



# Positive Deviance in Child Nutrition - with emphasis on Psychosocial and Behavioural Aspects and Implications for Development

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Positive Deviance in Child Nutrition - With Emphasis on Psychosocial and Behavioural Aspects and Implications for Development

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Complementary to the UNU-UNICEF Research on the Evaluation of Programmes of Nutrition and Primary Health Care at the Household Level, the research summarized in this volume was commissioned by the WHO-UNICEF Joint Nutrition Support Programmes financed by the Government of Italy. It examines the performance of mothers who were successful in maintaining their children's and family's nutrition and health under conditions of poverty in which most were failing to do so.

The major objectives of this study of positive deviance were to identify successful child-care and feeding behaviours and to determine effective aspects of social support systems as a basis for designing policies and programmes to reinforce and extend these adaptations to more mothers.

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The authors are also grateful to the respondents to the mail survey, who are listed in Appendix 2. Since international postal systems are subject to irregularities, some respondents will not find their names in the list in Appendix 2 because their questionnaires arrived too late for computer processing (or possibly did not reach us). Late arrivals were added to the mailing lists for the state-of-the-art paper.

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## Executive summary

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The term "positive deviance" has been used to describe the performance (regarding health, growth, and development) of certain children vis-à-vis the performance of other children in the community and the family. It has been seen as a form of social, behavioural, and physiological adaptability to nutritional stress.

From the perspective of young-child nutrition, positive deviants are children who grow and develop adequately in low-income families living in impoverished environments, where a majority of children suffer from growth retardation and malnutrition. A number of observers of this phenomenon, like Wray

and Greaves, have called for greater attention to be given to this process of apparent adaptation so that any common themes or principles occurring in different situations might be identified and described.

In searching for possible explanations, it is necessary to determine the critical factors that contribute to this positive deviance, and in particular to try to identify which factors are predominantly behavioural, which are biological and environmental, which are innate, and which are acquired.

The major purpose in studying positive deviance is to learn from adaptive child-care and feeding behaviours, as well as from the social networks that support them, in order to design policies and develop programmes that reinforce and transfer these adaptive mechanisms to the malnourished. While other works have concentrated on socio-demographic and physiological variables associated with good growth, this state-of-the-art paper focuses on psychosocial and behavioural considerations.

The paper places positive deviance in an evolutionary context as a form of adaptation and reviews theories linking infant development to nutrition, from pre-natal life to breast-feeding, the introduction of solids, and the transition to an adult diet, following the infant up to two or three years of age. The book consists of two parts.

The first part documents the literature and its policy and programme implications. It defines positive deviance, presents an overview of what has already been written on the subject, gives overall conclusions, and makes policy recommendations. It seeks to link psychosocial and behavioural characteristics to child growth, and analyses the most proximate caretaker-child interaction, associated individual temperaments, and the social support systems in which such interaction is formed and nurtured. The section is designed to assist programme managers and policy-makers in the application of approaches that may be relevant to local socio-cultural and environmental conditions.

The second part examines considerations for research in positive deviance, underlining assumptions for research and relating that research to epidemiological methods. It presents a model for conducting programme-relevant research, a conceptual framework for this research, and an overview of important concepts and variables. It goes on to review a series of methodological problems and ways of dealing with them. Its purpose is to provide the type of methodological information needed to assist nutritionists and other social and biological scientists in developing research on positive deviance.

The emphasis placed on research considerations distinguishes this paper from other state-of-the-art papers prepared for the WHO/UNICEF Joint Nutrition Support Programme (JNSP), which are much more application-oriented. The need to deal with research so extensively is predicated on the fact that the positive-deviance approach is relatively new to nutrition; as a result, little systematic research has hitherto been done in this area, and further study is needed in order to identify broadly applicable themes.

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## The literature and its policy and programme implications

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## Introduction

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The concept of "positive deviance" had already entered the nutrition literature by 1967, although serious field research in this area is more recent. Hegsted (1967), for example, advised that "we should pay a great deal more attention to those individuals who are apparently healthy while consuming diets which seem to us to be restricted. We should pay more attention to the reasons for nutritional success rather than nutrition failure." Wray (1972) advocated studying "successful mothers," while Greaves (1979) recommended that "another approach might be to identify in the village women who can cope: there are many who do manage to rear healthy and active children, and yet who belong to the same 'community' as some who cannot. How do they manage? Are they following some of the basic rules? What is their secret? Can it be shared with others? There would seem to be tremendous opportunity for research here."

Mata (1980), writing on child malnutrition in Guatemala and Costa Rica, observed that "maternal technology" is a distinct determinant of the malnutrition complex: "Maternal technology pertains to practices, traditions and beliefs relating to food preparation, feeding techniques, child care during illness and convalescence, handling of drinking water and of feces, and personal hygiene. It is important to note that some mothers exhibit a high level of technology, independent of their upbringing or schooling. That is why some infants and young children in a community thrive well under village conditions."

In addition to practices relating exclusively to feeding, health care, and sanitation, other modes of mother-child interaction have also been consistently related to the nutritional status of infants and young children. The mother's affect - whether she smiles and enjoys the baby - and the frequency with which she interacts with her child, verbally and non-verbally, can be used as examples (Alvarez et al., 1982). Genetic factors governing energy metabolism, immune function, response to stress, and activity levels also play an underlying and as yet poorly understood role in determining nutritional status (Danforth, 1983).

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## Rationale for studying positive deviance

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It is widely acknowledged that socio-economic development will not alleviate poverty over wide areas of the developing world during the next few decades. Nutritional conditions have worsened between 1980 and 1985 and are continuing to deteriorate in most developing regions outside of South and East Asia (Cornia et al., 1987). With these disturbing trends in mind, international assistance agencies have supported the search for and implementation of feasible approaches to improve child survival. An important goal is the protection of the health and development of the next generation of young children in the world's poorest regions.

