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Date April 24, 1991

HOUSEHOLD FACTORS AND THE GROWTH OF YOUNG CHILDREN IN TWO LESS-DEVELOPED COMMUNITIES

A Thesis

Presented for the

Master of Science in Nursing

Degree

The University of Tennessee, Knoxville

Benjamin David Francisco

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DEDICATION

This thesis is dedicated to the staff and students of the School of Primary Health Care, University of the Nations, Kailua-Kona, Hawaii, whose extraordinary vision and commitment have made this work possible.

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ABSTRACT

This correlational study examined the relationship between household factors and the growth of young children in two less-developed communities: 1) a Mexican urban community, and 2) a Filipino slum community. The theoretical framework of this investigation was a synthesis of the work of Florence Nightingale, Leonardo Mata, and Sister Calistra Roy. Growth of young children was viewed as indicative of adaptation to poverty.

Height, weight, age, and sex of 267 children ages 6 years and younger were obtained in house-to-house visits. Data were collected for each household by interview with the primary caretaker and by direct observation of the dwelling. Variables included two inventories and a variety of demographic factors related to poverty, housing, sanitation, family composition, mode of transportation, education, health care, and nutrition. A health and hygiene inventory examined 18 items related to general health issues. An early childhood feeding inventory examined 17 items related to the feeding of young children.

Data analysis was based on a comparison of the growth of children in the samples to reference data for children from the National Center for Health Statistics (NCHS), as recommended by the World Health Organization. Variability in the NCHS population reflects differing genetic potential and ethnicity inherent in any population of healthy,

well nourished children. Excess variability in growth indicators among children in this investigation was attributed to environmental influences. Relative standard deviation (SD) values for height-for-age (H/A) and weight-for-height (W/H) of children in the investigation were calculated based on the NCHS reference data. H/A was used as an indicator of long-standing nutritional status and growth, whereas W/H was used as an indicator of recent nutritional status and growth. A third dependent variable, the average of H/A and W/H SD values, was used to reflect the combined result of both recent and long-standing nutritional status and growth.

Inventory scores were highly correlated with growth. Demographic variables related to poverty and poor sanitation were negatively related to growth. Stunting and wasting were widespread among slum children. Families with increasing numbers of children had less income and less living space to support child-rearing needs than families with fewer children. However, 30 children from among the poorest households grew at rates which were above the median for NCHS children. Inventory scores were higher for these children than for children from wealthier households whose growth was below the NCHS median. This finding indicates that improved growth of young children is related to the role function of caretakers. Effective child-rearing practices appear to have a mediating effect on poverty and growth failure among young children in this study.

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CHAPTER I

INTRODUCTION AND PURPOSE OF THE STUDY

Malnutrition and Misconceptions

An estimated 40,000 children die every day as a result of the cumulative effects of malnutrition and repeated infections. They die one-by-one in millions of homes throughout the developing world. However, there is little awareness and little understanding of this "silent emergency" (Grant, 1987, p.1). Two important misconceptions are often linked to discussions about malnutrition: 1) the belief that malnutrition is easily recognized, and 2) the assumption that an absolute shortage of food is primarily responsible for the majority of deaths. These erroneous ideas have a) clouded the issue of childhood malnutrition and b) have prevented the development of effective interventions that would be appropriate for the economies of developing countries. In a landmark report by the United Nations Children's Fund, Grant challenged widely held misconceptions:

> To a public conditioned by photographs of starving children with empty rice bowls, it comes as something of a shock to realize that most malnutrition is invisible, that most malnutrition is not caused by shortages of food in the house, that most malnourished children are not hungry, and that

> most feeding programs fail to have any significant effect on children's nutritional status. Yet all of these statements are broadly true. And in exploding old myths, they clear the site for a new structure of understanding. (p. 65)

Others, like Grant, have challenged assumptions about malnutrition and health. They have called for a restructuring of understanding and a fresh approach. After studying the etiology of diarrhea and parasitic diseases for nearly twenty years, Dr. Leonardo Mata (1982) came to the conclusion that the single most important issue in child growth and survival in the developing world is what he called maternal or familial technology. In this context, technology is the ability to obtain life's basic necessities, such as food and water. Mata observed that simple family decisions, such as the choice between types of water storage jars, can have a tremendous impact on child nutrition and health.

Historical Considerations

Interest in household factors and health is not new to nursing. Florence Nightingale suggested many years ago that a principal role of nursing is managing the environment to preserve the patient's health, conserve the patient's strength, and speed recovery. Nightingale identified the "health of houses" (in Torres, 1986, p. 41). Unfortunately, her preliminary work on the health of houses has not

been reexamined through modern nursing research. The history of rapid development in the western world may have obscured the importance of household factors. The public health movement in the United States led to sanitary reform and the provision of basic services, including tap water and waste disposal systems. Industrialization introduced manufacturing processes which revolutionized food processing and storage. Electricity, refrigeration, hot water, and convenient methods of cooking and preserving food became widespread. Agricultural practices also improved rapidly, bringing an abundance of foods to the public at affordable prices. Economic growth broadened the ranks of the middle class and enabled federal, state, and local governments to provide assistance to poorer families. Cumulatively, these universal trends drastically altered the interior environments of American and European households, where young children grew over the last century. The nutrition status and health of children steadily improved during these years.

A Micro-Approach to Development

Yet, today, the majority of the world's children continue to live in household environments which have changed very little since the days of Florence Nightingale. It is unlikely that economic prosperity and industrialization will come in time to save or improve their lives. The Western pattern of development may never be repeated by many

of the nations of the world. How will health come to the millions of children born into homes of poor families? Development schemes calling for sweeping changes of economies, political systems, and social services are advocated, yet the fact remains that change of this proportion is slow and uncertain. In the intervening years countless young children suffer. The current world-wide recession signals further delays and failure of approaches that call for meta-change (sweeping reforms). Micro-change at the house-to-house level is an alternative pathway toward attacking the root causes of childhood malnutrition. This approach is warranted if household factors can be shown to be major contributors to child growth.

Purpose of the Investigation

In poor communities where household resources are in short supply and environmental conditions are generally adverse to child health, some children still manage to grow at or above the rate of healthy children around the world. Other children are not as fortunate. They show extreme growth failure and succumb to a cycle of repeated infections and chronic malnutrition. In this investigation, I will examine several household factors in an attempt to identify patterns of adaptation already modeled in the communities. By comparing a large number of households with preschool age children

and infants, it should be possible determine what factors correlate with growth outcome and which factors relate to serious growth failure.

CHAPTER II

LITERATURE REVIEW

Scope and Impact of Childhood Malnutrition

The world-wide impact of malnutrition is difficult to measure. The toll includes not only millions of deaths each year, with unthinkable human suffering and sorrow, but an array of debilitating illnesses as well. Blindness, low birth weight, developmental delay, and cretinism are only a few of the disturbing faces of malnutrition. The sheer number of children affected is staggering: 15 million children are born malnourished each year (low birth weight), 40 million are wasted from acute malnutrition, and approximately 125 million are stunted for life (World Health, 1984, p.16). The human loss is a tragedy of unequalled proportions. Over the last decade an increasing number of articles have been published addressing the scope and impact of malnutrition. This section of the literature review will be limited to a single article which characterizes the more subtle social, political, and human issues surrounding malnutrition.

Malnutrition is a problem well known to the thousands of street children of Brazil. Linhares, Round, and Jones (1986) compared a control group of privileged Brazilian children ages 7 to 17 years to a group of underprivileged children of the same age range. Malnutrition

delayed the onset of the adolescent growth spurt in the underprivileged group. Bone growth was delayed by as much as 4 years and 8 months. Over 80% of underprivileged children experienced delays of at least two years. Males were more severely affected. Menarche delays in underprivileged girls were approximately two years. Total protein levels were similar in the two groups, however albumin-globulin ratios differed. Underprivileged children had higher globulin levels consistent with a higher incidence of infections. Racial groupings within the sample did not significantly affect the nutritional findings. Environmental conditions accounted for the observed growth failure. Males were probably more severely affected due to the social practice of expecting adolescent males to work as street vendors. Adolescent females were more often kept at home or were employed in domestic service where the food supply was more adequate.

> We conclude from this study that destitute and malnourished children from the less privileged layers of the Brazilian population (which constitute practically half of the country's population of 120 million) are at risk of suffering delayed skeletal, and probably sexual, maturation. Boys of all ages (6 years and onwards) are seen roaming the streets of most cities of the country trying to sell fruit, candies, and other objects; begging for money; or involved in delinquency. This constitutes a serious social problem in Brazil. An

> effective government program in this potentially rich country should be launched in order to avoid the continuation of this situation and its unfortunate consequences for the physical health of over half its citizens (p. 557).

Anthropometric Indicators and Nutritional Status

A fundamental step toward dealing with the problem of malnutrition is recognition and classification. According to Macfarlane "children in the developing world live in the shadow of personal disaster--that of inapparent malnutrition" (1984, p. 533). Only a small percentage of malnourished children are obvious even to trained clinicians. With so many children affected, the need is particularly acute for safe, efficient, and accurate methods for assessing nutritional status. Sutphen (1985) has noted that anthropometric methods of assessment are based on the fact that healthy children grow to normally distributed adult heights and weights. Variation is small and is largely an expression of genetic potential in well nourished children. In contrast, malnourished children grow at rates which are primarily determined by adverse environmental factors.

Sutphen reviewed a variety of methods which are useful in evaluating growth and nutritional status: Growth velocity (GV) is the rate of change of stature. GV changes more slowly and is a sensitive

indicator of chronic malnutrition. Stature must be evaluated at intervals of about one year if change is to be accurately assessed. A variety of environmental factors including nutrition affect stature. Mean stature is proportional to socioeconomic status in ethnically homogeneous populations. Height stunting develops slowly and reflects chronically inadequate nutrition. Marshall (1974) found that growth rates in normal children are greater in the spring and early summer. This trend was not apparent in blind children. This apparent role of light in regulating GV is not well understood. Adolescence triggers a significant surge in GV and must be considered as a dominant factor in GV of older children.

Weight-for-age (W/A) is more often used as an indicator of child growth and malnutrition. The (U.S.A.) National Center for Health Statistics (NCHS) standards are recommended by the World Health Organization (WHO) for comparison. The greatest disadvantage of W/A is that it provides a flat or one dimensional view of child growth and health. Without knowledge of the child's height it is difficult to evaluate the relationship between long-standing and recent nutritional patterns. The need to evaluate a child for evidence of both acute and chronic malnutrition dictates a two dimensional view of growth. Acute malnutrition is apparent in either a recent weight loss or in a decreased weight-for-height (W/H). If a child fails to obtain adequate nourishment the short-term effect is failure to gain or maintain body

stores. Weight decreases while height remains constant. At what point is a child's W/H abnormal? In a normally distributed population, such as the NCHS standards, 95.4% of children have a W/H between -2 standard deviations (SD) and +2 SD. Of the remaining children only 2.3% have a W/H below the -2 SD level.

Waterlow (1975) proposed that children whose W/H is less than -2 SD below the mean be classified as wasted. Wasting is evidence of recent starvation with a loss of body mass. W/H is independent of age. Waterlow's system of classification included both H/A and W/H. Using -2 SD as the cut-off point, he identified four groups of children based on anthropometric indicators of nutritional status: 1) normal, 2) stunted, 3) wasted, and 4) both stunted and wasted. Another way of describing the categories is: 1) no convincing evidence of chronic or acute malnutrition, 2) evidence of only chronic malnutrition, 3) evidence of only acute malnutrition, and 4) evidence of both chronic and acute malnutrition. In the Waterlow system, normal children are not necessarily healthy or growing well--they simply have not crossed the -2 SD threshold for stunting or wasting. The value of the Waterlow classification system lies in the descriptive and predictive power of the categories.

Clinical examination of individual children must include an assessment of fluid balance along with weight findings. Weight measurements can be skewed by dehydration or edema. Nonetheless,

acute weight changes in an individual child are of great value, even apart from a consideration of their height or weight for height. The direction and magnitude of weight change is one important basis for determining the child's recent growth, general health, and response to disease.

Many other useful anthropometric indicators have been proposed and studied, including: skin-fold thickness, bone growth, muscle mass, percent body fat, percent nonfat body mass, head circumference, lower limb length, various ratios of indicators, and mid-upper arm circumference. Alam, Wojtyniak, and Rahaman (1989) studied the value of six anthropometric indicators in predicting mortality among children ages 12-59 months in Bangladesh. The indicators were based on weight, height, arm circumference, and age. Arm circumference alone had the highest predictive value. Arm circumference screening was a valuable and inexpensive means of identifying young children at risk for dying. This study illustrated the need to carefully consider the selection of indicators, since each indicator is sensitive to specific features of child growth and health. The complicity of findings also calls for caution in the use of indicators. Smedman, Sterky, Mellander, and Wall (1987) assessed the importance of nutritional status for survival. They found that H/A not W/H was positively correlated with survival. However, the number of children in the household

was a better discriminator for death secondary to measles than any anthropometric indicator of nutritional status.

A rather curious observation has been noted by several researchers during mass screening of children for malnutrition. Stunted children have been observed to have a higher W/H than the NCHS reference sample. Recently, a group of researchers studied this issue among stunted children in Peru. Boutton et al. (1987) examined 139 poor children with low H/A who had normal or high W/H to determine body composition. 89% of the females and 90.4% of the males were below the 50th percentile for H/A by NCHS reference data. 59.7% of the children were below the 10th percentile HA. However, 74.2% of the females and 63.0% of males were above the 50th percentile of W/H. The mean percent fat by triceps and subscapular skinfold thickness was 9.4 ± 3.0%. The mean total body water (TBW) was higher than predicted by height and weight at 67.4% ± 6.4%. According to the authors' calculations, these undernourished Peruvian children had higher than normal amounts of extracellular body water. The implication is that increased amounts of extracellular water accounts for the extra weight found in stunted Peruvian children.

Not all researchers have accepted proposed classification systems and NCHS norms. Richardson (1980) questioned the use of standard deviation scores for assessing malnourished populations. She argued for the continued use of percentile distributions constructed from

studies of well-nourished children (percent median). Richardson also noted the tendency for under-nourished black children to become a relatively well-nourished group after puberty. She pointed to the higher incidence of obesity which occurred among poor women in South Africa as further evidence that malnutrition was oversimplified by models based on growth alone. Richardson also questioned the validity of only using the Waterlow classification system for children less than 10 years. She argued that a classification system should be meaningful throughout the life span.

Cockrell and Mata (1979) disputed the need for the development of different growth curves for various ethnic and socioeconomic groups. They argued that evidence clearly points to common genetic potential in the human race except for small and isolated gene pools. The authors suggested that the main determinant of growth differences is adverse environmental influences, particularly deficient diets, overwhelming infections, and maternal illness and inadequate nutrition. They argued that "the socioeconomic environment is obviously the primary culprit, hence the importance of not disguising widespread stunting with special growth standards for those populations" (p. 347).

Addressing the question of genetics versus environment, Habicht, Martorell, Malina, Yorbrough, & Klein, (1974) conducted a review of studies relating to the growth of children from differing ethnic

backgrounds. The data indicated ethnic differences account for only 3% variation in height and 6% variation in weight in the growth of pre-adolescent children. Studies involving children of similar ethnic backgrounds and differing sociocultural backgrounds revealed that sociocultural differences account for variations of 12% and 30% for height and weight, respectively.

Today, under the leadership of WHO, general agreement exists on the use and value of anthropometric indicators and the NCHS reference data set. Recently, Wennberg (1988) used the NCHS standards to characterize a sample of 17,017 of preschool children--26% of the target population Cape Verde, Africa. He found 3.1% of children were wasted and 15.4% of children were stunted with significant differences from island to island in the archipelago. This study was designed to establish baseline data. Interestingly Wennberg's results were not very different than those obtained a decade earlier in much smaller samples by other researchers. This gives support to the use of smaller samples designed to study the impact and epidemiology of malnutrition in small population, such as traditional communities.

