

AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT
CLASSI-
FICATION

A. PRIMARY
Public Health
B. SECONDARY
Nutrition

2. TITLE AND SUBTITLE

Use of Growth Charts for Assessing Progress of Children and Teaching of Parents

3. AUTHOR(S)

(101) Agency for International Development; U.S. Department of Health,
Education and Welfare

4. DOCUMENT DATE

1971

5. NUMBER OF PAGES

24 p.

6. ARC NUMBER

ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS

U.S. Department of Health, Education and Welfare, Maternal and Child Health,
Washington, D.C. 20201

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publisher, Availability)

Free copies in English and French available: Agency for International Development
Office of Nutrition, Technical Assistance Bureau, Room 116 SA-2, Washington, D.C.
20523

9. ABSTRACT

This conference report summarizes a conference on this subject held in May, 1971. It discusses the design, functioning, and evaluation of growth surveillance systems useful for the following purposes: to provide an integrated health record of the child; to screen for high-risk cases, to educate the family about the growth of its child, to assess the effect of individual treatment, to evaluate the effect of applied nutrition programs, and to appraise the trends in the nutritional status of populations undergoing socioeconomic changes. The conference participants reviewed reports from various settings around the world, primarily in developing countries, on the use of growth charts for assessing the growth and health of children. Suggestions were made for the design of a simple longitudinal weight chart for use primarily by auxiliary workers for educational purposes in unsophisticated settings. Additional items to be incorporated into such charts as teaching materials were proposed. Emphasis was on the use of charts as part of a growth surveillance system. Discussions stressed the need for continuing evaluation of the charts themselves, their use, and their effectiveness in improving child health. The seven general recommendations, applicable primarily to developing countries, were as follows: 1) Growth charts incorporating weight measurements and health information should be used by all levels of workers in health and nutrition-related fields. 2) The deliberations of the conference should be widely disseminated to all relevant pediatric, nutrition, and public health workers. 3) Existing information concerning types of growth charts, educational material on their use, and evaluation of their effectiveness should be compiled and kept in one location, under international auspices. 4) Consideration should be given to preparation of a general brochure on the usefulness of growth charts. 5) A trainer's kit should be prepared, including a booklet covering the principles of growth charts and general aspects of their practical use.

10. CONTROL NUMBER

PN-AAC-206 - in English; PN-AAC-609 - in French

11. PRICE OF DOCUMENT

12. DESCRIPTORS

13. PROJECT NUMBER

14. CONTRACT NUMBER

RSSA HEW/MCHS 12-74 GTS

15. TYPE OF DOCUMENT

PN-AAC-206; PN-AAC-609 continued

6) Methods should be devised for conducting ongoing evaluations of the usefulness and practical effectiveness of growth charts as educational tools in different parts of the world. 7) Pilot projects using appropriately adapted growth charts should be initiated, both in less developed areas and in selected industrialized urban regions, including the USA. After an adequate trial period, research utilization conferences, based on the "share and compare" philosophy, should be held to assess the effectiveness of different forms of growth charts in various ecologies. This conference report also include 150-word abstracts of 12 papers on growth charts and their uses in various parts of the world. Authors are David Morley, William A. M. Cutting, Franz Pardo, Frank Falkner, Derrick B. Jelliffe, and E. F. Patrice Jellife, Carlo C. Capone, Lourdes Sumabat, Evelyn B. Wilson, George Cunningham, Ann Taole, Cecile De Sweemer and C. E. Taylor, and Nicholas Cunningham.

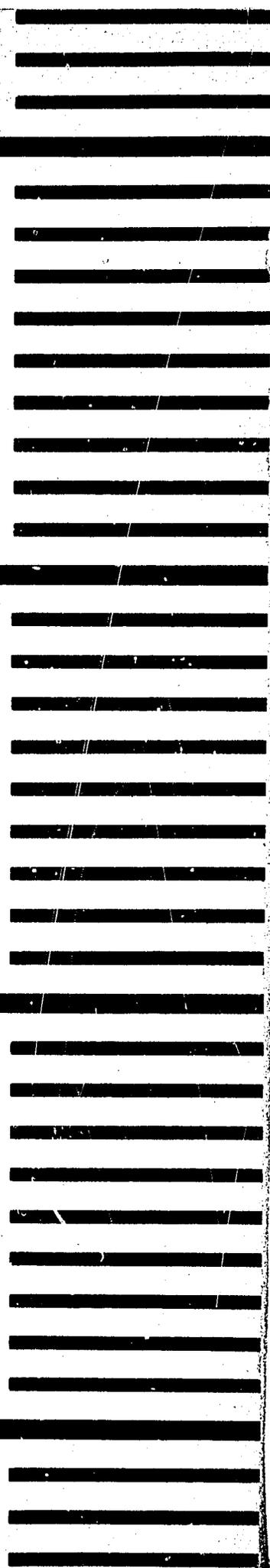
PN-AAC-206

Conference Report

Use of Growth Charts for Assessing Progress of Children and Teaching of Parents

Office of Nutrition
Technical Assistance Bureau
Agency for International Development
Washington, D.C. 20523

2030450



**USE OF GROWTH CHARTS
FOR ASSESSING PROGRESS OF CHILDREN
AND TEACHING OF PARENTS**

Conference Report

**May 10-12, 1971
Urban Life Center
Columbia, Md.**

**Sponsored by
U.S. Department of State
Agency for International Development
Technical Assistance Bureau
Office of Nutrition**

- and -

**U.S. Department of Health, Education, and Welfare
Public Health Service
Health Services and Mental Health Administration
Maternal and Child Health Service**

Supported in part by Grant No. MCR-390050 from Maternal and Child Health Service.

CONTENTS

	<i>Page</i>
Introduction	1
Design of Growth Surveillance System	2
Weighing Devices	2
Reliability of Measurements and Charting	2
Design of Growth Charts	3
Functioning of Growth Surveillance System	5
Settings	5
Screening by Means of Growth Charts	6
Growth Charts as an Educational Tool	7
Evaluation of Growth Surveillance System	10
Evaluation of the Charts	10
Evaluation of the Use of the Charts	11
Evaluation of the Results from Use of the Charts	11
Summary and Recommendations	12
Abstracts:	
The Road-to-Health Chart, David Morley	13
Growth Charts—Experience and Emphasis in Asia, William A. M. Cutting	13
Graphic Methods Used in Latin America to Record Physical Growth, Franz Pardo	14
Growth Charts Used in the United States—An Appraisal and Critique, Frank Falkner	14
An Assessment of Weighing Devices for the Evaluation of Nutritional Status of Young Children in Less Developed Areas, Derrick B. Jelliffe and E. F. Patrice Jelliffe	15
Use of Charts in Different Settings: "Under 5" Clinics, Carlo C. Capone	16
Use of Growth Charts in Mothercraft Centers and Schools in the Philippines, Lourdes Sumabat	16
Use of the Growth Chart in Comprehensive Health Programs for Children and Youth, Evelyn B. Wilson	17
Use of the Charts in Maternal and Child Health Programs, George Cunningham	17
Education of Health Personnel, Ann Taole	17
Use of Growth Charts in Teaching Family Health Workers, Cecile De Sweemer and C. E. Taylor	18
Preliminary Report on the Evaluation of Weight Chart Use in Nigeria, Nicholas Cunningham	18

INTRODUCTION

On May 10-12, 1971, at the Urban Life Center, Columbia, Maryland, U.S.A., a conference on the Use of Growth Charts for the Assessment of Progress of Individual Children and for the Teaching of Parents was convened under the cooperative sponsorship of the Office of Nutrition, Technical Assistance Bureau, U.S. Agency for International Development, and the Maternal and Child Health Service of the U.S. Department of Health, Education, and Welfare.

