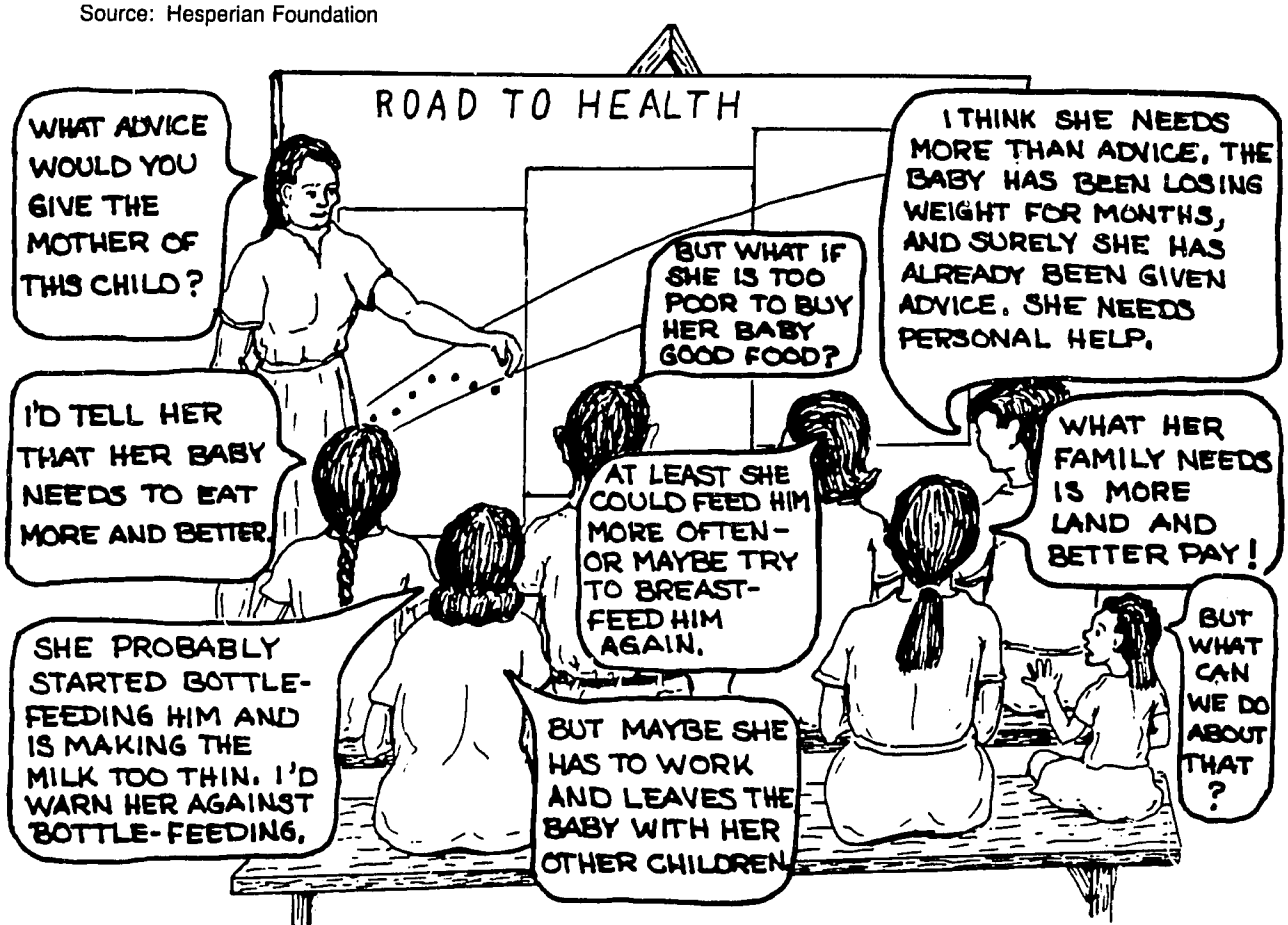
Teach health workers how to interpret the chart through example. A large growth chart or the individual samples completed by the health workers will serve this purpose. The lessons should focus not only on the child's position on the chart but also on the child's growth pattern: is the child's weight increasing, remaining constant, or decreasing? The recommendations that the health worker will give to the mother to improve her child's nutritional status depend on these observations. The two cases most often misinterpreted are: 1) the child who is within the normal range on the chart but whose growth has stopped or who is losing weight; 2) the child who is classified as undernourished on the chart, but who is gaining weight. In the first case the health worker will often believe that the child is healthy because the mark is still in the normal range on the chart, while in fact the child has a problem that needs attention. In the second case, because the child has remained in the same category on the chart, the health worker may believe that the child is in danger and may fail to reinforce positive dietary changes made by the mother that have started the child on the road to recovery.