Evidence of Multifactorial Causation

Efforts to demonstrate the role of single factors in the etiology of childhood malnutrition have largely failed. Dewey (1983) focused on the effect of gastrointestinal parasites and infections on the nutritional

status of children between the ages of 2 and 4 years in Tabasco, Mexico. The children lived in rural communities in a tropical, lowland environment where the Mexican government established an agricultural development project in the late 1960s. The project organized 6000 families into 22 "ejidos" of 200 to 300 families each. Rows of cement block houses were provided with water, electricity, primary schools, and clinics. Each family had 2 hectares of land to cultivate. Dewey's findings make a strong case for the argument that studies which focus on only one factor or category of factors fail to show reasonable and expected relationships. In Dewey's study in Tobasco, Mexico: 1) children with Ascaris, Trichuris, and Strongyloides were taller and fatter than children with no parasites. Furthermore children with Strongyloides had significantly higher hematocrit levels than children w/no parasites. 2) No children showed biochemical or clinical evidence of protein deficiency, yet stunting was common among the children. The children consumed 99% of the Mexican RDA for protein (37 gm/day). Finally, 3) no significant differences were found in the nutritional status of children living in developed communities with central services as compared to children living in makeshift communities on the outskirts of town. The group in town with "better sanitation" actually had more parasites than the rural group, despite the availability of toilets in each home in town.

Simple models are unable to explain such disparate findings. Apparently the relationship between growth and the presence of intestinal parasites is not a linear one. Parasites may not always be a critical factor in child nutrition. These findings support the need for a multifactorial model which allows for the interplay of a constellation of factors impacting child growth. The value of defining and weighing the impact of these variables lies in the uniqueness of each community and each home. Knowing which variable profiles favor growth may make it possible to make more intelligent decisions about priorities for intervening in specific homes.

In fairness to Dewey, it is important to note that efforts were made to consider a wider range of factors which could explain some of the unexpected outcomes. Dietary intake analysis was detailed enough to determine that children in the study consumed only 85% of the RDA for calories, 64% of calcium, 63% of iron, 64% of riboflavin, 53% of niacin, 83% of ascorbic acid, and 30% of vitamin A. Biochemical assays supported dietary intake data. Only 53% of the children had adequate levels of vitamin C, 64% had adequate levels of vitamin A, 52.5% had adequate riboflavin, and 86% had adequate hemoglobin levels. Sixty-eight percent of the children were below the 3rd percentile of height-for-age. This indicates that the primary deficiency accounting for the widespread stunting evident in these children was due to inadequate

intake of calories, vitamins, and minerals, not protein. Anemia was apparently more a result of diet than parasitic infestation.

Dewey also made an effort to expose both demographic and environment variables which interacted with the study variables. Females were significantly more likely to have poor nutritional status than males, based on both dietary intake and anthropometric findings. Seasonal differences were also found to be important. Winter illnesses involved respiratory problems and resulted in less growth failure than summer diarrheal diseases. Dietary intake did not vary significantly from season to season in the Tabasco study. The findings of Dewey and many other researchers led to a reconsideration of classical models of epidemiology and nutritional disorders.

> In its modern sense, epidemiology has progressed from a classical concern of causality as expressed within biological limits to recognition that a variety of social factors have proportionate significance in the origin and behavior of human nutritional disorders. ...Nutritional epidemiology, so employed, becomes a general scientific discipline, widely purposed and incorporating objectives beyond public health: measures concerned with social welfare, economic growth, political stability, and behavioral compatibility with fellow humans and other living things. (Gordon, 1978, p. 2339)

There is evidence of a broadening of research approaches to the study of malnutrition. Martorell, Leslie, and Moock (1984) studied 510 children between the ages of 3 and 10 years of age living in subsistence farm households of rural Nepal. Age, district of residence, household income, breast-feeding, and several dietary factors were significant predictors of nutritional status. Age of the child was negatively correlated with weight-for-height. Stunting and weight-for-age was more widespread in one district. Household income was positively related to all anthropometric indicators. Longer durations of breast-feeding were negatively related to height-for-age. Of 56 food items surveyed, the consumption of 10 items varied significantly. Only 6 of the 10 items showed strength as predictors of growth and those 6 were included in the final regression analysis. Consumption of beaten rice and sugar or molasses was positively related to height-for-age and weight-for-age. Intake of pigeon peas (a legume) was positively correlated with weight-for-age and weight-for-height. The authors demonstrated the influence of multiple factors on child nutritional status.

In a study of pre-hospital factors, Oyedeji (1984) investigated the epidemiology of severe malnutrition in 88 hospitalized children in Nigeria. Prevalence of severe malnutrition was highest in the 6-18 month age group. Parental separation or divorce was found in 72.7% of households. Poverty and polygamy prevailed in more than half of

the families. Measles or gastroenteritis preceded hospitalization in 30.7% and 33% of cases, respectively. Breast-feeding had been stopped within three months of hospitalization in 46.6% of cases. Breast-feeding was stopped before three months of age in 11.4% of cases. The mother was expecting another child in 15.9% of cases. The mother was nursing another child in 4.9% of cases. Only 4% of fathers and 28% of mothers were unemployed. Oyedeji described a composite environment of factors predisposing to severe malnutrition in hospitalized children. Risk was based on a combination of factors including poverty, disturbed family unit, disrupted breast-feeding, and recent measles or prolonged gastroenteritis.

In a comparison of urban, rural, and slum communities, Bagenholm, Kristiansson, and Nasher (1988) studied preschool children in Democratic Yemen. They found 8.7% of the children were wasted and 35.2% were stunted. There were significant differences between rural, urban, and slum groups among infants through age 24 months. In urban communities they found early and widespread use of diluted milk-powder with shorter breast-feeding periods. In rural communities they found longer, exclusive breast-feeding, poorer sanitation, and an increased attack rate of diarrheal disease. Mothers were similar in height, but were lighter in slums and rural areas than in urban communities.

The effect of environment on the growth of African children was investigated by Cutting, Elton, Campbell, Minton, and Spreng (1987). They recorded height, weight, and age for 651 children ages 12-69 months in rural, subequatorial Africa. Stunting (defined as height less than -2 standard deviations based on National Center for Health Statistics, USA) was found in 46% of the children. A large portion of the children (20%) fell below the -3 SD level. Wasting was found in only 1.4% of the children. Only 0.6% of the children were both stunted and wasted. The authors raised the question of whether growth failure was a factor of harsh environmental conditions, rather than malnutrition alone. One other explanation advanced by the authors was that growth in African children is repeatedly interrupted by infections. During brief recovery periods weight gain would occur, however height increases which take longer would not occur. The authors pointed to evidence for this pattern of catch up growth in children recovering from celiac disease.

The Ok Tedi nutrition project (Lourie, 1986) was a descriptive study of a group tribal people who were facing economic development with the growth of a mining camp in remote New Guinea. Proximity to the mine correlated with the fatness and height of the Wopkaimin, probably due to the availability of imported foods. Females of all ages were significantly less well nourished than males. Inability to establish exact age of infants and children makes comparison to norms more

difficult, however a significant portion were malnourished by several indicators. Approximately 40% of the children ages 1 to 5 years had arm circumferences of less than 14 cm, whereas about 12% had arm circumferences of less than 12.5 cm. 65% of children ages 2 to 9 years had positive malaria slide. 19.4% of the 766 subjects were children 5 years and younger. Alterations in growth included a significant depression in the weight for age curve of boys and girls from age 2 to 3 years. This period of growth.was followed by a marked depression in the curve representing the percent of adult height achieved from until 10 years of age. Wopkaimin children attain maturity in height about four years later than a well-nourished British sample. By 18 years of age Wopkaimin males and females fell at about the British 3rd percentile for height.

Bairagi, Chowdhury, Kim, Curlin, and Gray (1987) studied the association between diarrhea and malnutrition in rural Bangladesh. They found that the duration, but not the incidence of diarrhea was related consistently to nutritional status. Poor nutrition measured by weight-for-age or weight-for-height was associated with longer duration of diarrhea. The authors regressed the number of diarrheal episodes and the duration of diarrheal episodes on age, floor space, and maternal education. Only age appeared to be a significant predictor ($p<0.01$). Younger children had more episodes of diarrhea and younger children had diarrheal episodes of greater duration. The authors found

that children who had diarrhea for more than 10% of days over an 8 month period had lower weight and height gain.

The Case for a Holistic Approach

Leonardo Mata has been one of the most outspoken advocates of the need for new holistic approaches to the study and resolution of childhood malnutrition. After many ethnological investigations of the role of parasitic disease in traditional and transitional communities, Mata (1982) concluded that the main determinants of parasitic disease are poverty, lack of education, "deficient home technology" (p. 871), population density, and rural lifestyles. According to Mata traditional medical interventions failed to adequately consider the sociocultural determinants of malnutrition and disease. As a result most development efforts failed because of single factor approaches. Mata advocated a new model for research and service. He asserted that "the holistic approach (implementation of several types of intervention simultaneously) appears to be the most reasonable means of improving the quality of life" (p. 877).

Mata also suggested that this new model should emphasize maternal and child health with attention to: 1) optimizing nutrition, 2) managing diarrhea and dehydration, 3) improving personal and home hygiene, 4) immunizing children, 5) organizing an effective community environmental effort, 6) providing pharmacological

means for prevention and control of diseases, and 7) family planning. Taken together these approaches comprise the primary health care approach, which has been promoted by the WHO over the last two decades. However, Mata's work is unique in the explicit call for a departure from conventional biomedical research models.

> Finally, research should focus on ethnic, cultural , and behavioral factors that determine infection, malnutrition, and underdevelopment in the community. ...The importance of considering several interrelated measures instead of isolated steps has been pointed out in many investigations and is clear from day-to-day experience. (p. 878)

Mata's claim that traditional, single intervention approaches have generally failed to improve nutritional status and health is substantiated by a recent report. Lindskog, Lindskog, Carstensen, Larsson, and Gebre-Medhin (1988) studied the effects of a new piped water system on the mortality of young children in rural Malawi. They failed to demonstrate a significant decrease in mortality, however mortality was decreased in households using the new system. Mortality rates were highest in the first year of life. Since breast-feeding was almost universal and the average weaning age was 19 months, the impact of water quality on this population may have been a less important factor in mortality. W/H was most highly predictive of mortality risks among the 137 children who died during the three year

study period. Upper arm circumference and weight-for-age were also highly predictive of mortality risk. The mortality rates outside the neonatal age group were highest in the second six-month period of life--from 6-11 months. The authors conclude that a tendency towards reduced mortality was evident for children living in households using the piped water system. However, they pointed out that a complicating variable was the water storage method. Contamination of water supplies frequently occurred after the water was obtained from the public tap. This may account for the fact that a follow-up study failed to demonstrate a change in nutritional status among young children.

Others have asked why traditional approaches to malnutrition have generally failed to produce desired changes. According to Keusch and Scrimshaw (1986) global efforts to arrest malnutrition have generally failed because of the complexity of underlying biological and social causes. They contended that a lack of understanding of social factors has been the main shortfall. The authors acknowledged that malnutrition affects several subpopulations, however they argued that the nutrition of young children deserves the greatest attention. Keusch and Scrishaw pointed to the disparity of outcomes among children living in adjacent households as evidence that "the feeding, health, and hygienic practices of the mother--succinctly characterized by Mata as 'maternal technology'--may make the difference" (p. 282). The authors focused on the inter-relationship of infection and

malnutrition. They identified nine measures to reduce the prevalence and consequences of infections: immunization, oral rehydration, breast-feeding, feeding children during illness, adequate weaning foods of local origin, nutrient fortification, growth monitoring, improved environmental sanitation and water supplies, and education.

Other researchers have noted the importance of household factors, yet have not defined or studied specific variables. Cameron and Geoffrey (1986) conducted a cross-sectional study of 297 Aboriginal children in four river communities in the Murray River region of Australia. As expected, the authors found an increased incidence of moderate malnutrition among the communities. The frequency of low birth weight in the study population was twice that of the local non-Aboriginal population. Among the Murray River children 7% were stunted, 4% were wasted, and 17% were moderately malnourished (less than 80% of weight for age). The authors pointed out that differences between communities were greater than the differences between the total sample and non-Aboriginal Australian children. Cameron and Geoffrey attributed the differences between community "to the standards of housing, the degree of community organization, and the social pressures that were experienced by each community" (supplement, p. 5). However, apparently no effort was made by the authors to describe or measure specific aspects of these factors. The authors concluded that community resources, including

Aboriginal participation in primary health care, accounted for improved environmental conditions and better nutrition.

Differences between apparently similar communities have been noted by several researchers. Comparing two Indian communities, Mata drew distinctions between the epidemiology of malnutrition in traditional Central American communities. The Guaymi lived in isolation in Costa Rica. Family huts were scattered at a great distance from one another. Mata found no wasting among Guaymi children. He suggested that the absence of wasting could be attributed to lack of environmental contamination, to the acceptance of breast-feeding, and to the persistence of positive child-rearing practices. Weanling diarrhea with poor hygiene and low-nutrient foods was widespread. Periodic introduction of contagious illness from outside the community also contributed to an infection-malnutrition complex which caused stunting among many Guaymi children. In contrast to the Guaymi, the Cauque Indians of Guatemala lived in closer proximity. The Cauque enjoyed improved living conditions and a better diet than the Guaymi, yet malnutrition among Cauque children was much more severe than among the Guaymi. Mata described the Cauque homeland as a rural setting where "land saturation" (p. 13) resulted in a contaminated environment and a much higher rate of enteric infections. Mata concluded that the most serious problems contributing to malnutrition among these two traditional cultures are:

1) land saturation, 2) poverty and child deprivation, 3) a low level of education, and 4) a lack of basic technologies (affecting sanitation, agriculture, and housing).

Mata also drew an important distinction concerning education. He suggested that education as a factor impacting child health is not necessarily correlated with the level of formal education completed by the mother or father. According to Mata, beliefs and practices directly affecting child health are the real issue. The most critical educational factors are the family's beliefs and practices pertaining to breast-feeding, food preparation, feeding, general child care, care of sick children, water storage, and basic hygiene.

Mata also proposed a model for malnutrition which used an "iceberg" analogy to describe the fact that most malnutrition is hidden. Mata's constructed different models for traditional, transitional, and modern cultures. In all three models invisible malnutrition was much more prevalent than visible (severe, clinically obvious) malnutrition. Three causes of childhood malnutrition were considered in the models: 1) under-development, 2) neglect and abuse, and 3) organic disease. The size of the icebergs decreased from traditional to transitional to modern cultures. The relative frequency of the three causes also evolved from a prevailing cause of underdevelopment in traditional cultures to a prevailing cause of neglect and abuse in modern cultures. Concluding, Mata called for a better definition of

priorities and a reorientation of efforts. He suggested that in the past too much emphasis has been placed on clinical and laboratory studies of malnutrition, while a holistic approach to the problem has been neglected.