The rationale for this conference was the undeniably universal problem of malnutrition. Protein-calorie malnutrition and its interaction with infection is the most important pediatric problem in developing countries. Many authorities believe that such malnutrition is both directly and indirectly responsible for the high morbidity and mortality of infants and children in these countries and—although there are differences in the nature and the degree of the malnutrition-infection problem—even in such developed nations as the United States share in it. Therefore, the assessment of the nutritional status of children is most significant.

Assessment can be based either on overt clinical signs of protein calorie malnutrition or on anthropometric indices. By its very nature, a clinical appraisal is expensive and gives an incomplete account of the extent and the gradations of the problem within a population. On the other hand, anthropometric indices are relatively inexpensive; their use as a tool in programs concerned with improving the health and nutrition of young children has grown considerably in all regions of the world.

A variety of growth charts have been developed for the following purposes: to provide an integrated health record of the child, to screen for high risk cases, to educate the family about the growth of its child, to assess the effect of individual treatment, to evaluate the effect of applied nutrition programs, and to appraise the trends in the nutritional status of populations undergoing socio-economic changes. Physical growth is an important indicator of nutritional status and is significantly related to the health status of the child. Clinical evidence supports this assumption. Furthermore, infection and activity are known to influence growth through the mediation of nutritional status.

Because the experiences with growth charts and the feedback from workers in the field indicated a potential benefit from an indepth discussion, the sponsors brought together experts concerned with the practical aspects of the growth chart as an educational tool. The conference has four specific objectives:

1. To review experience in the use of growth charts in child health.
2. To suggest improvements in growth charts and explore their potential in child health services.
3. To plan for an evaluation of their effectiveness as a program tool in improving health of the young child.
4. To make recommendations on the use of growth charts to the Office of Nutrition, Agency for International Development, and the Maternal and Child Health Service. (In 1973 this service was incorporated into the Bureau of Community Health Services, Health Services Administration.)

DESIGN OF GROWTH SURVEILLANCE SYSTEM

The rationale for growth surveillance rests on the observations that rapid growth is maintained during early childhood and that growth failure is one of the earliest indications of protein-calorie malnutrition and other important pediatric diseases.

Height or length and weight are the most valuable anthropometric indices to child health clinics. Height best reflects the history of the child because it is stable and is not influenced by recent disturbances. Weight reflects both past and present status of the child although its interpretation may be ambiguous unless the child has been followed longitudinally.

The field conditions in developing countries allow weight to be measured far more easily and accurately than height, which is difficult to obtain with reasonable accuracy in children under the age of 3 years. Under these conditions, weight is the index of choice for routine growth surveillance in areas with a significant level of malnutrition. The use of both weight and height should be considered on a regular basis in well-staffed clinics or as a part of a cross sectional screening.

Growth surveillance through longitudinal weight measurements requires attention to weighing devices (scales), reliability of measurements, and functional design of growth charts.

Weighing Devices

Dr. D. B. Jelliffe and E. F. Jelliffe of the Caribbean Food and Nutrition Institute in Jamaica conducted a survey of workers in 52 countries to identify characteristics of weighing devices suitable for health clinics in developing countries. Workers agreed on the following criteria: low cost, accuracy to a level of 100 grams or 1/4 pound, sturdiness, portability, readability, convenient and safe weighing surfaces, realistic weight ranges, simplicity of operation and repair, ease of calibration, and nonfrightening appearance.

Reliability of Measurements and Charting

Auxiliary health workers seem to be the logical staff members to make the actual measurements for growth surveillance. Reliability of weight measurement by physicians is initially high, but it declines as they lose interest. Reliability of measurement by auxiliaries is initially low, but it increases with training. When good supervision is provided, auxiliaries maintain a relatively constant level of reliability.

A health clinic or program needs to incorporate the following points to reach an acceptable degree of reliability for effective growth surveillance.

Provisions for maintenance and repair of scales. With proper maintenance, scales can continue to be used for longer periods. Worn out or damaged scales should not be used. Where scales are provided on a wide basis, as for example by UNICEF, the agency providing them should be encouraged to arrange for maintenance and spare parts.

Proper training of personnel. Training of auxiliary health workers in the use of scales and other weighing devices should be detailed and intensive. It should include instructions in the care, calibration, maintenance, packing, and testing of the device. Supervisory personnel also need to be trained and encouraged to test scales periodically. The training program should be evaluated for effectiveness.

A standardized weighing technique. Standardization of the actual process of weight measurement has been found to be feasible. The instructions should include the units to be used in weighing (kilograms or pounds) and the frequency of testing and calibration of the scales, depending on the type of device and where it is to be used. The technique should provide for nude weighing or appropriate minimum garments whenever possible and the use of a deduction from the gross weight (tares) to compensate for diapers, garments, cord clamps, amulets, or jewelry not removable from the child.

Accurate recording on the weight chart. This requires clarity of divisions and calibrations on the chart, preferably 100 grams or 1/4 pound. An advantage of the divided chart is that the weight calibrations can be repeated for each year, thereby reducing the likelihood of error.

A reliable method of determining the age of the children. Early registration of infants and young children helps to minimize errors in recording age. Birth documents, comparison of birth months to those of other children of known age, local calendars, and number of teeth are useful in decreasing order of reliability. When necessary, fictitious birth months may be temporarily assigned and should be so labeled. This permits subsequent plotting of the growth curve.

Additional notes on the weight chart. Notes are necessary to explain special reasons for sudden changes in weight—such as oedema, dehydration, ascites, or amputations—as distinguished from weighing and charting errors.

Design of Growth Charts

A variety of growth charts have been developed and are in use throughout the world for the assessment of growth and health of children. These charts vary as to complexity, the scientific basis and standards of reference used for their development, the type of program in which they are used, the purpose for which they are used, the educational level of the staff using them, the availability of sufficient staff, and the level of development of the country in which they are used.

The functional design of growth charts lead to different designs for different purposes. Charts for growth surveys and research projects must be responsive to much more complex objectives than charts used for routine individual growth surveillance. Growth charts can be used for the following purposes:

1. Growth surveillance to promote health and provide ongoing screening for individual care.
2. Clinical use to follow impact of infections or intervention.
3. Nutrition education of staff and parents.
4. An integrated record assuring continuity of service.

Charts that are used for growth surveillance by auxiliaries and for continuing health education of the parents must be carefully designed. Experience from a number of areas suggests that the following features of the growth chart are desirable:

1. The chart should be simple.
2. The chart should be durable enough to last through at least 5 years in the keeping of the child's mother. The durability of the card is dependent on the quality of the cardboard used. Providing a strong, well-fitting plastic envelope with the card seems essential to its 5-year use.