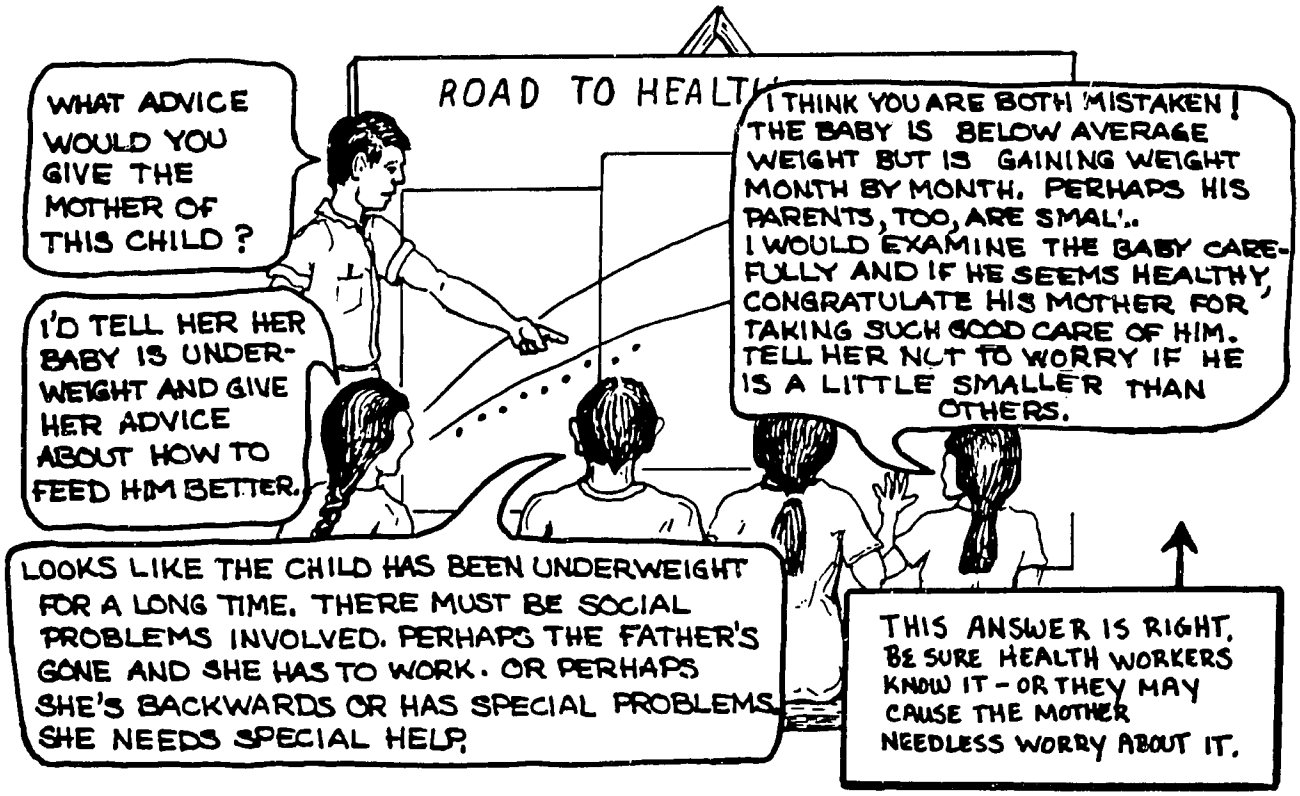
The pictures below illustrate the kind of discussion that should take place with the health workers (126).

Health workers should also be instructed to ask a few basic questions of the mother whose child has failed to grow or who has lost weight. The questions to be asked depend on the capabilities of the worker and what they have been trained to offer. Examples of questions are the following:

- Has your child been eating normally or has s(he) claimed not to be hungry?

Fig. 1. Examples of Discussions That Should Take Place During Health Worker Training
Source: Hesperian Foundation





- Have you noticed anything different in your child (cough, cold, fever, etc.)?
- Does your child currently have or has your child in the past weeks had diarrhea or vomiting?
- Have you noticed any blood, mucous, or worms in your child's stools?

Use role playing to teach communications techniques like open-ended questioning. In one-to-one role playing, health workers can practice interviewing, discussing results, and planning dietary changes with other health workers who play the role of mothers. Any visual aids used with mothers should also be tried during training. The ability of health workers to speak in front of groups or with community leaders can be greatly strengthened if they have the opportunity to practice during training.

Offer the health workers instructions and practice in completing any other forms required for monitoring activities. Do not assume that, because written instructions accompany forms, all details are always understood.

If health workers are expected to make a community chart, this should be practiced during training, preferably with the results obtained during the community visit. The community chart can be compiled during or after the monitoring session. To make the chart, the health workers place a dot representing that child's current position on the same chart for any children seen. Or the workers can make a column graph as described in Chapter IX. These charts should then be examined for dips at particular ages, general status of the community, and changes over time. The health workers should practice the same techniques of open-ended questioning with the community as they do with the mothers to engage the community in problem diagnosis and resolution based on the interpretation of the community chart.