Using vital statistics, Jayachandran and Jarvis (1986) designed and tested several models to consider the effect of socioeconomic development, medical care, nutrition, and the status of women on infant mortality rate. Through a review of the literature the authors identified five dominant factors believed to influence IMR: 1) economic development, 2) literacy, 3) female labor force participation, 4) health care, and 5) nutrition. Data for the models included summary statistics from sixty less developed countries. Variables included: 1) per capita energy consumption, 2) per cent women aged 15 years and over who are illiterate, 3) percent of women aged 15 and older who are in the service sector, 4) number of physicians, nurses, and midwives, and 5) per capita calories consumption as percent of requirement. Indicators of social and economic development were modeled as exogenous variables. Medical care, nutrition, and status of women were viewed as endogenous (determined in part by exogenous variable effects). The authors found that good nutrition and the presence of midwives were more significantly related to IMR than were employment status of women and presence of doctors and nurses. Concluding, the authors noted their findings as evidence that multiple

interventions should be integrated into a primary health care approach. Jayachandran and Jarvis also cautioned against a trend toward exaggerated emphasis on family planning, evident in primary health care in India.

In recent years, an increasing number of studies have examined the specific role of household factors and the growth of young children. In a study of child mortality in Morocco, Crognier (1987) employed a multivariate analysis to evaluate the effect of household composition, number of wage earners, occupation, electricity supply, and running water on fertility and infant mortality. Household composition variables included monogamous versus polygamous marital structure and number of persons in the household (reported as either less than 7 or 7 or more.) Electricity and tap water was reported as either available or lacking in the home. Four occupational categories were identified for analysis. A polarity of groups was identified by Crognier by correspondence analysis. Material comfort was strongly associated with monogamy, use of contraception. Material comfort was moderately related to small household size, lower fertility rates, and lower infant mortality. There was a strong association between the lack of material comforts, polygamy, the absence of contraception, and the highest mortality rate. The highest fertility classes were strongly associated with higher mortality rates and large households.

Bley and Baudot (1986) reported that households where husbands were employed in service professions were different from other urban households. Service occupations (civil service, education, the military, and the police) were associated with households that had the largest number of wage earners, smaller number of persons per house, presence of tap water and electricity, and lower infant mortality rates. The authors also compared the age occurrence of exogenous infant mortality (deaths causes by living conditions rather than difficult labor or neonatal disease) in urban versus rural areas. They found that infant deaths rates increased starting earlier in urban settings at the fourth month of age in urban settings They found an increase in infant deaths among disadvantaged urban households. By four months of age the risk of death for urban infants began increasing. Rural infants were less likely to die at the same age. Lower mortality rates was attributed to persistence of breast-feeding among rural mothers.

Recently, Geefhuysen and Soetrisno (1988) examined the nutritional status of poor children in Java. The authors advocated the use of wasting as the suitable criteria for prioritizing nutritional intervention in countries where a large portion of children are stunted. They called for more intense efforts to understand the socioeconomic basis of malnutrition.

> More attention must be paid to information other than weight: the mother's story, observations by the ...worker, knowledge of the family. ...Common sense and personal experience of village mothers must be better exploited; sensible, economically acceptable advice and help in kind should be added. (p. 856)

Sigman, Neuman, Baksh, Bwibo, and McDonald (1989) demonstrated the need for additional research into the relationships among nutrition, social environment, and child growth and development. They challenged the bias toward focusing on family background (socioeconomic status, parental intelligence quotient, and parental literacy). In their work with 110 Kenyan toddlers, the authors found that home rearing variables were consistently stronger predictors than family background variables. Food intake was positively related to anthropometric status, play behaviors, and total amount of verbalization. Measures of length and weight were positively related to Bayley Mental and Motor scores, even when family background and home-rearing practices were covaried. The authors concluded that traditional approaches to intervention which focus on socioeconomic status and parental education are more costly, more time-consuming, and of less value than improved child-feeding and home rearing factors.

Progress and Pitfalls

Evidence exists that progress has been made over the last decade. Advancement of malnutrition theory is apparent in the work of Pradilla (1984), who identified three environments of malnutrition: disasters (natural or man-made), the developing community (where marginal nutritional status and frequent infections prevail), and the industrialized setting. Pradilla suggested that various factors interact in different ways in each of these environments. The effect of a change would depend on the context. A new water system, immunization services, or a new highway could not be expected to have the same impact on malnutrition in different communities. Pradilla also identified several important factors affecting the nutritional status of young children, including: food availability, environmental hygiene, time available for child care, feeding practices, frequency and duration of illnesses, fuel and water supply, and practices related to feeding ill children. Pradilla concluded that low-cost, effective means were available to correct the prevalent causes of malnutrition. The lack of success of past efforts was attributed to the absence of a multidisciplinary perspective. Pradilla asserted that "an intersectoral approach is essential for dealing with the variety and intricate interplay of the adverse factors that cause malnutrition" (p. 4).

Other researchers have contributed to the end of single intervention approaches. Fink (1985) challenged the notion that breast-

feeding behavior among indigenous or traditional societies is uniform, as suggested by popular literature and health policy planners. In a study of two rural Mexican communities, Fink found evidence that widely-held beliefs about breast-feeding in rural Mexico were not substantiated. Fink found that a wide variety of behaviors were exhibited among the women of the communities under study. Unexpected findings included: 1) most women believed that early milk (colostrum) is too strong for the baby, 2) supplemental feeding began on the first day of life and resulted in diarrhea in most newborn, 3) breast milk was believed to be the cause of diarrhea in infants, 4) women who were experiencing any sort of pain during lactation were believed to produce bad milk and they were instructed by the midwife to stop breast-feeding, 5) commercial bottle beverages posed a greater threat to continuation of breast-feeding than did commercial powdered milk and infant formulas, 6) many women complained of inadequate milk supply and difficult breast-feeding, and 7) women did not perceive lactation as an important means of child-spacing. Fink suggested that breast-feeding was culturally determined and subject to many intervening factors at the community level. She cautioned against viewing breast-feeding as a panacea. Fink argued that efforts to improve nutrition and reduce fertility rates among traditional peoples must be based on knowledge of individual communities.

> Human behavior cannot be studied under rigorous laboratory conditions, but systematic microstudies of communities living under different conditions of time and place may contribute some answers to those questions with which biologists are presently concerned in determining the relationship between nutrition, lactation, and fertility. (p. 1304-1305)

Mata (1978) has also examined the role of breast-feeding in infant health in traditional societies and has noted three common problems: 1) maternal malnutrition and diminished breast milk supply, 2) lack of appropriate weaning foods and nutrient rich foods for maternal consumption, and 3) infections (especially enteric) which reduce intake of food, increase wastage, and result in loss of body stores. He suggested that supplementation has always been pursued by traditional cultures due to these complicating factors. Mata concluded that early weaning and poor supplementary feeding practices are two important aspects of deficient child-rearing practices. He identified three factors expected to increase the success of breast-feeding: 1) a secure and unstressful environment, 2) availability of advice for the inexperienced mother, and 3) acceptance by the husband of the value of breast-feeding. Mata called for investigation of the causes of premature weaning with attention to the interaction of culture, lifestyle, and society. He also identified the need for health services

research which would improve acceptance and success in breast-feeding.

Other researchers have focused on the complexity of behavioral change. Tonon (1980) related the experience of a rural Guatemalan community where a health education project was conducted. The implementation of a sanitation project was undertaken through formation of a voluntary committee of villagers. Desirable behavioral changes were identified prior to the project and were measured at the completion of the 18 month program. Piped water, soap, and other materials for improved hygiene were introduced and promoted. Behavioral objectives of the project included: hand washing, washing of raw foods, covering of cooked food and stored water, cleanliness of the water tap area, increased potable water consumption, animals kept out of the kitchen, kitchen kept free of fecal material and garbage, family has access to a latrine, and latrine used by the family, kept clean, and in usable condition. Tonon examined several variables as predictors of change, including: wealth, education, cosmopolitism, attitudinal modernity, and voluntary participation in the project. Only participation was highly predictive of behavioral change. Tonon concluded that education efforts should emphasize participation when behavioral change is the desired outcome.

The multidisciplinary, holistic approach to malnutrition is not without pitfalls. Habicht (1984) identified what he believed to be a

fundamental problem at the center of the malnutrition issue--acceptance of responsibility by the health sector. Habicht described a tendency among health professionals to reject responsibility for addressing the problems of food supply, nutrition knowledge and practice, and economic development. He also suggested that solutions to the problem of malnutrition must be based on interventions at all levels of activity, including individuals, households, communities, nations, and the family of nations.

Habicht advocated specific countermeasures against four causes of malnutrition: 1) poverty, 2) shortage of nutritious foods, 3) ignorance, and 4) sickness. He also listed specific factors which need to be examined more closely, including: income, expenditures, food and nutrient subsidies, rationing, food prices, diversity of the diet, innovation in agriculture, processed and fortified foods, nutrient supplementation, food imports, breast-feeding, weaning practices, child feeding patterns, use of health care services, immunization, food hygiene, sanitation, housing, water supply, and endemic illness. Habicht cautioned that countermeasures which were effective in one setting might adversely affect child nutrition in another setting. He suggested that several interventions would usually be necessary and that those interventions would require the cooperation of several sectors, such as health care, eduction, agriculture, and labor. Habicht argued that community-based primary health care services are well

suited for implementing the range of countermeasures needed in most developing communities. Finally, he called for improved nutritional surveillance to: 1) clarify needs and prevent nutritional crises from occurring, 2) evaluate the impact of interventions, and 3) direct planning and policy activities.

Political obstacles to implementing comprehensive development strategies are formidable. Recently, Anita (1988) described a comprehensive primary health care project which addressed the needs of a rural population of 30,000 people in India. Over a 6 year period, the Mandwa project succeeded in implementing a community-based system of primary health care workers. Dramatic gains in vital health statistics and basic services were achieved by recruiting and training village health workers (predominantly women). Services were delivered to households rather than from a central clinic. The approach was cost-effective, but came under attack from community leaders and the established government health organization whose traditional power roles were challenged. As a result of sustained political opposition, the project was eventually forced to suspend services. According to the author, the fate of the Mandwa project illustrates the value of primary health care, as well as the economic and political obstacles which have prevented it from being widely implemented.

Summary

Healthy, well-fed children grow at similar rates regardless of ethnic background. Genetic variation in growth is small in comparison to the effect of malnutrition and poverty. The WHO recommends the use of the NCHS reference population for examining weight-for-age, H/A, and W/H of children. Waterlow's system of classification, based on H/A and W/H, is widely used to describe the incidence of malnutrition in communities. Childhood malnutrition is a devastating problem. There is general agreement that malnutrition is the result of many factors. Traditional approaches to eliminating malnutrition through single interventions have failed. Newer approaches recognize the value of simultaneously implementing several types of assistance based on each community's unique needs. A priority for reducing the impact of childhood malnutrition is to identify key household determinants of child growth. The role of the caretaker is central to the health and growth of the young child.

CHAPTER III

CONCEPTUAL FRAMEWORK

Theoretical Framework, A Synthesis of Theories

A synthesis of the work of Nightingale, Mata, and Roy provides a framework for this investigation. The child, like the recovering patient, responds to the immediate surroundings. Certain environmental factors encourage growth. Other factors lead to illness, loss of appetite, and malnutrition. The quality of the child's environment is dependent on the level of adaptation of caretakers and is related to specific household factors.

Florence Nightingale suggested that the role of the professional nurse included managing the environment to promote recovery. Her efforts are the first recorded by a nurse describing specific household factors which influence the health of children. Later, Leonardo Mata suggested that a malnutrition-infection complex accounts for most growth failure among young children in developing countries. Mata, a microbiologist, pointed out that household factors which determine child growth are predominately shaped by caretakers. Sister Callista Roy further described the modes of adaptation by which individuals respond favorably to their environment. Her model suggests that adaptation can involve physiologic, self concept, role-function, or

interdependency factors. Each of these modes of adaptation have bearing on the growth of young children, who depend on adult caretakers.

Nightingale's Health of Houses

There can be little question that Nightingale was an extraordinary observer of the environment. She identified five basic factors concerning the health of houses: 1) pure air, 2) pure water, 3) efficient drainage, 4) cleanliness, and 5) light. Nightingale also commented on many other factors including: management skills of caretakers, noise, sleep, aesthetics, feeding of the sick, frequency and amounts of meals, contamination of foods, palatability of foods, nutritive value of foods, appetite, and the importance of close observation by the caretaker. This extensive list of factors appeared in her notes about general nursing practice. However, Nightingale left no question about whom the comments applied to: "The whole of the preceding remarks apply even more to children and to puerperal woman than to patients in general." (Seymer, p. 209)

Mata's Environments of Childhood Malnutrition

Leonardo Mata proposed an informal model of childhood malnutrition which describes three different contextual environments: the macroenvironment, the microenvironment, and the

matroenvironment. (Mata, 1979) Each of these environments contributes to the health status of children by determining the adequacy of nutrition and the extent of exposure to infectious agents. Mata asserted that malnutrition is a man-made phenomenon, since wild-animals living in small population groups do not exhibit malnutrition. The macroenvironment is man's habitat- the soil, water, and air. Malnutrition and poverty are concentrated in tropical and subtropical belts around the world. According to Mata, climatic conditions in these locations favor the malnutrition-infection complex. Organisms pathogenic to man, animals, and plants abound in this macroenvironment. Mata also pointed out the pervading impact of social forces in these regions, where political and economic systems fail to provide for the basic welfare of most people.

The microenvironment is the home, where the child comes in direct contact with the immediate physical world. Mata suggested that deficient sanitation is the most detrimental aspect of housing. Poor hygiene, inadequate food preparation and storage, exposure to insects and other vectors of disease, inadequate waste disposal, and lack of safe piped-water supply also play a role in the malnutrition-infection complex. Lack of positive psychological and social stimuli were also cited by Mata as negative aspects of the microenvironment.

The matroenvironment was identified by Mata as the final and most important important determinant of a child's health. Mata

defined the matroenvironment as the mother and her role as caretaker. A mother's health, beliefs, attitudes, behaviors, and interactions with her child shape the child's experience of the wider environments. Mata based this belief on the observation that child growth can be good in extremely primitive settings, when maternal technologies are appropriate. In contrast, growth failure can be found among children living in modern homes where there is no shortage of food. Mata listed the following positive aspects of mothering: breast-feeding, sanitary waste disposal, hand-washing, provision of clean drinking water, avoidance of feces during food preparation and consumption, adequate food storage, and aggressive hydration and feeding practices during the care of ill children.

Roy's Modes of Adaptation to the Environment

Sister Callista Roy proposed a systems model of adaptation which has relevance to Mata's environments of malnutrition. (Roy and Roberts, 1981). According to Roy, a person continually adapts to the environment by responding to stimuli. Adaptation is accomplished through responses by the individual at four levels or in four modes: physiologic, self-concept, role function, and interdependence. Roy's model suggestsd that individuals (or households) have opportunities to adapt to the adverse environment of poverty, infection, and malnutrition through each of these four modes.

Application of the Framework to Research

Due to the large number of household factors which are believed to affect child growth, this investigation was limited to some of the more widely recognized factors. Among the factors selected for study were items related to the physical environment of the home, the beliefs and practices of caretakers, and the resources available to the household. The selection process was further guided by Mata's concept of the matroenvironment and Roy's view of role function as a critical mode of adaptation. Two central household concerns were identified: 1) general health and hygiene, and 2) factors related to the feeding of infants and young children.

CHAPTER IV

METHODOLOGY

The Research Questions

How are household factors related to the growth of young children in two less-developed communities?

Subsidiary questions:

1. Are health and hygiene factors associated with growth?
2. Are early childhood feeding practices associated with growth?
3. Are other socioeconomic factors associated with growth?

Research Approach and Basic Assumptions

Children grow as a result of both genetic potential and adequate nutrition. Failure to grow is indicative of disease or malnutrition. There are reliable biochemical, anthropometric, and developmental markers of growth. Anthropometric indicators are readily obtainable through noninvasive methods. The NCHS reference data for growth are based on anthropometric indicators in a healthy population of children of varying genetic potential and ethnicity. NCHS H/A and W/H values are established indicators (WHO) of adequate growth which are useful in describing growth failure. The rationale for use of

the NCHS reference data by WHO is: 1) the inherent variability of genetic potential and ethnicity in the American sample on which the NCHS data was based, and 2) the general state of good health and adequate nutrition among children in the NCHS sample.