3. The chart should provide space to record the child's age in calendar months for each weight measurement.
4. The chart should be marked in kilograms or in pounds, according to the weighing unit normally used in the area.
5. The chart should be designed to be used in association with weighing machines accurate to 100 grams or 1/4 pound.
6. The face of the chart should allow space under the relevant month to record major events, (such as illness, end of breast feeding, birth of sibling, or supplementary feeding).
7. The chart should show only two reference lines. The position of a point relative to these lines is of less significance than the progress shown by repeated measurements. For international comparisons, it might be advisable to use the same two reference lines throughout the world. However, the conference participants did not designate reference lines that could be construed as standards because standards of optimal growth are essentially unavailable and would require minute evaluation in each homogeneously defined area of the world. It was not considered feasible to set such standards, even for the United States. The choice of the two reference lines should be based on several considerations. In developed countries the lines would be chosen to detect even mild malnutrition and overnutrition, while in developing countries the major focus would be on detecting more severe degrees of malnutrition. Conference participants suggested that the choice of the two reference lines for growth charts be made from the following measuring points, according to area needs:

- 120 percent of the Boston median (equivalent to the 97th Boston percentile).
- 100 percent of the Boston median (50th Boston percentile).
- 90 percent of the Boston median.
- 80 percent of the Boston median (roughly equivalent to the 3rd Boston percentile).
- 60 percent of the Boston median (useful because below this, the B.M.R. drops substantially).

The chart should also include:

1. Information about the child's family, including the number of pregnancies, the family size, birth interval, the number and health status of siblings, and his position in the family.
2. Records of immunizations and malarial suppression where necessary.
3. Clearly marked indications of situations leading to high risk.
4. Where acceptable, a record of parents' attitude and practice toward family planning.
5. Messages about child feeding, including simple dietary principles stressing the continuation of breast feeding, utilizing available high protein foods, maintaining feeding during illness, etc. The messages should be adapted to the local culture and deal with predominant problems of malnutrition.

The chart can be used to introduce a new sophistication to family planning. Data from all available charts shows the average birth interval in a specific community. This is calculated in centiles, and the duration of pregnancy (9 months) is subtracted from the birth interval 5th centile, to give the "vulnerable"

month. This is the month by which 5 percent of mothers will conceive again. Health workers caring for the child will discuss birth spacing with the mother and record both her own and her husband's attitude. The objective is to provide family planning in the postnatal period before the vulnerable month.

When introduced on the weight chart, family planning will be associated with birth spacing rather than family size. It will probably be more acceptable at a clinic where the mother is coming for help than in a setting where the mother is approached by strangers.

Space should be used effectively. Color patterns which are expensive to print, may be confusing and culturally undesirable. Pejorative or potentially alarming terminology should be omitted from the chart. The general consensus of the participants was that advertising of infant foods and other commercial products should be avoided.

Experiences with charts in appraisal and followup programs have been largely limited to those based on Morley's road-to-health and the Gomez classification. Charts to be used in programs in developing countries should probably be of the road-to-health type. Charts based on the Gomez classification have been most extensively used in South America and the Philippines. Although useful for screening, the multiple growth curves on the Gomez-type chart probably confuse, and may alarm, the mother, and they often confuse the clinic personnel as well. A trial is underway with simple weight/height charts, but their usefulness has yet to be evaluated.

The basic instructions for the use of a growth chart as well as relevant information on its design and purpose, should be included with all packets of charts. The growth chart used in nutrition education is best kept by the mother. An integrated record of the child's health can be shown if the chart is properly designed and maintained. All morbidity and clinic visit information, except that emphasized on the chart, can be written on separate sheets to be included in the same envelope. Participants in the conference had had experience with written child feeding advice, printed pictorial advice, and rubber stamped pictures.

The consensus of the discussion was that simple growth charts can be extremely valuable in growth surveillance, clinical followup, and nutrition education. Moreover, they can easily be developed into integrated health records. An integrated growth surveillance system pursuing each of these objectives is considered the core of child health services, especially in developing countries. No matter what other nutrition care programs are appropriate, a strong element of health education should be included for success.

FUNCTIONING OF GROWTH SURVEILLANCE SYSTEM

Settings

The usual settings for a growth surveillance system are:

- "Under Fives" clinics or maternal and child health centers.
- Mothercraft or nutrition rehabilitation centers.
- Nursery schools and day care centers.
- Postpartum newborn and pediatric curative sections of hospitals.

Growth surveillance is most effectively carried out through regular weight measurements, which experience has shown can be the core for MCH services. Use of growth charts should be adapted to the prevalence of malnutrition and the resources available for services.

Screening by Means of Growth Charts

In a community with high prevalence of malnutrition and clearly definable high risk groups, screening for those in need of health evaluation may be undertaken in two steps:

1. Identification of the groups most in need in the population at large.
2. Identification of the individuals most in need within those selected groups.

Some conference participants believed that such screening would lead to self-defeating efforts in which the program would focus wholly on groups with low social priority. Most programs have used one-step longitudinal screening for the individual in need, a technique that is also called growth surveillance. Some have combined this with marking on the card the reasons for special care. This is done most efficiently when high-risk groups have been well defined.

Social and economic conditions and educational opportunities of children provide clues to the identification of children at risk. Examples of social risk are low caste or class, unemployment, and poor child-rearing practices. Social variables have different meanings in each society and therefore require decentralized research.

Weight is a useful measurement for screening children because it is labile and because it is sensitive to current conditions of health and diseases, emotional stress, and caloric intake. However, an isolated weight without concurrent observations is of little value in the care of an individual child. In contrast, a series of weight measurements over a period of time is a useful tool in screening for children. For an individual child under treatment, a series of weights may indicate improvement or deterioration in health status. In an underprivileged population, a single weight for each child plotted on a standard weight chart is useful in selecting children most likely to need health care.

Some conference participants expressed a desire to increase the information obtained at the first screening, to include height, skinfold, skeletal maturation, and head circumference. Others thought that complete evaluations should only be performed on those identified as probable problem cases after the initial screening. Still others believed that in areas with scarce human and financial resources where a complete evaluation does not pay off, health workers and money should be allocated for service rather than for refined screening.

No one uniform screening procedure valid in all circumstances can be decided upon. The relative sensitivity and specificity of screening will be dependent on the type prevalence, and severity of malnutrition in the community, the wealth of meaningful information that can be obtained, and the level of the decision-maker.

The relevance of further refining screening procedures for protein-calorie malnutrition depends mainly on the quantity and quality of services that the area can afford. Where the prevalence of malnutrition is high and treatment resources are sparse, arbitrary screening levels or criteria are more closely geared to what services can offer than what might academically be considered "need".

Research is needed to define different levels of weight-for-age mean as predictors of health problems or as indicators of the probability of improvement with treatment. Some of this information may be obtained by careful analysis of already completed studies; some may require carefully planned experiments. The conference participants did not regard repeated "optimal growth" studies in each of the populations under consideration as necessary. They said the dynamics of growth should be the chief factor in growth surveillance. Problem cases referred by the auxiliary to the physicians will benefit most from additional anthropometric information above weight/age and a thorough medical history, including a dietary history.