If health workers have sufficient education, they can be trained to make further analyses of the growth data. For example, they can identify families with more than two children under age five and then compare these children's nutritional status to that of children from families with only one or two children under five. Similar comparisons could be made for such groups as immunized and unimmunized children, children whose water comes from a well or from a river.

NOTE: Reading the scale or height board and completing the record are the only parts of growth monitoring that usually require literacy. Non-literate people, however, should not be excluded from growth monitoring programs. Even non-literate workers have learned to organize monitoring sessions, interpret cards, and educate families (50, 83, 132). Family or community members and school children can be invited to training sessions to learn to complete the charts and do other written work.

CHAPTER IX

problem identification and program evaluation

Initially developed to identify individual children with health or nutrition problems, growth monitoring has become a means of identifying nutrition problems geographically and of monitoring program impact on the target population. The growth record kept in a monitoring program allows for:

- evaluation of program impact on individual children based on their exposure to the program;
- examination of program impact on communities when growth data is compared over time;
- examination and comparison of neighborhoods, communities, regions or countries according to the nutrition profiles that emerge from aggregate monitoring results.

It has been noted that having the growth data tabulated and accessible permits continued supervision and assessment; if individual growth cards had to be collected to obtain data, the assessments could only be periodic (24). Therefore, the first step in data aggregation is usually assigned to the community-level health worker—the task of making a community profile using the results obtained at each weighing session or at the end of a specific period of time. (This task can be done during supervision visits.)

Unfortunately, the reason for compiling growth results is seldom explained. Consequently, the blanks are filled on the forms and the forms returned to a distant office and never used again to help the villages in which they originated. A few programs have attempted to change this trend.

Operation Timbang in the Philippines

This mass weighing program has an effective information exchange and response system between the municipal level (the Rural Health Unit-RHU) and the village (42), despite its lengthy data aggregation system from the village to the national level. This interchange allows for immediate follow-up care to children with problems as well as for an evaluation of changes taking place within the village. After each weighing session, all growth data and village maps are submitted to the RHU, where statistics are compiled for each of the different Gomez classifications. Each child's house is marked on the village map with a colored sticker indicating the child's nutritional status. Children with poor nutritional status are visited immediately by a worker from the RHU and brought to the attention of the village nutrition committee. The RHU can also assess which villages in their area have the worst health or nutrition profile. Any village with 30 percent or more of its children in second or third degree malnutrition is eligible for outside help. The process of identifying high priority areas for nutrition interventions continues to the national level.

The National Nutrition Program in Indonesia (UPGK)

This program has focused attention on record keeping at the village level rather than on a lengthy reporting system (20). These village records are reviewed during supervisory visits by staff from the central office. In this program, health workers are

Fig. 1 ***Village Weight Roster from Indonesia***

Source: *Buku Pedoman Petugas Lapangan UPGK*, Division of Nutrition, Ministry of Health, Jakarta, Indonesia

1980 No.	Child's Name	Date of first weighing	Age at first weighing	Weight first time weighed	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Weight of the child at the end of participation in the program (36 months)
1	Lestari	5/2/79	4 mo.	5kg		B	N	N	T	N	N	N	T	N	T	T	
2	~~Kliwon~~	~~8/3/79~~	~~30 mo.~~	~~11.2kg~~			~~B~~	~~N~~	~~T~~	~~N~~	~~N~~	~~T~~					~~12kg~~
3	~~Rawit~~	~~7/5/79~~	~~5 mo.~~	~~5kg~~					~~B~~	~~T~~	~~N~~	~~N~~	~~N~~				~~moved~~
4	Ribut	7/5/79	16 mo.	9kg					B	T	–	O	N	T	N	O	
All Children Increasing Weight							1	2	0	2	3	2	2	1	1		
All Children Decreasing Weight									2	2	0	1	1	1	1	1	
All Children Attending						1	2	2	4	4	3	4	2	2	2	2	
All Children under 3 yrs. in village																	

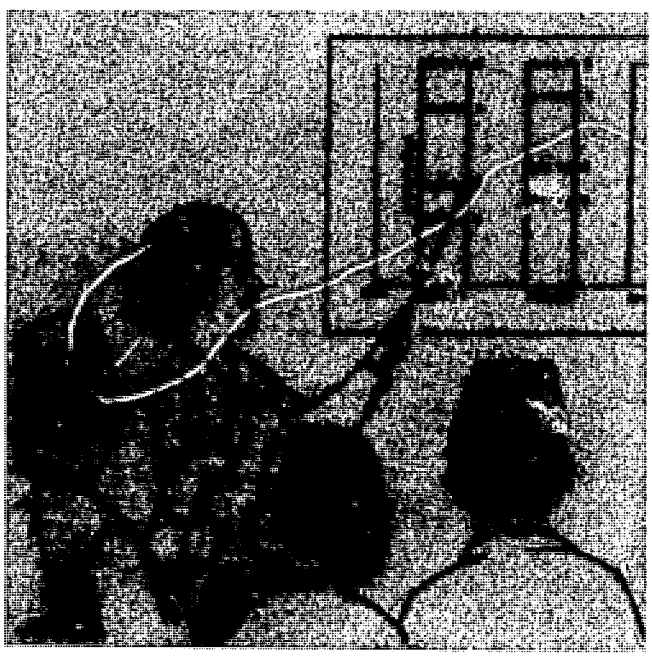
Key: B = New Child N = Increased Weight T = Decreased Weight O = No change