H/A provides evidence of long-standing nutrition, since height changes slowly over many months. Appropriate stature is reached only if nutrition is adequate over a long period of time. Stunting (<-2 SD of expected H/A) is evidence of long-standing disease, malnutrition, or genetic potential. By definition 2.3% of a normal distribution falls below -2 SD. In the NCHS sample, 2.3% of childen were stunted. W/H changes in response to the recent intake of nutrients. W/H is an indicator of the adequacy of body mass for frame. W/H is independent of age. Wasting (<-2 SD) occurs in 2.3% of the NCHS reference population. W/H and H/A standards are different for males and females.

H/A and W/H reflect different aspects of a child's growth and are useful for classifying malnutrition. In this investigation the combined effects of malnutrition were of interest. The average of the standard deviation values of H/A and W/H (relative to the NCHS reference population) for each child was used as a third dependent variable. The value of this statistic lies in its ability to reflect net nutritional status and growth. A child who is tall for age, but wasted will have a lower average standard deviation value than a child of the same age and

height who weighs more. A child who is stunted, but of average weight-for-height will have a higher average standard deviation value (average SD value) than a child of the same age and height who is also wasted. A more conventional net statistic is weight-for-age. However, use of the average SD value in this investigation reflects an interest is evaluating its usefulness in understanding the relationship of household variables to types of malnutrition. The average SD value allows for comparison of stunted children on the basis of weight-for-height and wasted children on the basis of height-for-age.

Basic assumptions of this investigation are summarized below.

1. Growth of young children is an expression of successful adaptation. Malnutrition is an indicator of maladaptation.

2. Height (or length) and weight are valid anthropometric measurements. H/A and W/H are reliable indicators of child growth and malnutrition.

3. Normal genetic and ethnic differences in growth account for the variability of the NCHS reference population. By comparing the study samples to NCHS data, it is assumed that excess variance in the samples is due to the effects of nutrition, health, and child-rearing factors, rather than genetics or ethnicity.

3. A relationship exists between the quality of the household environment and the growth of young children. Aspects of the household environment which influence the growth of young

children can be described by a specific list of factors. A list of household factors should include physical and physiological variables, self-concepts (beliefs) of the caretaker, aspects of role function (practices), and interdependence factors (use of resources).

4. Families are willing to give accurate information to community health workers regarding household factors such as income, feeding practices, health, and hygiene.

Study Design

This is a correlational study designed to examine household factors which affect child growth. The study design actually developed over a number of years as a result of my work as a volunteer nurse and educator in medical mission projects in Central America and Asia. I developed the final survey instrument (Appendices A-F) in February and March of 1989 in Juarez, Mexico, in collaboration with John Feldes. Mr. Feldes was a community health student from the School of Primary Health Care, University of the Nations, Kailua-Kona, Hawaii. He contributed many of the survey questions pertaining to health care. Community leaders in Juarez asked Mr. Feldes to assist in determining the health status of several urban neighborhoods. I was present for the field test of the instrument and the training of a survey team.

Two inventories were devised to examine: 1) health and hygiene and 2) early childhood feeding practices (Tables I and II). All inventory

Table I: Items and scoring strategy for the health and hygiene inventory

Inventory question item	score
•Does your family have any benefits provided such as health care? [a]	y=1, n=-1
•Have you used any medical services in the last year?	y=1, n=-1
•Did you have a birth attendant with you when your last baby was born?	y=1, n=-1
•Is your child sick more than two days a month?	y=-1, n=1
•When your child is sick do you continue to feed her/him?	y=1, n=-1
•Is there a specific place where your children go to urinate or defecate?	y=1, n=-1
•Have all your children received 3 DPT immunizations?	y=1, n=-1
•Have all of your children been immunized against polio?	y=1, n=-1
•Have all of your children been immunized against measles?	y=1, n=-1
•Have all of your children been immunized with BCG?	y=1, n=-1
•Do any of your children have worms?	y=-1, n=1
•Does anyone in your home have a cough that has lasted a month or longer?	y=-1, n=1
•Does anyone in the family have eye problems?	y=-1, n=1
•Does anyone in the family have serious skin problems?	y=-1, n=1
•Has anyone in the family been seriously injured in the last year?	y=-1, n=1
•Has anyone in the home been seriously burned in the last year?	y=-1, n=1
•Are there any adults in the home who can not read or write?	y=-1, n=1
•Do you have any children ages 6-12 who do not regularly attend school?	y=-1, n=-1
•Do you have any children ages 12-18 who do not regularly attend school?	y=-1, n=-1

[a] No response on any item was scored as 0.

Table II: Items and scoring strategy for the early childhood feeding inventory

Inventory question item	score
•Was this child breastfed? [a]	y=1, n=-1
•Do your children eat foods prepared with butter, oil, or fat each day	y=1, n=-1
•Are there days when there's no food to feed the young children	y=-1, n=1
•Do your children often refuse food?	y=-1, n=1
•Do your children eat more than two times a day?	y=1, n=-1
•Do you believe that it is good to BF your baby for 2 years or longer?	y=1, n=-1
•Did you begin feeding your baby foods other than milk by 6 mo of age?	y=1, n=-1
•Are there many foods which you do not believe children should eat?	y=-1, n=1
•Is there often food left over after everyone has eaten a meal?	y=1, n=-1
•Are any of your children sick more than two days a month?	y=-1, n=1
•When your child is sick do you continue to feed her/him?	y=1, n=-1
•Do they eat sweet foods every day, such as sugar, honey, or candy?	y=1, n=-1
•Do they eat fish, meat, eggs, or cheese/yogurt/milk products daily	y=1, n=-1
•Do you feed your children soup three or more times per week?	y=1, n=-1
•Do you usually feed your children 2 or more different foods each meal?	y=1, n=-1
•Are there foods the child can get on their own whenever they want to?	y=1, n=-1
•Are there foods which you prepare especially for the young children?	y=1, n=-1

[a] No response on any item was scored as 0.

questions involved a yes or no response by the caretaker. The use of two inventories reflects the theoretical framework of this investigation. Infection and malnutrition are viewed as principal determinants of child growth in less-developed settings. The scoring strategy is indicated in Table I and II. A negative score on an item (-1) reflects an response by the caretaker which is viewed as adverse to child growth. A positive item score (+1) indicates a response which is favorable to child growth. The range of possible scores for the health and hygiene inventory was -19 to +19. The range of possible scores for the early childhood feeding inventory was -17 to +17. A total score was also calculated as the sum of the two scores. The total score reflects the combined influence of health and hygiene factors and nutritional factors. The range of possible scores for the total inventory score was -36 to +36. Negative inventory scores are associated with an adverse (maladaptive) household environments and were expected to correlate with poor growth. Positive inventory scores are associated with a favorable (adaptive) household environments and were expected to correlate with normal growth.

A number of other factors were studied, including demographic variables related to poverty, housing, sanitation, family composition, mode of transportation, education, health care, and nutrition. This information was collected by observation of the household andthrough additional survey questions asked of the primary caretaker.

Numeric variables included:

- Weekly income
- Number of household occupants
- Square footage of the dwelling
- Number of children in the household
- Age of each child in months
- Height (or length) of each child six years or younger
- Weight of each child six years or younger
- Space in months between each child and the younger sibling
- Space in months between this child and the older sibling
- Number of times/day caretaker believed children should be fed
- Age in months at which breast feeding is usually stopped
- Age in months at which foods other than milk are introduced

Calculated numeric variables included:

- Living space in square feet per occupant
- Annual income in U.S. dollars

Nominal data included:

- Adult caretaker composition of the household
- Water source
- Method of potable water storage
- Sewage type
- Employment type
- Availability of benefits

- Type of home construction
- Type of heating
- Mode of transportation
- Sex of each child

Settings and Subjects

Two communities provided the setting for this investigation. The first community was an urban neighborhood of a large city in Mexico. The second community was a slum area in a large city in the Philippines. The distinction between "urban" and "slum" is largely descriptive and will become apparent in the results of the survey. Generally, the slum community was much more impoverished and was not considered to be a legitimate community by the municipal authorities. Basic public services and utilities were generally not available to residents of the slum. The Mexican urban community was recognized as a legitimate part of the large city in which it was located. A total of 267 children ages 6 years and younger were assessed in the two communities.

Community One

Community One was an urban setting in Juarez, Mexico. Two neighborhoods (colonias) were selected by convenience from among a large number of similar low-income colonias which shared the

following characteristics: 1) the colonias were geographically distinct areas which had been subdivided into 1000-2000 single family lots of approximately 1000 square feet each; 2) each colonia had city water taps located at intervals of about 200 feet along the dirt streets; 3) no sewage drainage system was present; 4) dirt roads demarcated the colonias; 5) no major businesses or public facilities were located in the immediate vicinity; and 6) the colonias were heavily populated, having few vacant lots. The two colonias chosen were selected primarily because of their willingness to allow house-to-house visitations. Local Mexican health workers, Mr. Feldes, and his assistants conducted the actual home visits and data collection.

A systematic sample of every 5th house began at a random point and proceeded along the colonia streets according to a city map of the lots. The initial target sample size was 200 homes, based on the estimate of 10,000 residents (Brown & Brown, 1984) in the two colonias combined. Forty-five homes were visited in colonia one and a total of 47 children 5 and under were weighed and measured. Sixty homes in colonia two were visited and a total of 73 children five and under were weighed and measured. The total sample size was 105 homes and 120 children. The two colonias were viewed as homogeneous and the total number of observations were treated as a single sample.

Community Two

The setting for Community Two was a squatters area of Manila in the Philippines. Replication of the survey in the Philippines was part of a community health project conducted by the University of the Nations. Mr. Don Traller, P.A. (former director of the School of Primary Health Care, University of the Nations) and a survey team carried out the house-to-house visits in the summer of 1989. The Philippine survey team canvassed a large slum neighborhood. All households who were willing to participate took part in the survey. Participation was voluntary and most families were eager to have their children weighed. No benefits were promised to the people. The project was described to households as an effort to understand why some children grow well and others do not. Children who were found to be seriously malnourished or ill were referred for follow-up by medical workers. Very few families chose not to participate (less than 1% refusal rate). Persons from the community took part in the survey and served as translators when necessary. English was a common second language, however Tagalog and other dialects were the principal languages spoken by the inhabitants. One hundred and sixty-nine childen were included in the Philippine sample.

Procedure

The written instruments (Appendices C and D) were carefully reviewed after translation and data collectors were required to execute a test interview with an examiner who was fluent in English and the local language. In each home the purpose of the study was described. Participation was voluntary and the subjects were told that they could stop the interview at any time for any reason. No benefits to the subjects were claimed. The measuring and weighing procedure was fully described to the family and a growth card was given to the caretaker for each child under the age of 6 years. [Rohde's report "Feeding, feedback and sustenance of primary health care" (cited in Grant, 1987) underlines the importance of teaching parents to weigh their own children and to understand the value of a rising growth curve. This was a possible benefit of the survey process.]

After the interview each child six years or younger was measured. The sex and birth date of the child was recorded. Height or length (of the infant not yet standing erect) was measured with a tape in centimeters. A spring scale was used to weigh the children in Juarez. The scale was supplied by Teaching Aids At Low Cost, London, England. The instrument was calibrated at 0, 1, and 10 kg. A Salter type Detecto scale was used to weigh children in the Philippines. The scale was calibrated at 0, 1, and 10 kg.

Data analysis

Data analysis was conducted using SAS (Statistical Analysis System). A univariate procedure was executed to examine numeric variables. Checks for normality were performed and where necessary outliers were excluded from the sample for correlational procedures. Frequency tables were constructed for all nominal variables. Procedures were executed for the combined samples and then for the urban and slum samples separately. A correlation matrix was constructed for the urban sample for height-for-age, weight-for-height, average standard deviation value, number of children, age table foods were introduced, preferred weaning age, age difference of younger sibling, and age difference of older sibling. Correlation matrices were also constructed for the urban and for the slum samples for height-for-age, weight-for-height, mean standard deviation value, number of children, income, number of occupants, and living space per occupant. Inventory scores were calculated and the correlation between inventory scores and the dependent variables was examined.

CHAPTER V

RESULTS

Distributions of the Dependent Variables

An obvious concern of this investigation is the nature of the variance of the dependent variables: height-for-age (H/A), weight-for-height (W/H), and the average of H/A and W/H. I subjected the dependent variables to tests for normality. The urban sample, the slum sample, and the combined samples were tested. After a single outlier (+11) for W/H was excluded as erroneous data, the distributions were found to be normal (-1<skewness<1 and -3 <kurtosis<3). Table III describes the distributions of all numeric variables in the samples. Both urban and slum H/A means are well below the expected value of zero (mean of a well nourished reference sample- the NCHS standard). The mean H/A for slum children is drastically lower than urban children. Mean W/H for urban children was greater than zero, possibly reflecting the tendency for stunted children to weigh more than children of normal stature due to a greater amount of total body water (Boutton et al., 1987). Slum children weighed considerably less that the expected W/H, indicating a significant level of acute malnutrition. The average SD value for urban children was nearly zero, whereas for slum children the average SD value was -1.3. For all

Table III: A comparison of growth and household factors in urban, slum, and combined samples for children ages 6 years and younger in two less-developed communities

Variable / Sample	Total Responses	Mean	SD	Range Low	Range High
Height-for-age SD [a] value					
Urban	116	-0.54	1.2	-3.3	3.3
Slum	150	-1.63	1.3	-3.7	1.9
Combined	266	-1.15	1.4	-3.7	3.3
Weight-for-height SD value					
Urban	116	0.46	1.1	-1.9	3.5
Slum	150	-0.96	1.3	-4.0	3.7
Combined	266	-0.34	1.4	-4.0	3.7
Average SD value [b]					
Urban	116	-0.04	0.7	-1.6	2.3
Slum	150	-1.30	0.9	-3.4	0.9
Combined	266	-0.75	1.0	-3.4	2.3
Age of the child in months					
Urban	116	27.9	19.4	1	69
Slum	151	25.5	18.2	0	71
Combined	267	26.5	18.7	0	71
Number of children in the family					
Urban	108 [c]	3.3	1.9	1	9
Slum	142	5.6	1.8	3	9
Combined	250	4.6	2.2	1	9
Yearly household income in dollars [d]					
Urban	104	2466	1240	0	4771
Slum	146	663	255	0	1423
Combined	250	1411	1209	0	4771

[a] Standard deviation values for the samples were derived from NCHS reference data

[b] The average SD value was calculated as the average of H/A and W/H SD values

[c] Missing data accounts for a response rate of less than the sample size

[d] Calculated in US dollars exchange rates for the respective time period of surveys

Table III: (cont.)

Variable / Sample	Total Responses	Mean	SD	Range Low	Range High
Area of the house in square meters					
Urban	110	69.3	89.0	15	443
Slum	167	18.4	14.1	6	150[a]
Number of people living in the house					
Urban	115	5.8	2.0	3	9[b]
Slum	54	6.2	1.8	3	9
Combined	169	5.9	2.0	3	9
Living space per occupant in square meters					
Urban	97	7.9	3.6	2.2	20.8
Slum	54	4.0	2.5	1.3	16.7
Combined	151	6.5	3.7	1.3	20.8
Health and illness inventory score					
Urban	115	9.9	4.6	-2	16
Slum	146	1.4	5.0	-8	12
Combined	261	5.1	6.4	--8	16
Early childhood feeding inventory					
Urban	109	8.5	4.3	-3	15
Slum	142	-1.2	5.3	-11	15
Combined	251	3.0	6.9	-11	15
Total score for both inventories					
Urban	109	18.2	7.6	-3	29
Slum	140	0.1	8.1	-16	27
Combined	249	8.0	12.0	-16	29

[a] Combined sample means for this variable were not calculated or used in analysis and are not reported, see living space per occupant

[b] A maximum of value of 9 was entered into the database for number of occupants

three dependent variables, means for slum children fell far below means for urban children (more than one SD point).