Mothercraft or nutrition rehabilitation centers, MCH clinics, Under Fives: clinics, and hospitals may use the growth charts as a tool in clinical followup. In these settings the dynamics of growth becomes the most important, if not the sole, indicator of recovery.

Growth Charts as an Educational Tool

Monitoring progress of growth. Growth charts have been part of the armamentarium of the pediatrician for at least the last 50 years. The charts were designed for clinical followup; in most cases no educational purpose was intended.

Simpler growth charts that can be filled in and interpreted by auxiliary workers have been devised in the last 20 years. Use of these charts has led to the development of what came to be known to this conference as the growth surveillance system.

The first objective of the system, the maintenance of adequate growth, implies a major effort for nutrition education and further demands great regularity in growth surveillance. The most extensive experience has been with a monthly schedule of measurements, which is more than adequate. There has been some experience with schedules that lengthen the intervals between measurements as age increases and the rate of growth naturally slows down. This significantly diminishes the routine input in growth surveillance and may leave more time to pursue nutrition education and to give double attention to those in need of rehabilitation.

Any setting in which the growth chart is used should lead to nutrition education of the parents and the personnel. The teaching should aim at creating a:1 understanding of the dynamics of growth and should carefully avoid creating anxiety or equating bigger with better.

Nutrition education can make full use of the growth chart. The children, and their cards are the best demonstration material one could wish. Children often respond dramatically to increased quantity or quality of food. Encouraging results can be demonstrated to trainees, auxiliaries, and mothers. Regular reinforcement of a selected number of messages about food can be given on the occasion of each measurement and charting. The very pragmatic and tangible aspects of this approach to nutrition education make it attractive for illiterate villagers as well as for sophisticated workers.

The growth surveillance system is thus the vital core of a child health service, emphasizing health maintenance and health education as well as the actual delivery of clinical services. Moreover, the growth surveillance system centers attention on continuing concern for the individual rather than on episodes of illness. Experience has shown that the growth surveillance system is a good introduction for MCH services in developing countries. In developed countries a growth surveillance system permits even more effective MCH action.

Educational components of growth charts

The main messages of growth charts are that regular health supervision of young children with relatively basic techniques can promote normal growth, prevent malnutrition, and serve as the nucleus for the development of health services for the young child.

The educational components of growth charts are both visual and written.

Visual message. This is embodied in the road to health channel on the weight graph, which is uncomplicated and easily understood.

The growth chart can act as an early warning signal in depicting different forms of stress; for example, nutrition-infection in less developed areas and interacting economic-social-psychological factors in industrialized urban societies. The chart can also show the beneficial effect of appropriate intervention.

If standardized charts are used, local foods may be illustrated through the use of rubber stamps.

Written messages. These may be directed to health staff or parents, depending upon the level of literacy and the language in which the chart is produced.

A wide variety of written messages are incorporated in different growth charts. These should be adapted to local priorities and needs, including special care categories, immunization, antimalarials, family planning, feeding schedules (including the use of protein-rich foods), developmental screening, and additional body measurements. Information regarding ill health and commercial advertising are inappropriate for growth chart messages.

Target Groups

Growth charts can have educational aspects for many different groups. These include:

Parents and the community. Growth charts have a major educational impact both on parents and on the community because they demonstrate a correlation between improvement (or maintenance) of growth and health. They can be used to overcome cultural misconceptions concerning malnutrition, diet, and health.

The use of growth charts in the home involves parents personally in the health supervision of their children, and their influence may be expected to spread into the community.

Policy makers. Growth charts can be used to detect malnutrition in the community and they can be used to convince policy makers, administrators, and political leaders that they represent an economical, visible, practical, and acceptable tool to deal with the problem of malnutrition. They can also be used as a visual aid to demonstrate the effectiveness of intervention in an individual case or in the community.

Health workers. Growth charts have an educational message for all levels of health workers, including key figures and leaders in clinical and public health pediatrics and nutrition, professional staff, and auxiliary personnel. Growth charts illustrate the prevalence of malnutrition in a community, its type, age incidence, the relation of growth and health, the advantage of early detection of malnutrition (including obesity) judged by growth deviations, the identification of high-risk groups, the link between curative and preventative services, and the assessment of the effectiveness of clinics and other health units.

Miscellaneous groups. A variety of other groups may be motivated and educated by means of growth charts. These include school children and their teachers, various workers involved in child care—especially day care centers, youth clubs and groups, voluntary agencies, institutions concerned with children, agricultural and other extension agencies.

Education in the use of growth charts

In primary grades all over the world, the teaching of the symbolism of graphs and charts is increasing. When growth charts become available in a community, the meaning of a chart could well be taught by and through the weight charts of a child's younger siblings, as well as by charting his own weight.

Growth charts need to be made available in the pre and in-service training of all cadres of health workers and others previously mentioned.

Education in the use of growth charts should be in large measure by practice; that is, by using the charts and practicing the techniques of recording, interpreting, and communicating results. Involvement and

participation by all levels of staff, as well as parents, is necessary. Valuable teaching methods include flannel graphs and other visual aids, and problem-solving approaches—using actual charts in the form of programmed instruction of increasing levels of complexity.

Education in the use of growth charts needs continual reviewing, reappraisal, and renewal.

Teaching aids, including a booklet for trainers, need to be developed.

Increasing the Use of Growth Charts as an Educational Tool

Using the growth charts as a health education tool is a relatively new concept. Experiences reported from Africa, Asia, and the Philippines convinced conference participants that a definite effort should be made to spread the practice. This would require the following special inputs:

- A simple booklet to explain the need for and the use of growth charts in developing countries.
- A program to educate the medical profession to accept growth charts as important.
- Designation of a Growth Surveillance System to dignify the concept with a noble title.
- Efforts to encourage professional medical organizations to stress and teach the concept.
- A focus on involvement of parent or child caretaker in the process of growth evaluation by charting.
- Continued, persistent education and frequent monitoring of health auxiliaries in weighing and charting.
- Use of consolidated growth data from charts to educate government officials concerning the health and nutrition status of communities.
- A training manual for health workers who train other workers in weighing techniques, plotting, etc.
- Development of a list of risk factors peculiar to each locale and a method for adding this information to the growth chart. A code might be devised if the information seems to be emotionally charged for the parents.

The nationwide growth surveillance systems reported from Lesotho and the Philippines seem to confirm that all the above factors should receive full attention.

Whether the growth surveillance can be successfully combined with a nutrition education program is by and large dependent on the morale and training of the medical auxiliaries. Small demonstration programs have shown that auxiliaries can be successful in carrying out growth surveillance; under proper supervision, they can conduct the weighing, charting, and health education. This is economical enough to be relevant to developing countries; furthermore, auxiliaries have developed an acceptable level of reliability in weighing and charting. That these workers are effective agents of change suggests a similar approach in developed countries.

EVALUATION OF GROWTH SURVEILLANCE SYSTEM

Countries willing to build a growth surveillance system may not be in a position to combine their service effort with sophisticated evaluation, even on a sample basis. Some conference participants proposed that an international center for scientific evaluation be established to coordinate efforts and, where such efforts are lacking, to initiate them.