encouraged to keep a roster during the weighing session in addition to maintaining the individual weight cards. An example of the roster is presented in Fig. 1. Unlike many, this roster does not record the actual weight of the child each month on the area of the chart in which the child falls, but rather whether the child has gained weight, stayed the same, or lost weight. At the bottom of each roster a tally is made of the number of children seen and the number who have gained weight, stayed the same, or lost weight.

The health workers in the UPGK program are also encouraged to compile a community graph (Fig. 2) for use by the community in decision making. In this graph a column based on the roster is drawn for each month's weighing session. The top of the column (Line S) represents all of the children under three years of age in the community. The level of Line K represents the number of children who have growth charts because they attended at least one weighing session. Line D is determined by the number of children who attended the session that month, and Line N by the number of children whose weight increased between weighings.

Fig. 2. Community Nutrition Profile Compiled at the Village Level in Indonesia

Source: *Buku Pedoman Petugas Lapangan UPGK*, Division of Nutrition, Ministry of Health, Jakarta, Indonesia



This column graph allows each village to measure progress clearly toward the goal of 100 percent participation in the growth monitoring and weight gains each month for all children.

Projects more concerned with changes in nutritional status than in weight gain can utilize a similar roster and column chart. For example, in Morocco a roster maintained in the health center is marked with P, N, or S, indicating whether the child has above normal (P), normal (N), or subnormal (S) nutritional status. During monthly supervision by an auxiliary nurse, the totals for each nutritional rank are calculated and discussed with health center personnel. This roster proved extremely valuable to a team of evaluators who were assessing the nutritional impact of a nutrition education and food supplementation program (2).

When statistics are based on nutritional status, a column graph similar to the one used in Indonesia can be made to show the growth monitoring results to the community. In each column the top line would represent the total number of children; the K line would show the number of children measured; a line beneath K would represent the number of children who were of normal weight. Each month the number of normal weight children can be compared.

Using either of these two "column" systems, percentages of children in attendance or of those well nourished can be calculated. If percentage calculations are too complicated for the village workers, they can be done by supervisors. Data stated as percentages are often more meaningful than absolute numbers (11), especially for growth monitoring programs where the number of children weighed does not remain constant from month to month.