Figures 1, 2, and 3 (pages 61-63) illustrate the distributions of the dependent variables for two samples. When the urban and slum samples are compared with respect to H/A, two important differences are apparent. By Waterlow's classification system, any child falling below the -2 standard deviation (SD) line is considered stunted. There are obviously many more stunted children in the slum sample in Figure 1 (page 61). A second trend which is evident in the slum sample is a decreasing number of older children who are at or above the median. There is progressively less chance with aging that children (6 years and younger) in the slum will be of average height-for-age.

When the urban and slum samples are compared with respect to W/H striking differences are again apparent (see Figure 2, page 62). No children in the urban sample are wasted (less than -2 SD), whereas a large number of children in the slum sample are wasted. The vast majority of wasted children fall between the ages of 6 and 40 months, with a clear peak of wasting between 12 and 22 months. This trend supports the belief that toddlers are at greatest risk for wasting. It is important to note, however, that wasting did occur among younger infants, as well. Another interesting feature of the urban sample is the tendency toward above average W/H, which has been reported among stunted children.

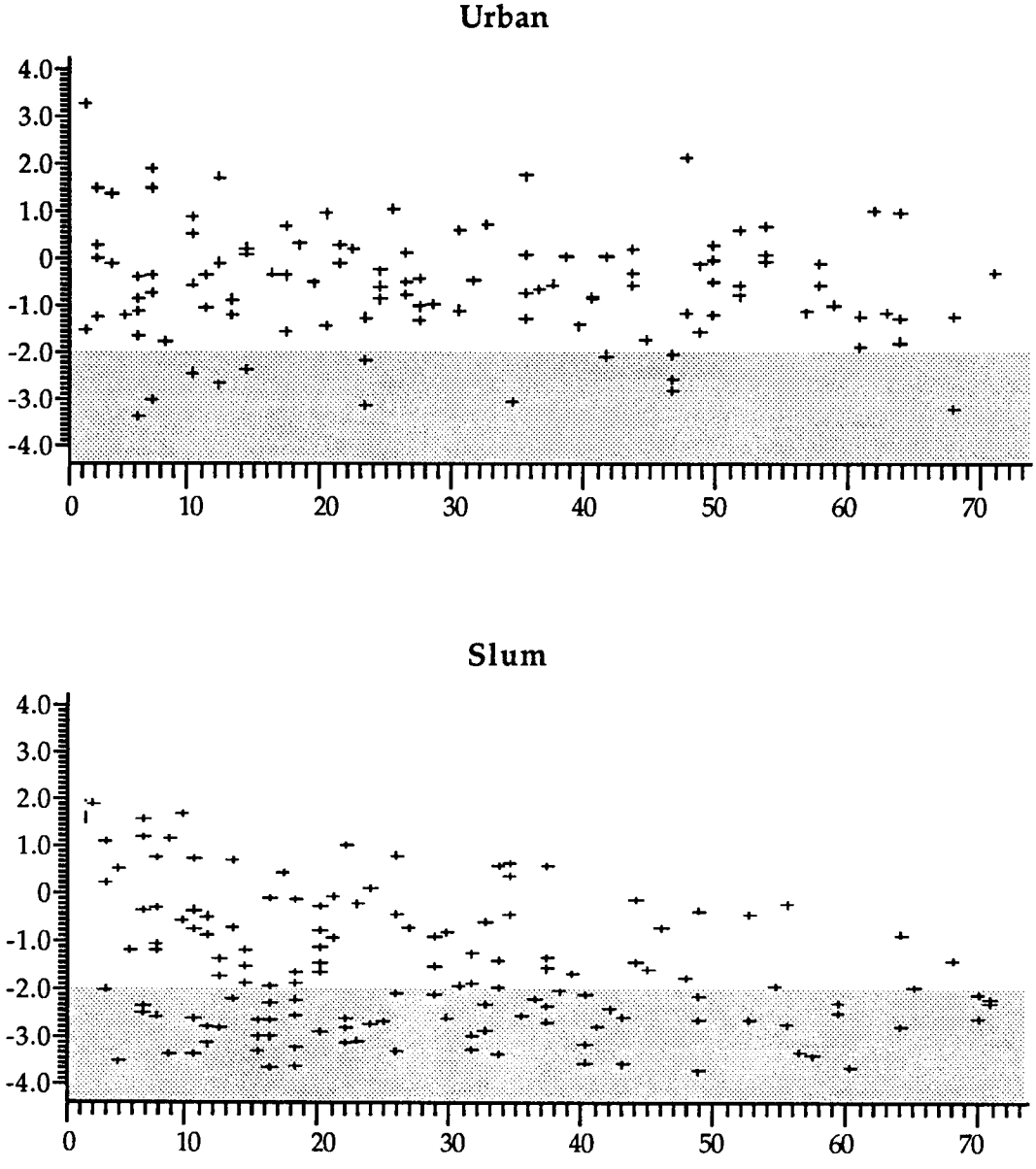

Figure 1. Plot of height-for-age (H/A) standard deviation values for an urban (n=116) and a slum (n=159) sample of children ages 0 to 72 months as compared to the NCHS reference standards. Children falling in the shaded area are classified as stunted (<-2 SD H/A).

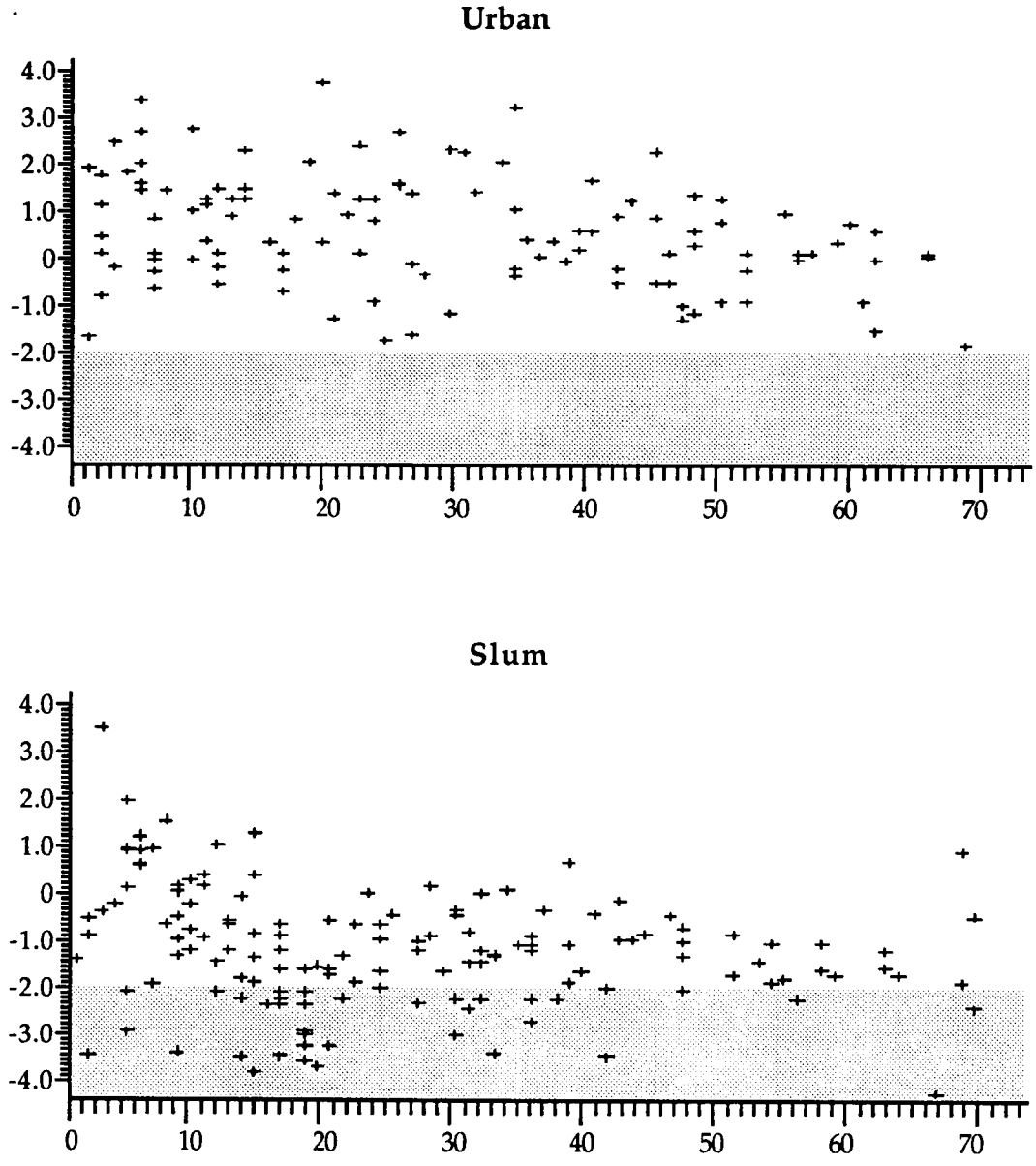

Figure 2. Plot of weight-for-height (W/H) standard deviation values for an urban (n=116) and a slum (n=159) sample of children ages 0 to 72 months as compared to the NCHS reference standards. Children falling in the shaded area are classified as wasted (<-2 SD W/H).

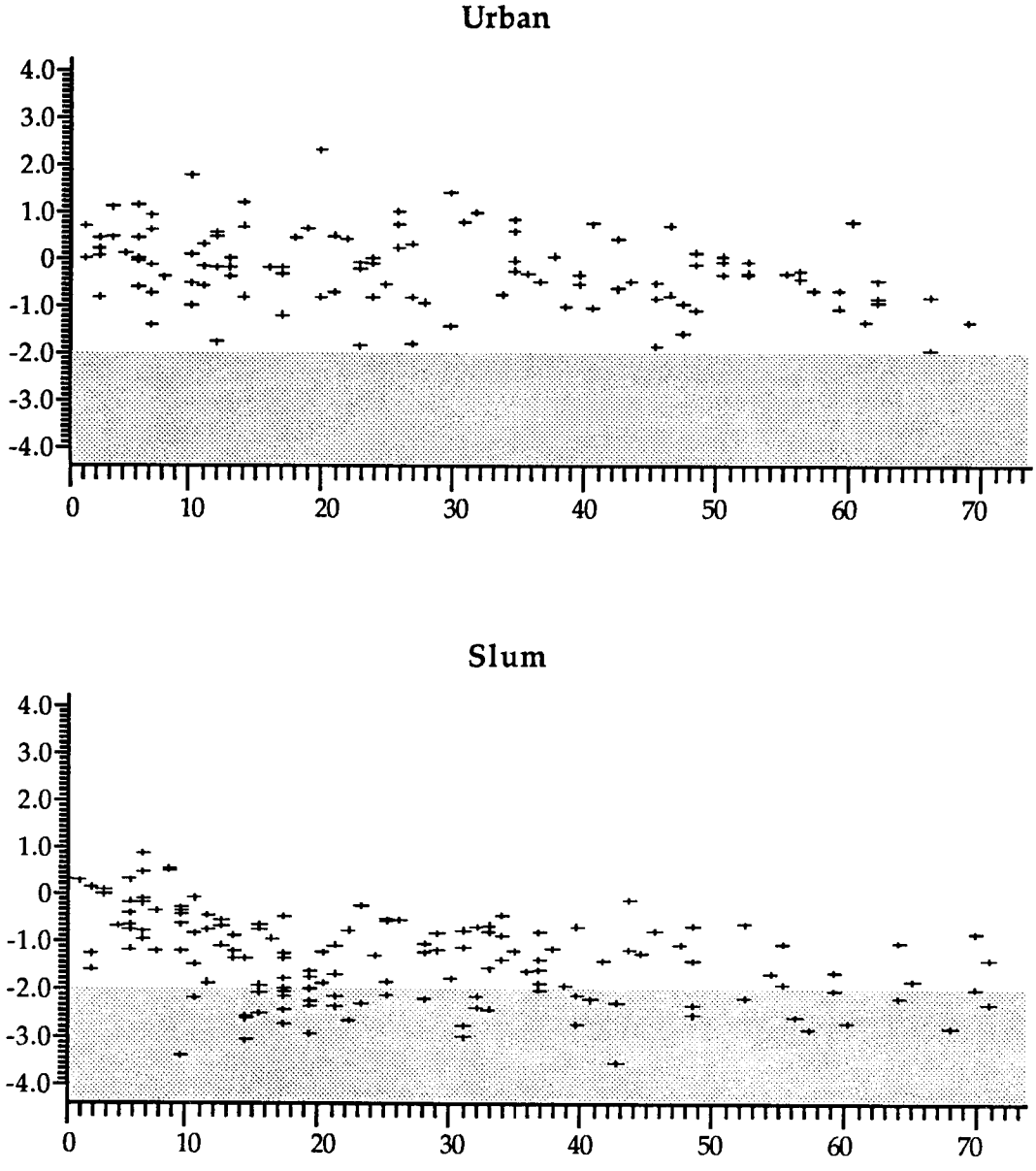

Figure 3. Plot of the average of H/A and W/H standard deviation values for an urban (n=116) and a slum (n=159) sample of children ages 0 to 74 months as compared to the NCHS reference standards.

Figure 3, page 63, illustrates the average standard deviation value for the samples. I have purposed to use this value as an indicator of the combined effects of long-standing and recent nutrition. It is interesting to note that despite the stunting observed in the urban sample, no urban child falls below -2 level for the average SD value. This may reflect a degree of compensation afforded by adequate recent nutrition. In contrast, a large number of slum children remain below the -2 SD level when recent and long-standing malnutrition are averaged. A clustering of low values occurs around 18 months of age.

Distributions of Numeric Independent Variables

For the urban sample the following continuous variables were normally distributed: 1) number of children in the family, 2) age difference in months between the subject and the younger sibling, 3) age difference in months between the subject and the older sibling. Normality was achieved for yearly income in U.S. dollar equivalents by excluding three outliers. Normality was achieved for preferred age in months of weaning from breast-feeding by excluding values of zero (28 non-breast-feeding mothers). Normality was achieved for living space per occupant of the household (calculated by dividing the total area of the house by the number of occupants) by excluding missing data, five outliers for total area, and two remaining outliers for living space per occupant. Due to a clustering of values, the number of meals the

caretaker believed young children should eat each day was not normally distributed. The number of child meals was subsequently treated as nominal data in the analysis. After exclusion of 4 outliers the age at which foods other than milk are introduced was still not a normal distribution. I created a new variable by transforming the original data into the square root of those values. I used the square root values for subsequent analysis.

In the slum sample the following variables were omitted from the survey at the discretion of the field director: preferred age of weaning, age at which foods other than milk are introduced, and age difference between the subject and younger or older siblings. No observations were made for these variables. The number of children in the family was normally distributed. Normality was achieved for yearly income in U.S. dollars by excluding three outliers. Normality was achieved for living space per occupant by excluding missing data for number of occupants and by excluding three outliers for total area.