It was also suggested that a compromise on the sophistication of the evaluation might be worthwhile in order to obtain community involvement. Local policymakers—village elders, parish councils, or even political parties—are close to the daily life of the villagers and their involvement usually is the best assurance of effective health education. Primary or secondary school children can be included in a simple evaluation such as counting the number of children immunized in the last year, the number of children with incomplete immunizations, and the frequency of visits for growth surveillance. This information can be shared with interested local leaders, who then participate in appropriate action.

Most participants agreed that both the scientific centrally-based evaluation and the simple community-based evaluation have merits and should be considered.

The conference discussion of scientific evaluation of the growth surveillance system pointed out the wide variety of growth charts in use throughout the world. The scientific basis for these charts, the procedures followed in their use, the type of service within which they are utilized, and the—existing data also vary so widely that meaningful comparison and evaluation of results are impossible. The participants were urged to think in terms of how evaluation can be most effective in the future when new standardized charts and procedures for use become widely accepted. Essential to the planning of such evaluation would be a reporting system to centralize and analyze information concerning the use of these charts and the results obtained in local services.

Evaluation of Charts

As an instrument for the assessment of growth and for the education of health personnel, the chart itself needs further evaluation and refinement. Reference standards used for growth charts currently in use can be divided into three major categories:

1. Those based on representative samples of the local community or national population;
2. those based on socially privileged sectors of the community; and
3. those based on other populations that are deemed sufficiently comparable as to be useful for reference purposes.

At present there is no single reference standard that is accepted internationally. Before worldwide adoption, any growth chart under consideration must be used as an experimental procedure. The usefulness or suitability of such a universal standard could only be judged prospectively and would depend on the collection and analysis of reports from health services using it.

Together with the concept of a universal reference standard must be considered the possibility of standardizing the classification of degrees of severity of malnutrition or failure to gain weight. Various systems are currently in use; however, little information has been published on their sensitivity in early detection of malnutrition. Indeed, little is available on their general usefulness or need for modification. The testing of an international system of classification would be a useful way in which to generate comments and suggestions leading to an acceptable compromise that would enable international comparisons to be made.

The conference raised no questions about the acceptability and cost of growth charts in clinical settings. Acceptance has been high, both by health staff and the community, in areas where the charts have been introduced. The cost involved is small; it would be difficult to analyze efficiency on a cost-benefit basis, however; as results of use are clearly related to services provided rather than the characteristics of the chart per se.

Evaluation of Use of the Charts

The use of health charts by health services and the community can be evaluated for the following purposes:

1. As a tool for monitoring the growth of the individual child;
2. As an aid in assessing community nutritional status and screening for high-risk individuals and groups;
3. And as an instrument for educating service staff and mothers on the importance of health surveillance.

There appears to be little question concerning the value of growth charts for the assessment of individual progress of preschool children on a sequential basis. The only area that requires evaluation concerns the use of height and other measurements as additional parameters in situations where these can be easily and accurately collected.

Community assessment and screening represent ways in which the use of growth charts can be evaluated very early. New projects in which growth charts will be used should undertake a baseline study of weight-for-age patterns by plotting all individual weights on a single chart. Such a study could be repeated at yearly intervals to evaluate changes. The usefulness of the unmodified chart for this purpose could be recorded as well as suggestions for improvement.

The evaluation of educational aspects can best be carried out by direct assessment in projects using growth charts on a continuous basis. The health staff can usefully combine testing of comprehension with continuing education, while the mothers' understanding can be evaluated by simple standardized questionnaires applied at regular intervals.

It may be difficult to isolate the improved motivation that may result from the introduction of growth charts on the part of health staff to provide better service and on the part of the mothers to use such services. Consideration should be given, however, to designing experimental situations in which such effects might be measurable.

Evaluation of the Results of the Use of Growth Charts

The evaluation of specific results of the use of growth charts within a given service situation may well be impossible to achieve with precision, and will probably have to be based on reasoned assumptions. If introduction of growth charts within a community results in improved delivery and use of services, then it may be assumed that favorable results deriving from these changes are due in part to the growth charts. Favorable results that might be measured would include reduced mortality and morbidity, continuing growth and development, and more frequent and widespread interaction between the community and the health service.

SUMMARY AND RECOMMENDATIONS

The conference participants reviewed reports from various settings around the world, primarily in developing countries, on the use of growth charts for the assessment of the growth and health of children. Acknowledging that differences existing between developed and developing countries would make any one type of chart inapplicable everywhere, the participants focused on the developing countries and made their recommendations in this context.

Suggestions were made for the design of a simple longitudinal weight chart for use primarily by auxiliary workers for educational purposes in unsophisticated settings. Additional items to be incorporated into such charts as teaching materials were proposed. Emphasis was on the use of charts as part of a *growth surveillance system*.

Discussions stressed the need for continuing evaluation of the charts themselves, their use, and their effectiveness in improving child health.

General recommendations, applicable primarily to developing countries, were as follows:

1. **Widespread Use.** It is recommended that growth charts incorporating weight measurements and health information be utilized by all levels of workers in health and nutrition-related fields for health surveillance and education.
2. **Dissemination of Technical Information.** It is recommended that wide dissemination be made of the deliberations of the conference to all relevant pediatric, nutrition, and public health workers. It is recommended that "interpretative articles" be written for the technical journals reaching these groups.
3. **Compilation of Information.** It is recommended that existing information concerning types of growth charts, educational material on their use, evaluation of their effectiveness, and so forth be collected and compiled in one location, under international auspices. This information should be continually updated and modified with the acquisition of new experience.
4. **General Brochure.** It is recommended that consideration be given to the preparation of a general brochure on the usefulness of growth charts. This would be directed principally to technical personnel and might be entitled "Growth Surveillance Systems - Basic Approaches to Community Involvement."
5. **Trainer's Kit.** It is recommended that a trainer's kit be prepared. This should include a booklet covering the principles of growth charts and general aspects of their practical use. This manual would be for general use throughout the world and the trainers would need to devise locally appropriate manuals adapted to particular circumstances and conditions. The manuals could be accompanied by appropriate teaching aids, such as flannel graphs and slides.
6. **Continuous Assessment of Effectiveness.** It is recommended that methods be devised for conducting ongoing evaluation of the usefulness and practical effectiveness of growth charts as an educational tool in different parts of the world.
7. **Pilot Projects.** It is recommended that pilot projects be initiated, using appropriately adapted growth charts, both in less developed areas and in selected industrialized urban regions, including the USA. After an adequate trial period, research utilization conferences, based on the "share and compare" philosophy, should be held to assess the effectiveness of different forms of growth charts in various ecologies.

ABSTRACTS

The abstracts of all papers are given in the sequence of their presentation. Those interested in the full text of papers may obtain copies from the speakers at the addresses given for conference participants.

THE ROAD-TO-HEALTH CHART

Dr. David Morley

The (Morley) road-to-health chart was developed 12 years ago as a tool for the early diagnosis of protein-calorie malnutrition. The experience gained in Africa and Asia led to the further concept of using the chart to promote adequate growth. Simplicity of design has been an important objective. The records have been filled in by auxiliary personnel and kept by the mothers.