The Catholic Relief Services System

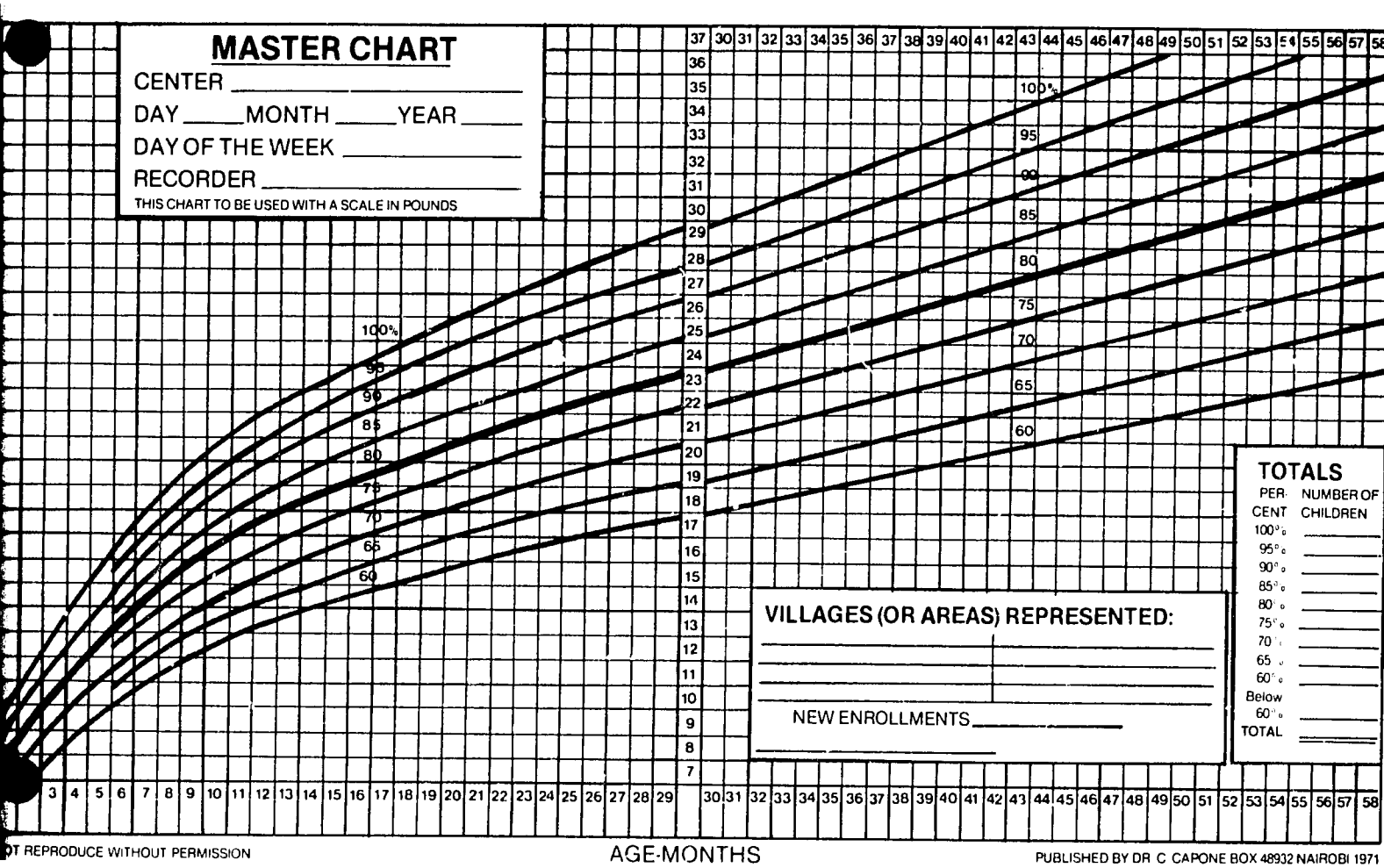
The system designed and used by Catholic Relief Services (CRS) in Africa puts data in a form that is useful both to the community and to program planners and supervisors (74, 127). As children are weighed throughout the month, their weight is first plotted on the Master Chart (Fig. 3). The result (the percent area in which the child falls) is then transferred to an individual chart that the mother keeps (See Fig. 9, Chapter IV). At the end of the weighing period (usually one month) each child is represented on the Master Chart, making a composite growth chart for the community. A comparison of monthly Master Charts yields both cross sectional and longitudinal pictures of the community.

The Master Chart is kept in the clinic until the food distribution has been finished and the children weighed. The health worker then completes the summary box in the lower right corner and sends the chart to the CRS office. There the following is quickly determined (24):

- number of children attending the weighing session;
- age composition of those attending;
- gross errors by the health worker in weighing or recording;
- comparisons of one community with another at a given time; and
- comparisons within the community over time (regularity of attendance, long-term upward or downward trends in nutritional status).

Figure 3. Master Chart for Growth Surveillance System—CRS/Africa

Source: Catholic Relief Services, Africa Regional Office, Nairobi, Kenya



A summary report is returned to the clinic with the following:

- the total number of children attending for the month;
- the number and percentage of undernourished children;
- the number and percentage of children in each percentage of the median range using the Boston reference population (100-91, 90-86, 85-81, 80-76, 75-71, 70-65, and 65 and below);
- change occurring over time in the community;
- other highlights.

This system deserves further consideration because of its relative simplicity and graphic presentation of the results of a month's weighing, which allows for easy interpretation in the clinic and more sophisticated interpretation at other levels. Currently the system is not being used to its full potential in the clinic and community. The individual record goes home with the mother, the only copy of the Master Chart is sent to the CRS office, and the returned summary is unlikely to be shared with program participants. Enlarging the Master Chart and keeping a copy in the community would show participants their community profile, or a column graph could be drawn each month when the summary report is returned from the regional office.

The information obtained through growth monitoring is too valuable not to be used in the planning, programming, and evaluation stages of the program. Although it is often time consuming, it is worth taking the next step after individual monitoring to aggregate the results and make a village or area profile.

The community profile is invaluable in helping community members identify, solve, and prevent problems. However, the data must be carefully examined and explained. A contaminated well or an increase in diarrhea might be discovered because of the high numbers of malnourished children in a neighborhood. The community and their health workers can take pride in seeing the statistics change because of their work. Compiling monitoring results and presenting them to communities can go a long way toward achieving community action, improved health, and the ultimate goal, self-reliance.

Photo: WHO/7035 by P. Almasy

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APPENDIX A:

growth monitoring tools

Arm Circumference Tapes

Instructions for making and using tricolored arm bands are available with samples from:
Teaching Aides at Low Cost
Institute of Child Health
30 Guilford Street
London WC1N 1EH, U.K.

Voluntary Health Association of India
C-14 C. Centre
S.D.A.
New Delhi 110016, India

Scales

A. Locally Manufactured (9)

The designs and procedures for making scales are available from:
Appropriate Health Resources and Technologies Action Group
85 Marylebone High Street
London W1M 3DE, U.K.