Discussion of Numeric Independent Variables

Table III, page 58, compares the numeric variables for the urban and slum samples. While the total number of occupants per household was similar, families in the slum sample had an average of nearly six children, compared to three children per urban family. Income and housing resources for families in the slum sample did not

support the increased demands of child-rearing. Mean household income in the slum sample was only $663, hardly a fourth as much as urban households. Mean living space per occupant in the slum was only one third that of urban households. The unbelievably small area per occupant reflects the cramped living conditions of the slum, where it is sometimes impossible for all members of the family to even lie down in the house at the same time. Number of occupants per house was reported in only one third of the observations for the slum sample. Numeric variables (see Table IV) reported for the urban sample only included: 1) preferred age of weaning, 2) the square root of the age at which foods other than milk are introduced, 3) age difference between the subject and a younger sibling, and 4) age difference between the subject and a older sibling. The mean age of weaning was higher than expected for an urban sample. This may be due in part to the limited extent to which the community was urbanized. Only primitive elements of urbanization were present in the Mexican community under study, such as demarcated roads and lots, public water taps along the streets, and an increasing number of males employed in the manual work force of the city. The mean age difference between the subjects and younger siblings was only 21 months, whereas the mean older sibling age difference was more than 42 months. However, urban children were twice as likely to have an older sibling than a younger sibling.

Table IV: Age factors which may impact the growth of young children, from urban households in a less-developed community (Mexico)

Variable	Total Responses	Mean	SD	Range Low	Range High
Preferred age of weaning from breast-feeding [a]	81	9.5	6.4	<1	24
Square root of age when foods other than milk are given [b]	106	2.1	0.6	1	3.5
Age difference between the subject and younger sibling	37	20.8	12.7	1 [c]	47
Age difference between the subject and older sibling	82	42.5	27.2	1	99

[a] all ages are reported in months

[b] a square root transformation of the data was used to achieve normality

[c] an age difference of 1 month was assigned to twins

Discussion of Categorical Independent Variables

Nominal independent variables included two types of data: items reported as categorical information and items reported as a yes/no response to an interviewer's question. Categorical information consisted of a mix of direct observations by the interviewer and verbal responses by the primary caretaker. Categorical data is presented in Table V. Observations are reported independently for each child and should be interpreted in that context. In the case of employment, for example, Table V indicates that 69% of urban children studied lived in households where at least one adult was employed on a full-time basis. The statistic should not be interpreted as meaning that 69% of households had at least one employed adult. This interpretation is skewed by the number of children six years and under per household.

In the urban sample children were twice as likely to live in households where at least one adult had some form of regular employment. Children in the slum sample lived in families whose composition was more homogeneous- 99% reporting both parents with or without other adults in the home. The high rate of intact families is substantiated by my anecdotal experience that Filipino couples consider themselves to continue to be married in all cases except death of a spouse. Even when severe marital problems existed, such as alcoholism or desertion, divorce was not considered to be an option. The urban sample was much more heterogeneous. An unexpected

Table V: A comparison of selected demographic factors in urban, slum, and combined samples for households with children ages 6 years and younger in two less-developed communities

Variable Group	Urban Number	%	Slum Number	%	Combined Number	%
Employment	**n=115**		**n=148**		**n=263**	
Regular, full-time	79	69	65	44	144	55
Part-time	14	12	0	0	14	5
Irregular or unemployed	22	19	83	56	105	40
Family composition, adult caretakers	**n=115**		**n=148**		**n=263**	
Both parents, only	48	42	91	61	139	53[a]
Both parents and other adults	28	24	57	38	85	31
Mother, only	1	1	0	0	1	<1
Mother and other adults	9	8	0	0	9	3
Father, only	24	21	0	0	24	9
Father and other adults	5	4	1	1	6	2
Type of housing construction	**n=114**		**n=133**		**n=247**	
Temporary, makeshift structure	16	14	133	100	149	60
Permanent, conventional	98	86	0	0	98	40
Heating or cooking fuel	**n=115**		**n=0[b]**		**n=115**	
Electric	5	4			5	4
Gas	44	38			44	38
Vented, solid fuel burner	45	39			45	39
Non-vented, open fire	9	8			9	8
None	12	5			12	5
Mode of transportation	**n=116**		**n=133**		**n=248**	
Personal car or truck	32	28	0	0	32	13
Motorcycle	1	1	0	0	1	<1
Public carrier	82	71	133	100	215	87

[a] Percentages may not total 100% due to rounding error

[b] Missing data

Table V: (cont.)

Variable Group	Urban Number	%	Slum Number	%	Combined Number	%
Source of household potable water	**n=115**		**n=149**		**n=264**	
Public utility	115	100	148	99	263	100[a]
Well	0	0	0	0	0	0
Rain catchment	0	0	1	1	1	<1
Surface water	0	0	0	0	0	0
Method of storing water in the home	**n=115**		**n=51**		**n=166**	
Water obtained from tap in house	18	16	0	0	18	11
Small-mouth, pour only vessel	17	15	2	4	19	11
Wide-mouth, covered, by dipper	64	56	49	96	113	68
Wide-mouth, open vessel	16	14	0	0	16	10
Waste disposal	**n=116**		**n=149**		**n=265**	
Flush toilet, single family use	37	32	0	0	37	14
Pit toilet, single family use	56	49	8	5	64	24
Flush toilet, shared	1	1	0	0	1	<1
Pit toilet, shared	20	17	9	6	29	11
Random, on the grounds	1	1	132	89	133	50
Preferred age to introduce table foods	**n=116**		**n=0[b]**		**n=116**	
Late (>6 months)	22	19			22	19
Early (<3 months)	24	20.7			24	20.7
Appropriate (at 3, 4, 5, or 6 months)	70	60.3			70	60.3
Sex	**n=116**		**n=151**		**n=267**	
Female	65	56	74	49	139	52.1
Male	51	44	77	51	128	47.9
Nutritional status by Waterlow class	**n=116**		**n=150**		**n=266**	
Normal	104	90	60	40	164	62
Stunted (chronic)	12	10	58	39	70	26
Wasted (acute)	0	0	18	12	18	7
Mixed (acute on chronic)	0	0	14	9	14	5

[a]Percentages may not total 100% due to rounding error
[b] Missing data

finding was the reported incidence of 25% of urban children living in households with the father, but not the mother. Only 9% of children were reported to live in households with their mother and not their father.

The type of housing construction clearly differentiates the two samples. All of the children in the slum sample lived in houses built of temporary, make-shift materials such as cardboard, plastic, scrap metal, and refuse. In contrast, most of the urban children lived in homes built of permanent materials, such as lumber, blocks, and cement. About half of the urban children lived in households where a convenient, clean source of energy was available for heating or cooking. Very few urban children were exposed to open burning and the attendant respiratory problems. Data for the slum sample was not recorded; however, the Philippine survey team reported that virtually none of the households had any energy source other than open burning of refuse. No households in the slum sample reported ownership of a private vehicle, whereas 29% of urban children lived in households which owned a car, truck, or motorcycle.

Virtually all households obtained potable water from a public utility tap. However, slum households usually purchased their water from a vendor, who drew the water from a public tap and delivered it to households in five gallon containers. The vendor kept the five gallon containers, so each household had their own storage vessel.

Urban households obtained their water free of charge from a public tap within 200 feet of their house. Most slum children lived in households where potable water was stored in a covered, wide-mouth vessel from which water was dipped. In contrast, almost half of the urban children lived in households where stored, potable water was much less subject to contamination. Nearly, all slum children lived in households where no facility was available for excretion of personal wastes. Random elimination on the grounds near the house was the only option for these families. In contrast only 1% of urban children lived in households where random elimination on the ground was common practice.

The age at which foods other than milk were introduced ranged widely in the urban sample with 19% of children living in households where late introduction of weaning foods (later than 6 months) was preferred, 21% of children living in households where late introduction of weaning foods (earlier than 3 months) was preferred, and 60% of children living in households where a weaning age of 3, 4, 5, or 6 months was preferred.

Classification of the children by the Waterlow system revealed striking differences in the extent of malnutrition in the two samples. The absence of wasting and relatively low incidence of stunting among urban children contrasts the high incidence of malnutrition among slum children. Sixty percent of slum children were malnourished

with more than 20% showing evidence of recent starvation. Nearly 10% of slum children fall into an extremely high risk group of children who are both stunted and wasted. Most of these children can be expected to die, even with expert intervention. Females were slightly more likely to be malnourished than males.

Discussion of the Inventory Responses

Table VI describes the differences between samples in terms of the percent affirmative responses to inventory items. All items from both inventories are reported. Urban children were twice as likely to live in homes where some health care benefits were available to the family. Half of all slum children were too sick to play or eat on at least three days of every month because of cough, fever, or diarrhea. Slum children rarely had a facility for eliminating wastes. Illiteracy rates and drop-out rates were similar in the two samples. Slightly more urban children lived in households which reported using medical services in the last year. Virtually all urban children and only half of slum children lived in households where a birth attendant was present for the last birth in the family.

Urban children were twice as likely to have been immunized against DPT, polio, measles, and tuberculosis. Most slum children lived in homes where someone has been coughing chronically for a month or longer. Most slum children lived in households where the

Table VI: Differences between urban and slum samples in response to inventory questions which examine factors believed to impact the growth of young children, reported as % yes

Inventory questions	urban %yes	slum %yes
Does your family have any benefits provided such as health care or social security?	51	21
Is your child sick more than two days a month? (On these sick days she/he would not play or eat well because of cough, fever, or diarrhea?)	23	51
Is there a specific place where your children go when they need to urinate or pass feces?	79	15
Are there any adults in the home who can not read or write?	30	32
Do you have any children ages 6-12 who do not attend school REGULARLY?	8	9
Do you have any children ages 13-18 who do not attend school REGULARLY?	14	9
Have you used any medical services in the last year, such as a visit to the clinic or hospital?	70	66
Did you have a birth attendant with you when your last baby was born?	95	50
Have all your children received 3 DPT immunizations?	57	34
Have all of your children been immunized against polio?	65	36
Have all of your children been immunized against measles?	57	29
Have all of your children been immunized with BCG?	59	32

Table VI: (cont.)

Inventory questions	urban %yes	slum %yes
Does anyone in your home have a cough that has lasted a month or longer?	17	71
Do any of your children have worms?	10	83
Does anyone in the family have eye problems?	21	44
Does anyone in the family have serious skin problems?	13	55
Has anyone in the family been injured in the last year? (The injury should have required some specific treatment if it qualifies to be reported here.)	10	15
Has anyone in the home been burned in the last year? (Again the test is whether treatment was required and if the injury was of a serious nature.)	1	1
Was this child breastfed?	65	72
Have you breastfed all your babies?	58	72
Do you believe that it is good to breast feed your baby for two years or longer?	48	54
Did you begin feeding your baby foods other than milk by six months of age?	82	77
Are there days when there is no food in the house to feed the young children?	46	70

Table VI: (cont.)

Inventory questions	urban %yes	slum %yes
Do your children eat more than two times a day?	81	80
Do your children eat foods prepared with butter, fat, or oil each day?	92	23
Do your children eat sweet foods every day, such as sugar, honey, or candy?	81	50
Do they eat fish, meat, eggs, cheese, or yogurt each day?	85	21
Do you feed your children soup?	91	41
Do you usually feed your children two or more different foods at meals?	96	25
Are there certain foods that your child can get whenever she or he is hungry, such as dried fruit or bread?	86	60
Is there often food left over after your children eat their meal?	57	33
Do your children often refuse food?	26	73
Are there foods which you prepare specially for the young children in your home?	38	57
Are there many foods which you do not believe children should eat?	26	86
When your child is sick do you continue feeding her/him?	90	73

children had worms (more than eight times the urban rate). Eye problems were twice as common and serious skin problems were four times as common in the households of slum children. At least one out of ten children in both samples lived in households where someone was seriously injured in the last year.

Slum children were slightly more likely to have been breastfed and were more likely than urban children to have lived in households were all the children in the family were breastfed. Caretakers of slum children were slightly more likely to believe that breast-feeding for two years or longer is a good practice and slightly less likely to begin feeding their infants foods other than milk by six months of age. Half of urban children and two-thirds of slum children went without food on some days. Twenty percent of children in both samples lived in homes where the young children were fed two or fewer meals a day. Urban children were four times as likely to live in households where young children eat foods rich in calories prepared with butter, fat, or oil. Only one fourth of slum children ate butter, fat, oil, fish, meat, eggs, or cheese daily.

Fewer than half of slum children ate cooked vegetables. Seventy-five percent of slum children ate only one food item per meal (usually rice). Forty-percent of slum children did not have access to foods in the household throughout the day. Two-thirds of slum children ate at tables where there is no food left at the end of the family meal. Most

slum children lived in households where the caretaker reported that children often refuse to eat and where the caretaker believed that there are many foods young children should not eat. Yet, over half of slum children lived in households where certain foods were prepared especially for young children. One-fourth of slum children lived in households where caretakers did not feed children when they were ill.

Correlation of Household Factors

Correlations were accepted as potentially meaningful at the 0.05 level, due to the exploratory nature of this study. Differences between households within the same community were less obvious than differences between households in the combined samples. The combined samples provided much more heterogenity. Since the unit of study in this investigation was the household rather than the community, the combined sample offered a better opportunity to examine a variety household factors and growth outcomes. Cultural and community differences which impact child growth are expressed and investigated as differences in household factors. The household (micro-approach) approach is enhanced by the inclusion of a variety of community and cultural settings.

Correlations for Numeric Variables in the Urban Samples

Table VII describes correlations between variables related to the growth of young children, feeding practices, and child spacing in the urban sample of households. These data was not collected in the Philippine survey. Correlations between H/A and average SD and between W/H and average SD are expected since average SD is directly derived from H/A and W/H. The only other significant relationship was found between the number of children and the preferred weaning age. The older preferred age of weaning apparent in households with larger numbers of children may be related to maternal experience and prior success with breast-feeding.

Correlations For Numeric Variables in All Samples

Table VIII describes relationships between variables related to income, housing, and number of occupants and children in the urban sample. As expected, the number of household occupants was strongly related to number of children. An increasing number of children was strongly associated with a decreasing amount of living area per person, indicating that households were not able to expand living space with increased numbers of children. This concept is strengthened by the observation that annual income is negatively related to the number of children. Financial resources were generally unavailable to

Table VII: Correlations between factors related to the growth of young children, feeding practices, and child spacing in an urban sample of households in a less-developed Mexican community

	Height-for-age	Weight-for-height	Average SD value	Number of children
Height-for-age		-0.25[a] 0.0067[b] n=116[c]	0.64 0.0001 n=116	-0.06 0.5464 n=108
Weight-for-height	-0.25 0.0067 n=116		0.59 0.0001 n=116	0.08 0.3874 n=108
Average SD value	0.64 0.0001 n=116	0.59 0.0001 n=116		0.02 0.8545 n=108
Number of children	-0.06 0.5464 n=108	0.08 0.3874 n=108	0.02 0.8545 n=108	
Table food age (square root)	0.02 0.8366 n=106	-0.15 0.1224 n=106	-0.10 0.2872 n=106	-0.01 0.9722 n=106
Preferred weaning age	0.01 0.9629 n=80	0.15 0.1931 n=80	0.12 0.2697 n=80	**0.30**[d] **0.0071** **n=80**
Age difference with younger sibling	-0.07 0.6773 n=37	-0.04 0.8085 n=37	-0.10 0.5739 n=37	-0.23 0.1860 n=36
Age difference with younger sibling	0.15 0.1917 n=82	0.07 0.5273 n=82	0.19 0.0821 n=82	-0.04 0.7530 n=80

[a] Pearson coefficient
[b] Probability statistic
[c] Sample size
[d] Bold values are discussed in the text

Table VIII: Correlations between variables related to income, housing, and number of occupants and children in an urban sample of households in a less-developed Mexican community

	Height-for-age	Weight-for-height	Average SD	Number of children	Annual income	Number of occupants	Sq.feet /person
Height-for-age		-0.25[a] 0.0067[b] n=116[c]	0.64 0.0001 n=116	-0.06 0.5464 n=108	0.20 0.0471 n=104	-0.08 0.3876 n=115	-0.03 0.7497 n=97
Weight-for-height	-0.25 0.0067 n=116		0.59 0.0001 n=116	0.08 0.3874 n=108	-0.06 0.5538 n=104	0.20 0.0334 n=115	-0.21 0.0382 n=97
Average SD value	0.64 0.0001 n=116	0.59 0.0001 n=116		0.02 0.8545 n=108	0.12 0.2107 n=104	0.09 0.3372 n=115	-0.20 0.0497 n=97
Number of children	-0.06 0.5464 n=108	0.08 0.3874 n=108	0.02 0.8545 n=108		-0.32 0.0014 n=99	0.84 0.0001 n=108	**-0.42[d]** **0.0001** **n=90**
Annual income	**0.20** **0.0471** **n=104**	-0.06 0.5538 n=104	0.12 0.2107 n=104	**-0.32** **0.0014** **n=99**		-0.13 0.1771 n=104	0.14 0.1941 n=87
Number of occupants	-0.08 0.3876 n=115	0.20 0.0334 n=115	0.09 0.3372 n=115	**0.84** **0.0001** **n=108**	-0.13 0.1771 n=104		**-0.31** **0.0020** **n=97**
Square feet per person	-0.03 0.7497 n=97	-0.21 0.0382 n=97	-0.20 0.0497 n=97	-0.42 0.0001 n=90	0.14 0.1941 n=87	-0.31 0.0020 n=97	

[a] Pearson coefficient
[b] Probability statistic
[c] Sample size
[d] Bold values are discussed in the text

households with increased numbers of children. Increased income level was associated with an increased H/A.