Most local communities have not determined growth standards, but in any community the difference in weight between members of that community tends to be very much greater than that between communities. For this reason, the teaching of the use of these charts concentrates on the idea that the child's curve should move in a direction similar to that of the curves marked on the chart. These curves represent the 50th percentile of the Harvard standards as the top line and the local 50th percentile as the lower line. The lower line is in most instances nearly identical with the third percentile of the Harvard standards.

GROWTH CHARTS—EXPERIENCE AND EMPHASIS IN ASIA

Dr. William A. M. Cutting

Weight-for-age charts are an excellent way of assessing growth, educating health workers and mothers, and promoting health. The road-to-health chart developed by Morley was found to gain in effectiveness if it was adapted to prevailing local conditions. Adaptations were made in South India by:

1. Using the local language on the card.
2. Illustrating nutritional advice with emphasis on local foods.
3. Adding a family planning section that recorded the relevant attitudes and practices.

Cultural factors may help or impede the use of the chart. In India a road-to-health chart seems to fit readily into the philosophical concepts of the "marg" or road-to-peace held by many mothers. However, giving the chart to the mothers is in direct conflict with the professional expectation of secrecy of medical records. Professional resistance can be overcome by emphasizing the ease of retrieval and the opportunity for continuity of care between institutions. Advocates of growth charts should not forget that their practical benefits are dependent on their effective use. Training of the auxiliary health workers as well as availability of the necessary medical and nutritional supportive services is therefore essential.

GRAPHIC METHODS USED IN LATIN AMERICA TO RECORD PHYSICAL GROWTH

Dr. Franz Pardo

Several types of growth charts are in use in Latin America, including:

1. Weight-for-age charts with percentage distribution.
2. Weight-for-height charts.
3. Intrinsic speed of growth charts (combined auxometric method).
4. Charts based on weight-for-age and height-age standards percentiles.

The weight-for-age charts with percentage distribution (Gomez classification) are most widely used for the evaluation of nutritional status of children. In some countries this chart is also used for educational purposes. The top curve on the chart indicates "normal expected" growth based on the 50th percentile of the growth study used as a base (Harvard, Iowa, or Mexico). Three more curves (90 percent of 50th percentile, 75 percent of 50th percentile, and 60 percent of 50th percentile) define different degrees of malnutrition.

The weight-for-height charts have only recently been developed and need more evaluation as to their effectiveness in detecting changes in the nutritional status of children. They seem promising as part of the armamentarium of rehabilitation.

The combined auxometric method offers the opportunity for full evaluation of growth. However, since it requires specialized training, it is not suited to public health programs in developing countries. The percentile charts applying internationally recognized standards have been mainly used in research centers.

GROWTH CHARTS USED IN THE UNITED STATES—AN APPRAISAL AND CRITIQUE

Dr. Frank Falkner

Growth norms describe a particular group of children. Rightfully they can only be applied to children of the group from which they were developed. Even when limited to this use, they do not permit an appraisal of desirable growth.

Height and weight are the most useful measures in the study of growth. Height is the more stable of the two, but is bothersome to measure. Weight is the more sensitive indicator of recent change and easier to measure. Other anthropometric indices add little information over and above weight and height.

Theoretically, it is profitable to measure both achieved growth and rate of growth. Few normative data for rate of growth are available.

Charts are meant to facilitate visual comparison of the individual growth and the growth norms of the reference group. The chart for general use should be simple, showing an upper and lower range. Charts that utilize grids and other complex devices, although not understood by most health workers, have their rightful place in growth research.

AN ASSESSMENT OF WEIGHING DEVICES FOR THE EVALUATION OF NUTRITIONAL STATUS OF YOUNG CHILDREN IN LESS DEVELOPED AREAS

Dr. Derrick B. Jelliffe and E. F. Patrice Jelliffe

Health workers in 52 countries who participated in a mail survey suggested the following criteria for weighing devices to be used by clinic staff in developing countries:

Low Cost. Cost is a major limiting factor. New weighing devices should be no more costly than the present UNICEF models. One participant suggested an upper price limit of US \$35 per scale.

Sufficient Accuracy. The weighing device should be accurate to a level of 100 grams or 1/4 pound. The small weight increments of the second and subsequent years demand a sensitivity at this level. There seems inadequate justification to attempt greater accuracy, which would require increased input for training and actual measurement. Moreover, greater sensitivity might result in inappropriate concern for minor variations in weight.

Sturdiness. The scale should be sturdy, durable, and easy to repair. The use of nonrusting material that is easy to clean was recommended.

Portability. The need for a portable scale depends on the location of the clinic. For field sites, the scale may have to be carried by hand, in a vehicle (such as a Land Rover), or by plane. Scales that are light weight are desirable, especially for female staff members. Other features mentioned were compactness in bulk and height and a well-designed transport box with foam rubber or other padding, spring hocks, a locking device, and a carrying handle.

Readability. Direct reading scales are considered optimal. Scale markings should be clearly legible. The markings should be on the side facing the observer or, when possible, on both sides of the scale; preferably, they should be at a level that can be read without stooping. Different colors for the two weighing units (ounces and pounds or grams and kilograms) and punched-out markings on metal were also suggested. A scale with an indicator that remains in position after a child has been removed is ideal.

Weighing Surfaces. A scale should have a flat surface large enough for a mother or attendant to stand on while holding a young child in her arms. A toddler rail may be needed to reassure the preschool child. For babies, an easily cleaned, stable plastic pan was suggested. This would provide a safe surface for the baby to lie on, but would not be affected by the baby's movements.

Weight Range. The range needed varies with the proposed use of the particular weighing device. For a multipurpose "family" scale, the weight range should be 100 to 150 kilograms to cover the combined weight of a mother or attendant holding an active preschool child. For the scale to be used for infants and preschool children, the range should be up to 25 kilograms.

Simplicity. Related to cost, easy transport, durability, and repairability, the need for simplicity in both apparatus and technique was stressed by many. In particular, the device should not require mental arithmetic or even any form of simple mathematics, including subtraction, in the field.

Calibration. Checking and recalibration of apparatus should be conducted at regular intervals. The question of the most appropriate form and level of test weights which would span the proposed weight range was discussed by some participants. Commercially available weights are usually very costly. Suitable home-made items can be prepared with tins containing dry sand or stones, or even better, a container of known size can be filled with water in the field.

Frightening Appearance. As is well known, the apprehensive but highly active, young preschool child is the most difficult individual to weigh. Some respondents suggested that the frightening appearance of the scale might be reduced by using a toddler bar or a chair in which the child can sit, and by ensuring that suspended weighing device does not lift the child further in the air than necessary. The need for this type of consideration is obvious, especially when apprehension in a group of young children waiting to be weighed can be "contagious."

USE OF CHARTS IN DIFFERENT SETTINGS: "UNDER 5" CLINICS

Dr. Carlo C. Capone

In "under 5" clinics and preschool centers in Africa, the growth chart is used both as an educational tool and a diagnostic tool. In most areas of Africa, a program of minimum requirements is the only feasible one to reach most people. The growth chart is sufficient to establish a meaningful nutrition education program. In fact, the aim of the preschool program is to help mothers maintain the adequate growth of their children. Initially the mother cooperates by giving assurance that she will attend the center regularly and that she will contribute, within the limits of her economy, to the costs of the service. The chart is regarded as a property of the family. Each monthly clinic visit consists of weight measurement and individual advice, complemented by group discussions and demonstrations arranged as the need arises. The success of the program depends entirely on the mother's understanding and cooperation. The growth chart is vital to both.