Another group with such experience:
Hesperian Foundation
P.O. Box 1692
Palo Alto, California 94302, U.S.A.

B. Commercially Manufactured

1. Single Beam Scales for Clinics

Description:
A wide variety of clinic scales are manufactured, each slightly different. Therefore, it is suggested that one write directly to the distributor for details.
Cost:
The table top model for weighing small children usually costs between U.S. $100-$150 although Detecto, CMS and UNICEF have models for less. The pillar models on which older children can stand cost a minimum of U.S. $125.00.
Write to:
Detecto Scales, Inc. Detecto International
103-00 Foster Avenue
Brooklyn, New York 11236 U.S.A.
or:
CMS Weighing Equipment, Ltd.
18 Camden High Street
London, NW1 OJH, U.K.
or:
Salter Industrial Measurement, Ltd.
George Street
West Bromwich, Staffs, U.K.

2. Single Beam or Bar Scales

The Philippine Bar Scale (41)
Description:
- This is a hanging bar available in 10, 25, and 50 kg. capacity.
- It is manufactured in the Philippines and is a type of scale with which these health workers are already familiar.
- It is made of iron and is heavier than many (scale alone weighs slightly more than 3 kgs.).
- The weight that slides on the bar often sticks.
- The scale cannot be tared.*

*Tare: the deduction of weight made in allowance for a weight hung on the scale. For example, if a basket is used to hold the child, the basket can be placed on the scale and the scale tared to read "0".

Cost:
U.S. $14.50 (10 kg.); U.S. $18.20 (25 kg.); U.S. $22.60 (50 kg.).
Write to:
Dr. Rodolfo Florentino
Deputy Executive Director
Nutrition Center of the Philippines
MCC P.O. Box 653
Makati, Metro Manila, Philippines

Kumudini Bar Scale (67)
Adaptation of the 25 kg. Philippine scale to a Bangladesh project.
Description:
The same as the Philippine scale except that units of measure are local—*seer* and *chattak*.
Cost:
U.S. $20-$25
Write to:
Mrs. Pati
Kumudini Welfare Trust
Naryanganj, Bangladesh

Chinese Wood Scale (84)
Description:
- The capacity of this scale is 30 kgs. in 100 gm. graduations.
- It is manufactured in Thailand from wood and is lighter than many (scale weighs 2 kgs.).
- Since numbers are etched in wood they may be difficult to read over time.

Cost:
U.S. $25.00 (comes with two harnesses for suspending the child).
Write to:
Nutrition Division
Ministry of Public Health
Bangkok, Thailand

Tansi Bar Scale (49, 75)
Description:
- Light weight metal scale (scale, basket, and weights weigh 2.4 kg.).
- The bar is short; however, it is not a direct reading scale. The bar only has a capacity to weigh 10 kg. If the child weighs more than 10 kg., a 10 kg. weight must be added on the bar. The health worker, then, must remember to add 10 to the number indicated on the bar.
- The scale is made in India.
- It can be tared.
- Enumeration is clear.
- Capacity is 20 kg. (this may not be sufficient if 6 and 7-year-olds are in the program).

Cost:
200 Indian Rupees (U.S. $25.00). Allow three months from date of order for delivery.
Write to:
K. Loganathan
General Superintendent
Tansi Tool Room
Tamil Nadu Small Industries Corp. Ltd.
Industrial Estate, Guindy
Madras 600-032, Tamil Nadu, India

Detecto "Machete" Model (59)

Detecto is in the process of developing a bar scale for use in growth monitoring programs. They have produced a model that is being field tested in Indonesia. Detecto anticipates having a scale ready to market in late 1981.

Write to:
Sam Jacobs
Export Division
Detecto Scales, Inc.
103-00 Foster Avenue
Brooklyn, New York 11236, U.S.A.

3. Dial Spring Scales

ITAC Model 800 (78, 116)

Description:
- Light weight in durable metal case with unbreakable plastic face.
- Case painted with enamel, which may chip and expose metal.
- Easy to read; large numbers mark five kilogram increments and small numbers mark every kilogram with lines at every 100 grams (not available in pounds).
- Capacity 25 kgs. in 100 gm. divisions.
- Scale can be tared although taring screw in tongue of scale is not as easy to adjust as that of the Salter Scale.
- Scale manufactured in United States.

Note: This is a new scale with limited field tests. Use over short period has shown no problems.

Price/Orders:
U.S. $50. Price includes two weighing pants and carrying bar, FOB*, sturdy export packing extra at cost. A discount is available for large orders.

Write to:
ITAC Corporation
P.O. Box 1742
Silver Spring, MD 20902, U.S.A.

CMS Model 235 PBW (78, 85)

Description:
- Light weight in durable stainless steel case, with unbreakable plastic cover.
- Easy to read, although ITAC scale is clearer.
- Capacity 25 kgs. in 100 gm. divisions.
- Scale can be tared. Screw in middle of scale's top; although not difficult, it is not as easy to use as the Salter taring screw.
- Has proven to be extremely durable under rough treatment.
- Manufactured in England.