Table IX describes the relationship among variables related to income, housing, and number of occupants and children in a sample of households in the slum community (Philippines). The only meaningful association was between income and number of occupants. Increasing number of household occupants was negatively associated with annual income.

Table X lists the numerous correlations among variables related to income, housing, and number of occupants and children in the combined samples. The strongest associations between the dependent variables and the independent variables consistently involved the average SD value, however similar associations were apparent with H/A and W/H. This affirms the value of using average SD value as a dependent variable when both long-standing and recent growth and nutritional status is of interest. All significant associations in Table X were in the expected direction. Increasing income and living space were positively related to growth. An increasing number of children in the household was negatively related to growth. An increasing number of children was strongly associated with decreasing income and decreasing living space. Increasing income was positively related to increased living space and decreased number of children.

Table IX: Correlations between variables related to income, housing, and number of occupants and children in an urban sample of households in a less-developed Filipino community

	Height-for-age	Weight-for-height	Average SD	Number of children	Annual income	Number of occupants	Sq.feet /person
Height-for-age		-0.10[a] 0.2341[b] n=150[c]	0.70 0.0001 n=150	0.08 0.3581 n=142	0.04 0.6104 n=146	0.02 0.8731 n=54	0.06 0.6910 n=54
Weight-for-height	-0.10 0.2341 n=150		0.65 0.0001 n=150	-0.06 0.4601 n=142	0.03 0.7599 n=146	-0.08 0.5553 n=54	0.20 0.1524 n=54
Average SD value	0.70 0.0001 n=150	0.65 0.0001 n=150		0.02 0.8627 n=142	0.05 0.5398 n=146	-0.04 0.7524 n=54	0.20 0.1450 n=54
Number of children	0.08 0.3581 n=142	-0.06 0.4601 n=142	0.01 0.8627 n=142		-0.01 0.9305 n=139	0.98 0.0001 n=52	-0.10 0.4589 n=52
Annual income	0.04 0.6104 n=146	0.03 0.7599 n=146	0.05 0.5398 n=146	-0.01 0.9305 n=139		**-0.33[d]** **0.0199** **n=51**	0.01 0.9395 n=51
Number of occupants	0.02 0.8731 n=54	-0.08 0.5553 n=54	-0.04 0.7524 n=54	0.98 0.0001 n=52	-0.33 0.0199 n=51		-0.13 0.3637 n=54
Square feet per person	0.06 0.6910 n=54	0.20 0.1524 n=54	0.20 0.1450 n=54	-0.10 0.4589 n=52	0.01 0.9395 n=51	-0.13 0.3637 n=54	

[a] Pearson coefficient
[b] Probability statistic
[c] Sample size
[d] Bold values are discussed in the text

Table X: Correlations between variables related to income, housing, and number of occupants and children for subjects (n=266) in the combined sample of urban and slum households

	Height-for-age	Weight-for-height	Average SD	Number of children	Annual income	Number of occupants	Sq.feet /person
Height-for-age		0.08[a] 0.2177[b] n=266[c]	0.73 0.0001 n=266	-0.18 0.0040 n=250	0.37 0.0001 n=250	-0.08 0.3256 n=169	0.17 0.0416 n=151
Weight-for-height	0.08 0.2177 n=266		0.74 0.0001 n=266	-0.26 0.0001 n=250	0.35 0.0001 n=250	0.04 0.6103 n=169	0.22 0.0070 n=151
Average SD value	0.73 0.0001 n=266	0.74 0.0001 n=266		-0.30 0.0001 n=250	0.50 0.0001 n=250	-0.03 0.7461 n=169	0.28 0.0006 n=151
Number of children	-0.18 0.0040 n=250	-0.26 0.0001 n=250	**-0.30**[c] **0.0001** **n=250**		**-0.50** **0.0001** **n=238**	0.79 0.0001 n=160	-0.52 0.0001 n=142
Annual income	0.37 0.0001 n=250	0.35 0.0001 n=250	**0.50** **0.0001** **n=250**	-0.50 0.0001 n=238		-0.17 0.0302 n=155	**0.43** **0.0001** **n=138**
Number of occupants	-0.08 0.3256 n=169	0.04 0.6103 n=169	-0.03 0.7461 n=169	0.79 0.0001 n=160	-0.17 0.0302 n=155		-0.28 0.0005 n=151
Square feet per person	0.17 0.0416 n=151	0.22 0.0070 n=151	**0.28** **0.0006** **n=151**	**-0.52** **0.0001** **n=142**	0.43 0.0001 n=138	-0.28 0.0005 n=151	

[a] Pearson coefficient

[b] Probability statistic

[c] Sample size

[d] Bold values are discussed in the text

Many of the survey items involved yes/no questions asked of the primary caretaker. Thirty-five questions were grouped into two inventories as described in Tables I and II (pages 52 and 53, respectively). Table XI describes correlations between inventory scores and H/A, W/H, average SD value, and income for the combined sample of 267 Mexican urban and Filipino slum children. Scores for all inventories were more strongly associated with average SD value than with H/A or W/H. Increasing inventory scores were positively correlated with child growth (for all dependent variables) and income. Table XII compares inventory scores for two groups of children: 1) poorer children who grew better than the mean for NCHS children, and 2) children from wealthier homes that grew poorly. The table demonstrates that inventory scores were higher for poor children who grew well than for children from wealthier homes. This suggests that household factors reflected by the inventory scores are associated with growth and may provide an advantage to children living in poorer homes.

Correlations For Rank Data in the Combined Samples

Table XIII summarizes the correlation (Spearman correlation procedure) of all categorical variables (rank data) with the DVs for all children in the combined sample. Generally, the average SD value and

Table XI: Correlations between inventory scores and height-for-age, weight-for-height, and average SD value for children 6 years and younger living in two less-developed communities (Mexican children in an urban setting and Filipino children living in a slum setting)

Sample	Feeding Inventory	Health Inventory	Total Score
Mexican Urban and Filipino Slum Samples Combined			
Height-for-age	0.32[a] 0.0001[b] n=251[c]	0.33 0.0001 n=261	0.36 0.0001 n=249
Weight for-height	0.39 0.0001 n=250[d]	0.25 0.0001 n=260	0.35 0.0001 n=248
Average SD value	0.46 0.0001 n=250	0.34 0.0001 n=260	0.44 0.0001 n=248
Annual Income	0.51 0.0001 n=243	0.53 0.0001 n=253	0.56 0.0001 n=241

[a] Pearson coefficient
[b] Probability statistic
[c] Sample size
[d] Variance in sample size due to missing data

Table XII: Comparison of inventory scores for children living in poorer households who grew well with children who living in wealthier households who grew poorly (from a sample of 267 children ages 6 years and younger living in a Mexican urban setting and a Filipino slum)

	Income below community mean and Average SD value>0	Income above community mean and Average SD value<0
Health & hygiene inventory score	n=29	n=86
Mean	**6.9**[a]	**2.4**
SD	6.0	5.3
minimum	-6	-8
maximum	16	12
Early childhood feeding inventory	n=30	n=81
Mean	**6.8**	**.1**
SD	5.7	5.0
minimum	-6	-9
maximum	15	15
Total of the inventory scores	n=29	n=81
Mean	**14**	**2.3**
SD	10.3	7.5
minimum	-8	-14
maximum	29	27

[a] Bold values are discussed in the text

Table XIII: Relationships between selected household factors and the growth of children six years and younger living in two less-developed communities (Mexican children in an urban setting and Filipino children living in a slum setting)

Variable	Family composition	Source of potable water	Type of water storage	Waste disposal
Height-for-age	0.21[a] 0.0006[b] n=264[c]	-0.05 0.3803 n=264	-0.12 0.1167 n=166[d]	-0.38 0.0001 n=264
Weight-for-height	0.14 0.0246 n=264	-0.02 0.7684 n=264	-0.02 0.8152 n=166	-0.41 0.0001 n=264
Average SD value	**0.24**[e] **0.0001** **n=264**	-0.05 0.3875 n=264	-0.10 0.1789 n=166	**-0.55** **0.0001** **n=264**

[a] Spearman coefficient
[b] Probability statistic
[c] Sample size
[d] Variance in sample size indicates missing data
[e] Bold values are discussed in the text

Table XIII: (cont.)

Variable	Employment	Availability of benefits	Type of housing	Number of child meals/day	Mode of transportation
Height-for-age	**-0.23**[a]	-0.18	-0.14	0.16	-0.24
	0.0001[b]	0.0052	0.0294	0.0117	0.0001
	n=264[c]	n=251[d]	n=247	n=252	n=248
Weight-for-height	-0.10	-0.12	-0.18	0.30	-0.14
	0.1011	0.0580	0.0042	0.0001	0.0273
	n=264	n=251	n=247	n=252	n=248
Average SD value	-0.20	**-0.19**[e]	**-0.23**	**0.32**	**-0.28**
	0.0010	**0.0024**	**0.0002**	**0.0001**	**0.0001**
	n=264	**n=251**	**n=247**	**n=252**	**n=248**

[a] Spearman coefficient
[b] Probability statistic
[c] Sample size
[d] Variance in sample size indicates missing data
[e] Bold values are discussed in the text

the independent variable provide the stronger associations than H/A or W/H and the independent variable. There was a positive association between family composition score and growth. Scoring for family composition is described in Table V (page 69). Higher scores relate to unusual family compositions. Table V indicates that Mexican households headed by fathers accounted for all higher scores in the combined sample. Since Mexican children consistently grew better than Filipino children, it is not surprising that higher family score is positively associated with growth, since the underlying association is really between a purely Mexican group and a combined group of children. Sewage systems were ranked from modern flush toilets to increasingly less sanitary waste disposal facilities. The waste disposal scale is described in Table V. Lower values indicate more sanitary systems. Growth was strongly associated with more sanitary systems. There was no apparent relationship between type of water storage system and the growth of young children in this sample.

Table XIII, continued on page 89, describes additional relationships between household factors and the growth of young children. Regular employment of an adult in the household was associated with better growth of young children, as was the availability of medical benefits to family. Temporary housing was negatively related to growth. A positive association was apparent between growth and an increasing number of meals which caretakers believe children should be fed.

Mode of transportation was ranked from most desirable to least desirable. A low score for mode of transportation indicated ownership of a private car or truck. A negative relationship was found between mode of transportation and growth. This association may in part be descriptive of the sample distribution. All Filipino households used public carriers (scored high for mode of transportation). However, a negative relationship also existed between H/A and mode of transportation in the urban sample. This may be another expression of income and poverty, rather than a pure association with child growth. However, availability of private transportation may also directly increase a family's chances for employment and improve their ability to procure household supplies.

CHAPTER VI

DISCUSSION AND CONCLUSION

A fundamental premise of this investigation was that childhood malnutrition is not the simple result of a lack of food in the home. A theoretical framework was proposed for this study which predicted that many different household factors would affect the growth of young children. The role of caretakers in shaping the home environment was considered to be very important in selecting factors for study. This approach was an integration of Nightingale's belief that environmental factors had a direct effect on the well-being of the child and Roy's assertion that adaptation to the environment was achieved through specific modes, such as effective role function of caretakers. To reflect an acceptance of Mata's theory that a malnutrition-infection complex is largely responsible for childhood malnutrition, two inventories of household factors were devised: 1) the health and hygiene inventory, and 2) the early childhood feeding inventory. Additional socioeconomic variables were examined in relation to child growth. These demographic variables included factors related to poverty, housing, sanitation, family composition, mode of transportation, education, health care, and nutrition.

The Research Questions--Answers Proposed

The research question was "Are selected household factors related to the growth of young children in two less-developed communities?"

Subsidiary questions included:

1. Are health and hygiene factors associated with growth?
2. Are early childhood feeding practices associated with growth?
3. Are other socioeconomic factors associated with growth?

Inventory scores indicated that there was a relationship between health and hygiene and the growth of young children in this study. Differences between communities were also apparent. Higher scores among households where children grew well suggest that improvements in general health and sanitation are important aspects of caretaker role function. Higher scores on the early childhood feeding inventory among households where children who grew well indicate that many other factors besides the mere availability of food are related to good nutrition and growth.

Other relationships were also apparent between certain socioeconomic factors and growth. Decreased annual income was associated with increased number of children. This finding supports the belief that poverty and increased birth rates are associated. Increased number of children in the household was negatively related to growth. Increased number of children was negatively related to the amount of living space per person. In contrast, increased income was

associated with fewer children, more living space, and improved growth of young children. In view of these relationships, poverty emerges as a pervading influence in growth failure.

Other factors were associated with child growth. Regular employment, availability of benefits, housing constructed of permanent building materials, and the availability of private modes of transportation were all positively associated with child growth. Access to sanitary waste disposal systems was strongly associated with improved growth. However, a relationship could not be established in this investigation between method of water storage and growth. Lack of an association may be due in part to missing data in the Philippine survey (only 51 households were surveyed for this variable) and a low number of households reporting use of sanitary systems. Only two households in the Philippine study were reported as having an optimal potable water storage system. No relationship was observed between source of water and growth due to the lack of variability in this factor. Virtually all households ultimately obtained water through a public tap. However, consideration of water source in other communities may be of utmost importance.

Children grew better in households where caretakers believed young children should be fed more frequently. This fact, together with the association between inventory scores and growth, raises a question. Is it possible for children to grow well even among the poorest

households if caretakers skillfully manage the environment? Thirty children who lived in homes where the annual income was below the community mean still managed to grow better than the median for NCHS children. These children seem to have adapted to poverty and the other adverse conditions of less-developed communities. In contrast, 86 children who lived in homes where the annual income was above the community mean fell below the median for NCHS children. Poor growth despite increased income may represent maladaptation for these children. When the two groups were compared, mean inventory scores were higher for the children who lived in poorer households and still grew well. In conclusion, this investigation demonstrated an association between certain household factors and the growth of young children.