USE OF GROWTH CHARTS IN MOTHERCRAFT CENTERS AND SCHOOLS IN THE PHILIPPINES

Dr. Lourdes Sumabat

Malnutrition, especially of preschool children, is one of the major public health problems of the Philippines. For the past 3 years the Department of Health of the Philippines has stimulated the development of mothercraft centers whose activities include nutrition rehabilitation and prevention, instruction in family planning, sanitation, and other aspects of homemaking. In addition, a school nutrition program has been initiated.

Growth charts are central to the operation of the mothercraft centers and the school nutrition program. The growth charts are based on the Harvard norms with the percentage classification of degrees of malnutrition printed in vivid colors. Individual growth charts are posted in the mothercraft centers and are used to educate the mothers and the local leaders.

The measurement of weight and its graphing is possible without unduly burdening the workers. Simple growth charts have been satisfactory educational tools. Under international norms 50 percent of Filipino children are presently classified as malnourished; the relevance of these norms remains an unsolved problem.

USE OF THE GROWTH CHART IN COMPREHENSIVE HEALTH PROGRAMS FOR CHILDREN AND YOUTH

Dr. Evelyn B. Wilson

Comprehensive children and youth programs in the United States, despite the seeming abundance of resources, have some important features in common with those serving poor rural children throughout the world. There is a scarcity of personnel with relevant training in the assessment of growth. Charting is most frequently performed by nurses and uncertified workers. But in 48 of 55 Children and Youth programs surveyed, it was said knowledge of growth patterns was limited to pediatricians, nurses, and nutritionists.

Auxiliary workers are ripe for training in this field. Parents could be excellent disseminators of health education with proper training.

In the United States, consideration should be given to adoption of growth charts as parent-owned longitudinal records, with notation of immunizations, regularly issued treatments, and listing of risk factors. Training in their use should be the core curriculum for all workers caring for children in comprehensive health, Head Start, and day care, and similar programs.

USE OF THE CHARTS IN MATERNAL AND CHILD HEALTH PROGRAMS

Dr. George Cunningham

The use of growth charts in 21 county and city health departments covering 90 percent of the California population was investigated. It was found that 17 departments measured each child routinely. Two did not measure each child and two did measure each child but not routinely. Furthermore, weight was measured by all 21 departments; 19 measured height, 15 head circumference, 3 chest circumference, and 10 skinfolds. The recording was done on Iowa growth charts by 11 health departments and on Harvard charts by 2 departments, while 4 used the Denver development chart. Only 4 departments had a written policy for allowable deviation, but these 4 were all different. The age at which measurements were discontinued was 12 months in 2 departments, 18 months in 3 departments, 24 months in 6 departments, and 5 years in 10 departments.

It seems assessment of growth is poorly done in most instances; the interpretation of the data is haphazard and no educational use is made of the measurements.

EDUCATION OF HEALTH PERSONNEL

Mrs. Ann Taole

In Lesotho, Catholic Relief Services in conjunction with the Ministry of Health sponsor a nationwide preschool nutrition education program with existing health units. There are 50 health units throughout the country with a monthly attendance of about 80,000 in the preschool program. The growth charts play an important role in this program. The Ministry of Health initiated the use of growth charts in 1961, but the charts were property of the clinics. In 1967 the Ministry of Health accepted the idea of the mothers' keeping the growth charts and allowed a corresponding change in design. The nursing personnel were slow at first in developing skill in filling in and interpreting the charts, but under repeated supervision they have reached a level of proficiency. Mothers have been very closely involved with the program. The success of the program can be measured by the progress of the child as recorded on the growth chart, the regularity of the attendance, and the interest in the group discussions and demonstrations.

USE OF GROWTH CHARTS IN TEACHING FAMILY HEALTH WORKERS

Dr. Cecile De Sweemer and Dr. C. E. Taylor

In developing a strategy for nutrition care in the Rural Health Research Center in the Punjab, India, procedures that could eventually be used in mass implementation under government programs were tried.

Logistical problems in reaching preschool children with a nutrition program are great. Preliminary judgments about cost effectiveness suggested that the greatest returns would come from an investment in screening so that feeding could be concentrated on those needing supplementation. One approach would have been to define need in social terms. However, the more direct approach of growth surveillance was selected, using low levels of achieved weight as well as low, zero, or negative rates of growth as alarm signals.

Experiences with teaching auxiliary workers the use of growth charts reinforces the importance of simplicity of design of the chart, both for recording and for interpretation. It also demonstrates that the growth chart may become a major focus for undertaking education of the health team in nutrition and in health education. Furthermore, it underlines the necessity for evaluating the training of the workers in light of results obtained in the field, and for a feedback mechanism that permits amplification or change of specific aspects of training and service.

The necessity for close coordination of training and service on an ongoing basis demands that the training be the responsibility of a person or persons with authority in setting priorities for the health team. The necessity for unorthodox approaches requires that a good resource person in educational methodology be available. Above all, great tenacity is required. Health education in general and nutrition education in particular touch on fundamental aspects of individual and family culture. Hard core cultural values can be changed only with the expenditure of great effort. By using growth charts as a tool, one can focus the effort and facilitate the transmission of the message in simplified form.

PRELIMINARY REPORT ON THE EVALUATION OF WEIGHT CHART USE IN NIGERIA

Dr. Nicholas Cunningham

The evaluation of the use of growth charts in Imesi Ile, a village in Nigeria, shows over 96 percent of children under 5 years have a chart, with weights charted an average of 50 times for 60 months. About 62 percent of mothers correctly interpret the growth charts.

Over 96 percent of the birth dates of the village children were known, the immunization status of the children was excellent, and each child had made over 25 visits to the clinic per year. All these indicators show very good performance; at least part of the credit should be given to the weight charts.

CONFERENCE PROGRAM

MONDAY - May 10

12:30 p.m.

LUNCHEON AND OPENING SESSION

Presiding: David Morley

Welcome: Katherine Bain and Martin J. Forman

Procedure and Arrangements: Andromache Sismanidis

2:00 p.m.

GROWTH CHARTS - AN OVERVIEW OF KINDS, INTERPRETATION, AND EXPERIENCES

Chairman: George M. Owen

In Africa - David Morley

In Asia - William Cutting

In Latin America - Franz Pardo

In United States - Frank Falkner (summarized by Samuel J. Fomon)

3:30 p.m.

DISCUSSION

4:45 p.m.

WEIGHING SCALES

Derrick B. Jelliffe

7:00 p.m.

DINNER

8:30 p.m.

GROUP SESSIONS

Group 1 - David Morley

Group 2 - Derrick B. Jelliffe

Group 3 - Isabelle Valadian

TUESDAY - May 11

9:00 a.m.

REPORTS OF GROUP SESSIONS

9:15 a.m.

USE OF CHARTS IN DIFFERENT SETTINGS

Chairman - Roberto Rueda-Williamson

Under 5 Clinics - Carlo Capone

Mothercraft Centers and Schools - Lourdes Sumabat

Comprehensive Health Services Projects for Children and Youth - Evelyn Wilson

Maternal and Child Health Programs - George Cunningham

11:30 a.m.