Price/Orders:
£21 or U.S. $40 FOB. Orders can be filled immediately from London stock. The cost is for weighing pack that includes the scale, a shoulder bag, and five baby-weighing trousers. A discount is available for large orders.

Write to:
CMS Weighing Equipment, Ltd.
18 Camden High School
London NW1 OJH, U.K.

Salter Model 235 (78)

Description:
- Light weight in durable non-rust metal case with an unbreakable plastic face.
- Easy to read although ITAC scale is clearer.
- Face available in pounds or kilograms. (Not recommended to get both on one face.) The kilogram face can be marked in either 100 or 500 gm. divisions.
- Capacity 25 kgs. or 56 lbs.
- Scale can be tared without difficulty.
- Scale has been well tested and modified to improve performance.
- Manufactured in England.

Price/Orders:
£23.80 or U.S. $46.00 FOB.
The price includes five pair of weighing trousers. Allow 12 weeks for delivery. A discount is available for orders of more than 500. This scale is also available at a reduced cost from United Nations/UNIPAK for affiliated programs.

Write to:
Salter Industrial Measurement, Ltd.
George Street, West Bromwich
West Midlands, B70 6AD, U.K.

Marsden Weighing Machine Group Ltd.
388 Harrow Road
London WG 2HU, England also distributes these scales. However, delays in delivery have been reported.

4. Tubular Spring Scales

Chatillon IN-50

Description:
- Small, extremely light weight, made of non-corrosive brass.
- Capacity in 25 kgs. or 50 lbs.
- Difficult to read; the marker is hard to distinguish and the scale is marked in both kilograms (250 gm. intervals) and pounds (8 ounce intervals).
- Scale can be tared.
- Manufactured in the United States.

Price/Orders:
U.S. $37, FOB. Discounts of 25-30 percent are available for large orders.

Write to:
John Chatillon and Sons
83-30 Kew Gardens Road
Kew Gardens, New York 11415, U.S.A.

AHRTAG or Super Samson

Description:
- Extremely light weight—made of durable plastic.
- Marked only in kilograms.
- Difficult to read because of small space between numbers.
- Capacity 20 kgs.
- Scale can be tared.
- Manufactured in England.

Note: This scale is new and is now undergoing extensive field testing.

Price/Orders:
£5.20 (U.S. $10) for 20 kg. scale alone. If ordered in a package with a nylon sling, tape measure, and carrying case, the total price is £12.15 (U.S. $24.00). Discounts up to 33 percent for large orders.

Write to:
Rasmussen, Webb and Company
First Floor
12/16 Laystall Street
London EC1R 4UB, U.K.

Or the Super Samson Weighing Kit is available:

Price/Orders:
£7.90 (U.S. $15.00) for 15 or 20 kg. scale, baby sling and measuring tape.

Write to:
Salter Industrial Measurement, Ltd.
George Street
West Bromwich
West Midlands, B70 6AD, U.K.

III. Length/Height Boards

(Many models exist. Those mentioned below are widely used and readily available.)

A. Microtoise Height Measure

Description:

*FOB = Freight on board

- Light and portable.
- Measures 0-2 meters in 1 mm graduations.
- Can be suspended from a wall or door frame or run along a table.

Cost:
£7.00 (U.S. $14.50).

B. Harpenden Infant Measuring Table
Cost:
£18.5 (U.S. $39.00).

For A and B write to:
CMS Weighing Equipment, Ltd.
Camden High School
London NW1 OJH, U.K.

IV. Weight-for-Height Wall Chart—"Thinness Measure" (120)

As described in Chapter V.
Price/Orders:
£1.50 (U.S. $3.12) plus postage and packing, includes the chart, a family record (see Fig. 13, Chapter V) and an instruction booklet. Orders under £4.00, please add £1.00. Orders over £4.00 add 25 percent.

Write to:
Teaching Aids at Low Cost
15 Park Avenue
St. Albans, Herts AL1 4PB, U.K.

Photo: WHO/7653 by P. Boucas

Photo: WHO/5652

APPENDIX B

protocol for weighing and measuring

To facilitate accurate measurement and to minimize confusion at monitoring sessions, a protocol (step-by-step guide) for weighing and measuring should be prepared and adhered to during the training of health workers. The protocol should be discussed and practiced to ensure that each technique as well as the rationale for the process are clear.

In compiling the protocols for each anthropometric measure the following sources were used:

1) *Weighing and Measuring Children: A Training Manual for Supervisory Personnel* (26);

2) "Anthropometric Field Methods: General," in *Nutrition and Growth* (137);

3) *The Assessment of the Nutritional Status of the Community* (61).