Implication of the Findings

The findings of this study strengthen the view that childhood malnutrition is a problem of multifactorial causation. The exact relationship of specific household factors to growth is unknown. However, a prudent course for intervening on behalf of malnourished children must consider several implications:

- Poverty is a dominant feature of childhood malnutrition. Long-term efforts to alleviate the problem should acknowledge that

equipping people to escape from the cycle of poverty is a critical step toward eliminating childhood malnutrition.

- The role of the caretaker is of utmost importance to the child. Interventions should empower the caretaker, rather than simply meet the immediate need. Children can grow well even in the poorest households when caretakers effectively manage the environment. Household skills which improve general health and hygiene and promote optimal nutrition benefit young children.
- The level of development of communities may be best described and monitored by household factors. Careful attention to basic technologies, such as water storage and waste disposal, is critical. Single interventions have historically failed. Therefore, it is important to consider interactions between related factors. Effective change at the community level will be evident within the home and apparent in the improved growth of young children.

Limitations of the Study

Within the restraints of the study design, missing data was the single greatest limitation. Interpretation of findings was severely limited by lack of information in the Philippine survey. Study variables affected included the number of occupants, preferred weaning

age, age of introduction of table foods, sibling age differences, and water storage system. Another limitation of the study was use of new inventories which have not been subject to testing and validation. Use of different survey teams may also have limited the accuracy and value of the findings. More uniform survey techniques are desirable, including use of the same scale for weighing all children, and use of a height/length board.

An inherent hazard of studying multifactorial phenomena such as growth is the problem of selecting appropriate variables for the investigation. A number of factors which were not included in this investigation may be of great importance to the problem of childhood malnutrition. Factors such as maternal nutritional status, height, weight, and age are worthy of consideration. Hand washing, bathing, and the availability of soap may also be important variables.

Selection of two diverse communities may also be a limitation of this investigation. Certainly, the strength of the findings would be enhanced if the study were replicated in one community for a much larger sample or in several different communities. There is a need for both intra-community and inter-community analysis of household factors. Intra-community differences may point to specific features of adaptation relevant to that setting, whereas inter-community comparisons may highlight universal aspects of household factors and the growth.

Need for Further Research

One clear conclusion of this investigation is the need for further study. In view of the scope of childhood malnutrition in the world today, it is unthinkable that this subject would not merit intense study. If a critical list of household factors were identified and investigated in a variety of settings, interventions could be much more effective. Health care workers and policy makers could be sensitized to the fundamental needs of children and caretakers. While it may be not be reasonable to expect to eliminate poverty in this century, it is imperative that we try to improve the growth and health of this generation of children.

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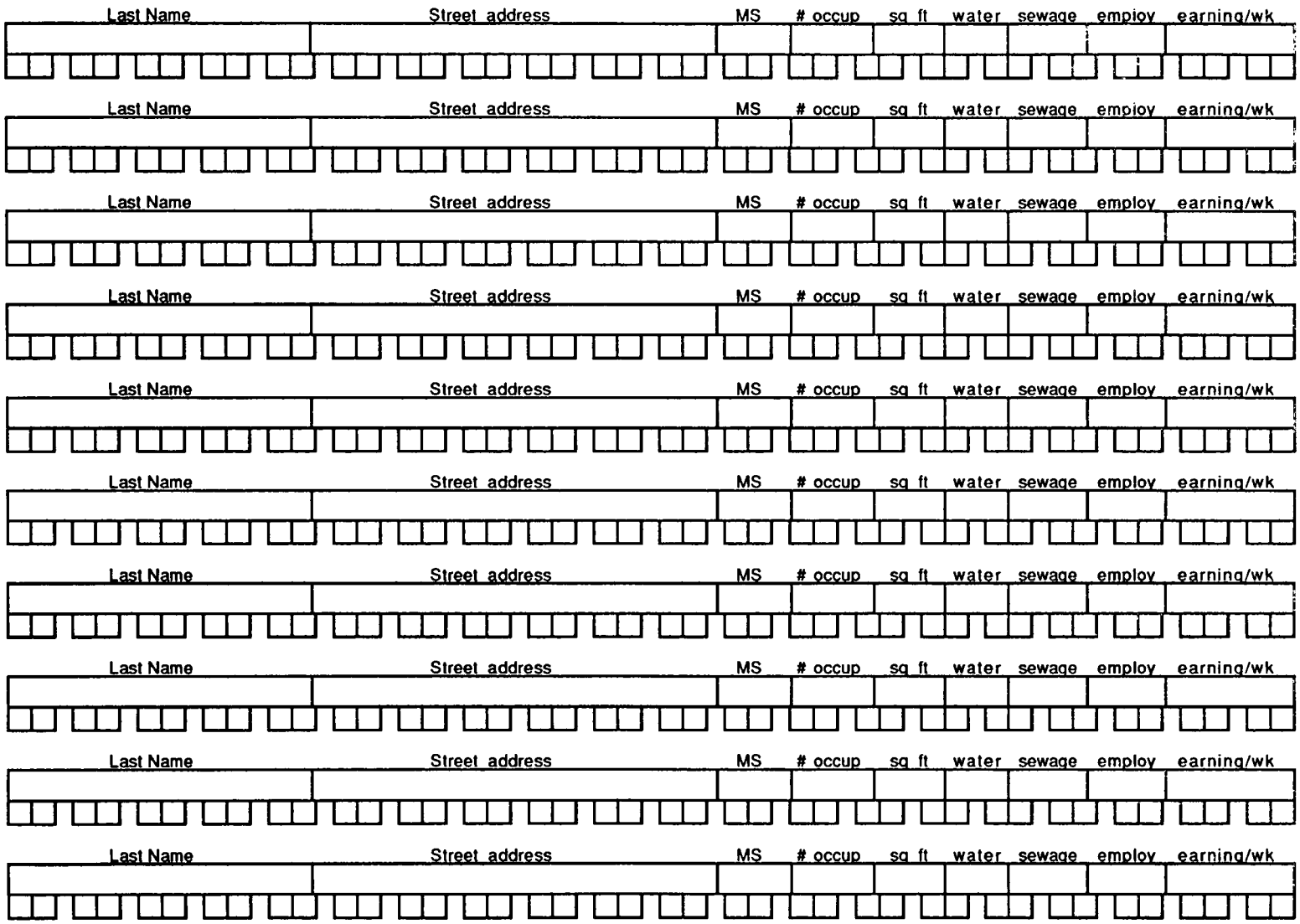
APPENDICES


Last Name
Street address
MS
occup
sq ft
water
sewage
employ
earning/wk

APPENDIX B

WATER CODES
*use 1 of each, eg. T/R

SOURCE	STORAGE
T=treated	T=tap in home
W=well	R=restricted vessel
R=rain	C=covered vessel
S=surface	O=open vessel

SEWAGE CODES
*use 1 of each, eg. F/C

TYPE	USE
F=flush	F=family
P=pit	C=communal
N=none	

EMPLOYMENT CODES
*use 1 of each, eg. I/N

TYPE	BENEFITS
R=regular, >30 wk	B=benefits, SS, etc
P=partime	N=no benefits
I=irregular	

*irregular=multiple employers, seasonal, etc

MS CODES
*use 1 of each, eg. T/R

ADULTS IN THE HOME
B= both parents
BO=both parents & others
M=mother only
MO=mother & other
F=father only
FO=father & other

APPENDIX C

Enter the letter assigned to your survey team. Each team will have a designated letter A-Z. A
(You'll use this code on the Child Data Sheet) Number the homes you visit consecutively, 1,2,3, etc. 1

Have all your children received 3 DPT immunizations? Ask to see their record. Y
If none is available start a TALC growth card record for each child. N

Have all of your children been immunized against polio? Y
N

Have all of your children been immunized against measles? Y
N

Have all of your children been immunized with BCG? Y
N

Does anyone in your home have a cough which has lasted a month or longer? Y
N

Do any of your children have worms? Y
N

Does anyone in the family have eye problems? Y
N

Does anyone in the family have serious skin problems? Y
N

Has anyone in the family been injured in the last year? Y
(The injury should have required some specific treatment if it qualifies to be reported here.) N

Has anyone in the home been burned in the last year? Y
Again the test is whether treatment was required and if the injury was of a serious nature. N

Do you have any children ages 6-12 years who do not attend school REGULARLY? Y
N

Do you have any children ages 13-18 who do not attend school REGULARLY? Y
N

Are there any adults in the home who can not read or write? Y
N

Have you used any medical services in the last year, such as a visit to the clinic or hospital? Y
N

Do you have relatives in the US who provide some financial assistance to your family? Y
N

Are you waiting to move to the United States? Y
N

Type of home construction:
(T-temporary, P-permanent)

Type of heat:
(E-electric, G-gas, V-vented stove, O-open burning, N-none)

Transportation:
(V-vehicle (truck or car), M- motorcycle, P- public carrier)

APPENDIX D

Enter the letter assigned to your survey team. Each team will have a designated letter A-Z. A
(You'll use this code on the Child Data Sheet) Number the homes you visit consecutively, 1,2,3, etc. 1

Did you have a birth attendant with you when your last baby was born (midwife, nurse, etc.)? Y
N

Have you breast-fed all your babies? Y
(Write a B on the bottom of each child's age line if he/she was Breast-fed) N

Do you believe that it is good to breast-feed your baby for two years or longer? Y
(Write a S & an arrow on the time ruler to indicate the age at which breast-feeding is usually Stopped.) N

Did you begin feeding your baby foods other than milk by six months of age? Y
(Write an F and an arrow on the ruler to indicate the age other foods are introduced.) N

The rest of the questions apply to young children in the home, ages 1 to 5 years. Y
Are there days when there is no food in the house to feed the young children? N

Do your children eat more than two times a day? (Write a number on the right end of the time ruler Y
to indicate how many times this caretaker believes young children should be fed.) N

Do your children eat butter, fat or oil each day? Y
N

Do they eat sweet foods every day, such as sugar, honey, fruit? Y
N

Do they eat fish, meat, eggs, and milk products (like cheese or yogurt) each day? Y
N

Do you feed your children soup? Y
N

Do you usually feed your children two or more different foods at meals? Y
N

Are there certain foods that your child can get whenever she/he's hungry, such as dried fruit or bread? Y
N

Is there often food left over after your children eat their meal? Y
N

Do your children often refuse food? Y
N

Are there foods which you prepare specially for the young children in your home? Y
N

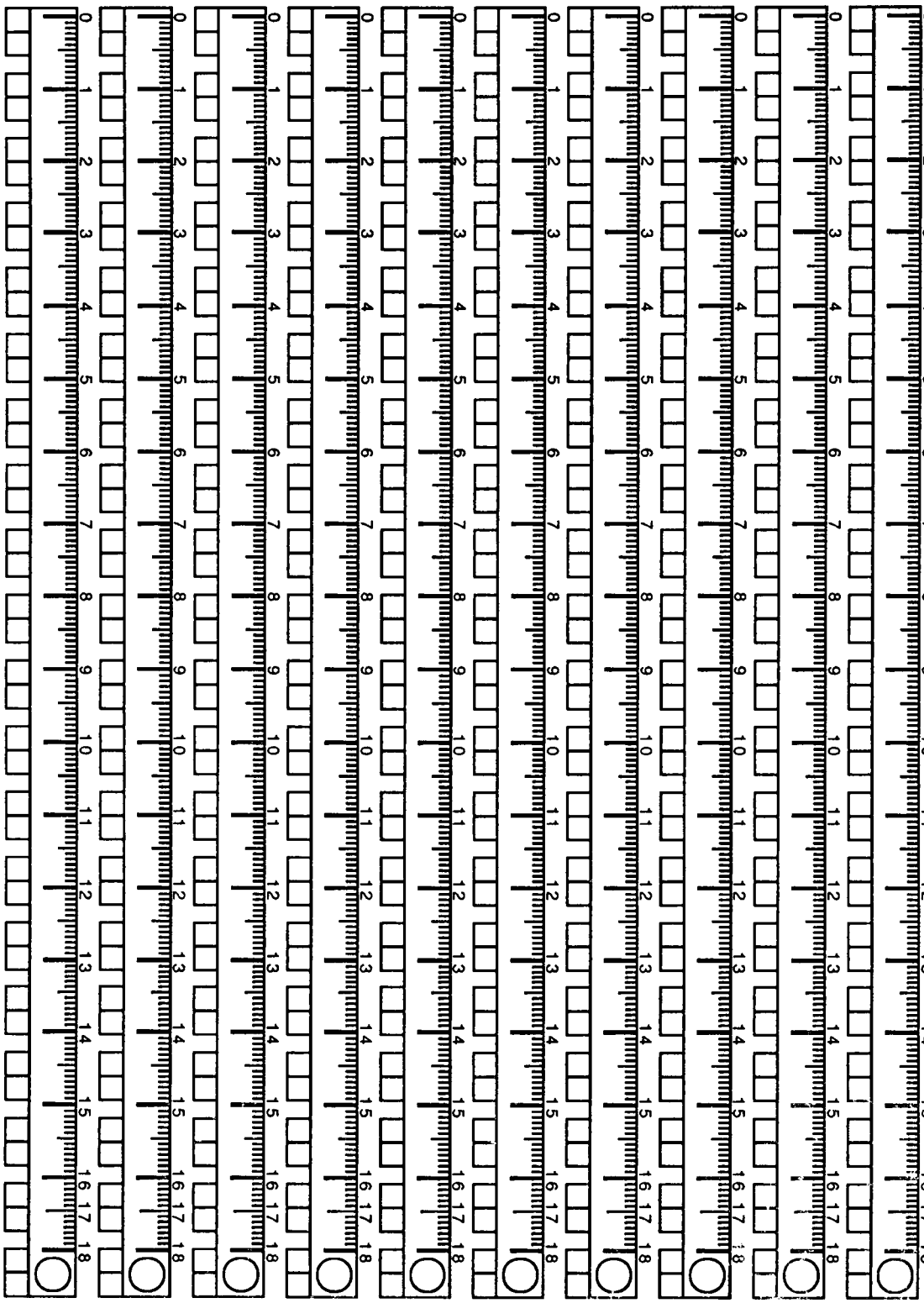
Are there many foods which you do not believe children should eat? Y
N

Is your child sick more than two days a month? Y
(On these "sick" days she/he would not play or eat well because of cough, fever, or diarrhea.) N

When your child is sick do you continue feeding her/him? Y
N

Is there a specific place where your children go when they need to urinate or pass feces? Y
N

APPENDIX E



APPENDIX F

Child Nutrition Data Sheet

Home visits by _____ & _____ Date: _____

#	family code	child's first name & sex (M=male, F=female)	child's age in months	median height (cm) for age	actual height (cm) for age	% median height for age	median weight (kg) for height	child's actual weight (kg)	% of median weight	median weight for age	% of median weight
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
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VITA

Benjamin David Francisco received a Bachelor's of Science Degree with a major in Public Health Education from the University of Tennessee, Knoxville, in 1976. He received an Associate of Science in Nursing from Lincoln Memorial University in 1978. He has served as Pediatric Clinical Educator at the University of Tennessee Medical Center for the last ten years. Mr. Francisco is the recipient of a Professional Nurse Traineeship Award.

Mr. Francisco earned certification from the American Nurses Association as a Maternal and Child Health Nurse in 1985. He was certified again in 1990. He is currently an instructor of Pediatric Advanced Life Support for the American Heart Association and the American Academy of Pediatrics.

Mr. Francisco has served as guest faculty and curriculum consultant for the University of the Nations School of Primary Health Care since 1984. He has taken part in medical projects in Guatemala, the Philippines, Belize, and Mexico. He and his wife Carol have co-authored an unpublished nutrition manual entitled "Feed My Lambs."

At the time of this writing Mr. Francisco has accepted a new position as Pediatric Education Nurse at the University of Missouri Hospital and Clinics in Columbia, Missouri.