DISCUSSION

12:30 p.m.

LUNCH

1:45 p.m.

EDUCATION USE OF CHARTS

Chairman - Mary C. Egan

For Health Personnel - Ann Taole

For Auxiliary Workers - Cecile De Sweemer

For Parents - Virginia Sanbury

4:00 p.m.

GROUP SESSIONS

7:00 p.m.

DINNER

8:00 p.m.

REPORTS OF GROUP SESSIONS

Film "CRS Nutrition Program in the Congo"

WEDNESDAY - May 12

7:30 a.m.

GROUP SESSIONS

9:45 a.m.

EVALUATION - ACTIVITIES, PROJECTIONS, PROPOSALS

Chairman - Miguel Guzman

Panel Moderator - John Kevany

Panel: David Morley

Roberto Rueda-Williamson

Nicholas Cunningham

Samuel J. Fomon

11:15 a.m.

DISCUSSION

12:30 p.m.

LUNCH

2:30 p.m.

REPORTS AND RECOMMENDATIONS

Chairman - Alice Chenoweth

On Growth Charts - Isabelle Valadian

On Education - Derrick Jelliffe

On Evaluation - John Kevany

4:00 p.m.

SUMMARY

David Morley

CONFERENCE COCHAIRMAN

David Morley

Andromache Sismanidis

PROGRAM PLANNING COMMITTEE

Muriel Caldwell

David Morley

Mary C. Egan

Roberto Rueda-Williamson

Samuel J. Fomon

Andromache Sismanidis

Martin J. Forman

CONFERENCE PARTICIPANTS

Katherine Bain, M.D.
Chief, International Activities
Maternal and Child Health Service
DHEW
5600 Fishers Lane
Rockville, Maryland 20852 U.S.A.

Muriel Caldwell, Nutritionist
International Activities
Maternal and Child Health Service
DHEW
5600 Fishers Lane
Rockville, Maryland 20852 U.S.A.

William K. Carlile, M.D.
Chief, Maternal and Child Health Branch
Indian Health Service
Phoenix Area Office
801 E. Indian School Road
Phoenix, Arizona 85041

Carlo C. Capone, M.D.
Consultant, Regional Medical Nutrition
Catholic Relief Services
P. O. Box 8932
Nairobi, Kenya

Alice Chenoweth, M.D.
Chief, Program Services Branch
Maternal and Child Health Service
DHEW
5600 Fishers Lane
Rockville, Maryland 20852 U.S.A.

George Cunningham, M.D.
Chief, Maternal and Child Health
2151 Berkeley Way
State Department of Public Health
Berkeley, California 94704 U.S.A.

Nicholas Cunningham, M.D.
Assistant Professor of Pediatrics
Mt. Sinai School of Medicine
19 East 98th Street
New York, New York, 10020 U.S.A.

William A. M. Cutting, M.D.
CXI Campbell Hospital
Jammalamadutu
Cuddapah District, A.P., South India

Cecile De Sweemer, M.D.
Research Associate
Department of International Health
Johns Hopkins University
Project Officer of Nutrition and
Infection Study
Narangwal, Punjab, India

Mary C. Egan
Chief, Nutrition Section
Maternal and Child Health Service
DHEW
5600 Fishers Lane
Rockville, Maryland 20852 U.S.A.

Samuel J. Fomon, M.D.
Professor
Department of Pediatrics
University of Iowa
Iowa City, Iowa 52240

Martin J. Forman
Director, Office of Nutrition
Technical Assistance Bureau
Agency for International Development
Washington, D.C. 20523

Miguel Guzman, M.D.
Chief, Division of Statistics
Institute of Nutrition of Central America
and Panama (INCAP)
Carretera Roosevelt Zona 11
Guatemala City, Guatemala, C.A.

Derrick B. Jelliffe, M.D.
Director
Caribbean Food and Nutrition Institute
P. O. Box 140
Kingston 7, Jamaica, West Indies

John Kevany, M.D.
WHO Representative
Bay Mount, Vico Road
Dalkey County
Dublin, Ireland

*Frank Falkner, M.D., M.P.C.P.
Director, Fels Research Institute
Yellow Springs, Ohio 45387 U.S.A.

Mary B. McCann, M.D.
Nutrition Program
Center for Disease Control
1600 Clifton Road
Atlanta, Georgia 30333 U.S.A.

David Morley, M.D.
Senior Lecturer in Tropical Child Health
University of London
Institute of Child Health
30 Guilford Street
London, W.C.1., England

Howard Meredith
Professor of Child Somatology
State University of Iowa
Iowa City, Iowa 52240 U.S.A.

George Owen, M.D.
Professor, Department of Pediatrics
Ohio State University
Children's Hospital
Columbus, Ohio 43205 U.S.A.

Franz Pardo, M.D.
Chief, Department of Investigation
Instituto Colombiano de Bienestar Familiar
Apartado Aereo No. 18-116
Bogota, Columbia

Jean Pinder
Public Health and Population Officer
Bureau of African Affairs
Agency for International Development
Washington, D.C. 20523 U.S.A.

Roberto Rueda-Williamson, M.D.
Regional Advisor in Nutrition
Pan American Health Organization
525 23rd Street, N.W.
Washington, D.C. 20037 U.S.A.

Virginia J. Sanbury, R.N.
Coordinator Undergraduate Pediatric Nursing
University of Maryland School of Nursing
655 W. Lombard Street
Baltimore, Maryland 21201 U.S.A.

Andromache Sismanidis
Nutrition Consultant
International Activities
Maternal and Child Health Service
DHEW/PHS/HSA/BCHS
5600 Fishers Lane
Rockville, Maryland 20852 U.S.A.

Pauline Stitt, M.D.
Health Forums Coordinator
White House Conference on Children & Youth
6th & D Streets, S.W.
Washington, D.C. 20013 U.S.A.

Joe L. Stockard, M.D.
Research Advisor
Office of Health
Technical Assistance Bureau
Agency for International Development
Washington, D.C. 20523 U.S.A.

Lourdes Sumabat, M.D.
Deputy Director
Research and Development and
Coordinator, National Nutrition Program
Department of Health
Manila, Philippines

Ann Taole, S.R.N.
Preschool Clinics Supervisor (Nursing)
CRS Preschool Clinics
P. O. Box 159
Maseru, Lesotho

*C. E. Taylor, Chairman
Department of International Health
School of Hygiene and Public Health
John Hopkins University
Baltimore, Maryland 21205

Lesley J. Tepley
Senior Nutritionist
UNICEF
United Nations
New York, New York 10017 U.S.A.

Isabelle Valadian, M.D.
Associate Professor
Department of Maternal & Child Health
Harvard School of Public Health
Boston, Massachusetts 02115 U.S.A.

Myron H. Vent
Education Officer (Special Projects)
Office of Education & Human Resources
Technical Assistance Bureau
Agency for International Development
Washington, D.C. 20523

Evelyn B. Wilson, M.D., Actg. Director
Dept. of Pediatrics, Lincoln Hospital
Bronx, New York 10454

John Wellman, M.D.
John Hopkins University
Department of International Health
Baltimore, Maryland 21205 U.S.A.

*Not in attendance