Weighing

1. Check the equipment:

- Is the scale in working order? Before each weighing session, standardize the scale. To do this, weigh an object of a known weight. The scale should register the correct amount each time.
- Is the apparatus to suspend or hold the child in poor condition (pants ripped, chair broken)?
- Is there an adequate structure for suspending the scale (good rope, a hook, beam, or tree limb)?

2. Position the scale at eye level so that the numbers can be easily read. Be sure that the child cannot hold onto the wall while on the scale and that even the largest child, if suspended, cannot touch the ground.

3. *Tare* the scale (bring the needle to zero or balance the scale). Most scales have an adjustable screw or small weight for this purpose. It is best to place the pan, pants, basket or whatever will hold the child on the scale and then tare the scale so the health worker will not need to subtract this weight from the weight of each child.

4. Ask the mother to remove all heavy objects (amulets, shoes, thick jackets) from the child. If it is impossible to remove the objects or clothing for cultural reasons or because the environment is too cold, weigh an equivalent amount of clothing and subtract its weight from the child's weight. If this procedure is impractical, note on the card that the weight of the child includes a heavy jacket, etc.

5. Ask the mother to stay with her child. Help her place the child on the scale. Wait until the scale is steady or the needle has stopped swinging to read the weight. If the needle is fluctuating slightly, estimate the midpoint of the swing, and use this number as the weight.

To balance a beam scale, move the weight away from the zero position until the indicator shows that too much weight has been added. Then bring the weight back toward zero until the indicator shows that *slightly* too much weight has been removed. Make the fine adjustment by either moving the light weight or gently tapping the larger weight until the scale is balanced.

6. Read the scale. If the child is weighed frequently (more than once per month) and/or the recording chart has sufficient spaces, read the weight to the nearest 100 gm. or quarter pound. If the child is weighed once a month or less frequently, read the weight to the nearest 250 gm. or half pound.

Length/Height

ALWAYS HAVE TWO PEOPLE AVAILABLE TO MEASURE (one can be the mother). Measure the recumbent (lying down) *length* of all children less than two years of age.

1. Check the measuring board to be sure it is in working order. The numbers should be easy to read and the moveable block sturdy, forming a right angle with the backboard.

2. Put the board on a flat, firm surface. It is easiest to take the measurement if the board is placed on a table top.

3. Ask the mother to help measure the child. Ask her to remove any shoes or hat from the child.

4. Ask the mother to position the child on the board. The child should be lying, back down, in the center of the board with shoulders and buttocks flat and the crown of the head against the fixed end of the board.

5. Ask the mother to help hold the child. She can stand or kneel at the head or to one side of the board, keeping the child centered and the head in position.

6. Check to be sure the child is completely extended. Place the left elbow and arm on top of the child's knees and grasp the child's ankles, holding the feet perpendicular to the headboard.

7. Use the right hand to slide the moveable block to meet the child's heels. Press down on the child's knees and press the block against the feet.

8. Read the measure to the nearest ½ cm. or ⅛ inch.

Measure the *height* (standing) of all children two years and older.

1. Check the measuring board to be sure it is in working order. The numbers should be easy to read and the moveable headboard sturdy, forming a right angle with the backboard.

2. Place the bottom of the board on a flat, hard surface and the back of the board against an upright structure (door frame or wall). The measuring board stands vertically.

3. Ask the mother to help measure the child. Ask her to remove any shoes and headgear.

4. Ask the mother to help the child stand correctly at the board. The child should stand:

- in the center of the board with feet flat and slightly apart.
- with knees fully extended and arms at the side.
- with the back of the heels, calves, buttocks and shoulders touching the back of the board (or the wall if no board is used).

- with eyes looking straight ahead.

5. Ask the mother to hold the child in position while the moveable headboard is brought down to rest firmly on the crown of the child's head (be sure it touches the top of the head and not just the hair).

6. Read the measurement to the nearest ½ cm. or ⅛ inch.

Mid-Upper Arm Circumference

1. Ask the mother to help measure the child's arm. Ask her to sit comfortably and either hold the child in her lap or have her child stand by her.

2. Sit or kneel at the left side of the child.

3. Ask the mother to bare the child's left arm and shoulder. This may require removing the child's shirt.

4. Find the mid-point of the child's arm. Place the end of the tape at the top of the shoulder (where the arm appears to connect with the shoulder) and measure to the elbow tip. Take half of this distance by folding the measuring tape in half, bringing the point on the tape at the tip of the elbow even with the tape end on the shoulder. Where the tape folds in half make a small mark with a pen on the child's arm.

5. Straighten the child's arm so that it is relaxed and hanging loosely. (For children under 6 months, ask the mother to hold the child's arm still and away from the body.)

6. Loop the tape around the child's left arm at the mid-point mark. Level the tape and pull it until it gently touches the skin all the way around the arm. NOTE: The tape should not be pulled so tight that any of the soft tissue is compressed, a common error in measuring arm circumference.

7. Read the tape, noting the color or the number to the nearest ½ cm. or ⅛ inch.

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