In presenting the rationale for seeking practicable solutions, it is also important to stress the importance of economic development and of equity of resource distribution, including access to health and other social services. Our focus on positive deviance should not divert attention and energy away from efforts to change the economic, social, and political conditions of the poor. Nevertheless, needless death and retardation of young children are among the most distressing manifestations of socio-economic inequity. This paper is concerned with the broadening of affordable methods that could be used in reducing these inequities.

At this point in time, primary health care (PHC) forms the programmatic basis for feasible interventions in health. The essential elements of PHC are: health education, promotion of food supply and proper nutrition, safe water and basic sanitation, maternal and child care, including family planning, immunization against communicable diseases, prevention and control of locally endemic diseases, appropriate treatment for common diseases and injuries, and, lastly, provision of essential drugs.

The knowledge base for the development of these activities as priority components was derived from a large number of epidemiological surveys focused on the causes of malnutrition, morbidity, and mortality of young children in developing countries. These epidemiological field studies were based on the need, first of all, to establish patterns of distribution of morbidity and to identify some of the broader associated factors. Given that this has been done, there is now an opportunity to promote more in-depth studies, in order better to identify and understand the group-specific characteristics associated with morbidity and mortality (Rogers, 1985; Griffiths et al., 1984).

A variety of social-science research methods are beginning to provide a greater depth of insight for the purposes of policy formation. Operational research and behavioural trial methods have begun to integrate the research process into the design of effective interventions.

Nutrition communications research and action projects have demonstrated that a blend of community development and commercial and social marketing techniques can achieve major changes in maternal behaviour. As found in Indonesia (Zeitlin et al., 1984), such changes may significantly improve the growth status of young children in low-income environments, even in the absence of major investments in health care or economic development. The JNSP in Haiti, as well as projects in Honduras and the Gambia, have used these methods to promote oral rehydration therapy (Smith et al., 1982).

To date, operational and behavioural research methods have not attempted to draw extensively upon the local adaptive wisdom of the mothers and families of the positive-deviant children in low-income communities. Very few studies in nutrition have systematically examined the households whose children are at the top end of the growth performance curve in order to learn from successful adaptations.

From a purely scientific point of view, additional interest in positive deviance is motivated by the recognition that a focus on the malnourished only-the bottom tail of the distribution - lacks methodological rigour and fails to provide the basic information needed to understand the causes of malnutrition.

Similar research in psychology, looking at "invulnerability" or the reasons why some children develop into

psychologically healthy adults despite poor nurturing or traumatic early circumstances, has been conducted for several decades (see Anthony and Cohler, 1987, for a review of this approach). In the epidemiology of diarrhoeal disease, a positive-deviance casecontrol approach is now popular for studying hygiene behaviours associated with greater and lesser diarrhoeal incidence in low-income communities (Clemens and Stanton, 1986).

### ***Example from Burma***

An example from a positive-deviance study conducted by the Burmese Department of Medical Research illustrates the value of this approach to nutritional research. It demonstrates that information gained from studying the top of the distribution curve may call into question the accuracy of previous conclusions based on study of the malnourished only. The Department of Medical Research in Burma collected socioeconomic, anthropometric, dietary, and morbidity data from 3,29X households of children aged 0 to 3 years in representative regions of Burma. Two-day weighed food intake, including test-weighed breast-milk, was taken from an intensive study subsample of 874.

According to the accepted theory concerning growth failure at the weaning age in developing countries (based primarily on studies of the malnourished), the quantity of breastmilk becomes insufficient after 6 months, and malnutrition occurs in infants whose mothers do not start supplements soon enough or in large enough quantities. The Burmese study conducted by Dr. Cho Nwe Oo and colleagues (Nutrition Research Division, 1985) suggests that supplementary feeding patterns were not of primary importance in determining those who were well-nourished and those who were malnourished from 0 to 12 months. Rather, the quantity of test-weighed breast-milk consumed by the children differed significantly between positivedeviant, average, and malnourished infants between 0-3, 4-6, and 7-12 months.

From 0 to 6 months positive-deviant children receive fewer calories from supplementary foods than the other two groups. In fact early introduction of larger quantities of supplements was associated with poorer nutritional status in this breast-fed population (who did not practice formula feeding). From 7 to 12 months, the well nourished received significantly more breastmilk but only slightly more calories from supplements than the average and malnourished groups. These findings are supported by research from Thailand (Van Aarsdale, 1983). In the Burmese case, a scientific test of positive-deviance hypotheses yielded findings with important implications for intervention.

The accepted theory concerning growth failure at the weaning age and the hypothesis based on the Burma study are contrasted in figures 1a and 1b.

The study raises the question of the degree to which the large quantity of breast milk the mothers produced was due to the fact that larger babies stimulated greater milk production by their more vigorous sucking and higher intake needs, as the proportion of low birth-weight (< 2,500 g) was 4 per cent among the subsequently well nourished, versus 17.5 and 36.7 per cent among the average and malnourished.

If early supplementation and a larger quantity of supplements are not associated with good nutritional status between 4 and 12 months, this may be due to quality of food given, its hygienic standard, and the possible reasons for starting supplementation.

[Fig. 1a. The logic of traditional weaning theory.](#)

[Fig. 1b. New implications based on Burma positive-deviance study.](#)

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## **Conceptual approaches**

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Given the exploratory nature of positive-deviance research, this review will refer broadly to positive-deviance factors, behaviours, and hypotheses. These terms will generally characterize or pertain to the families of children whose

growth falls in the upper third of the nutritional status distribution within a homogeneous low-income population.

Table 1. Four types of adaptation to limited food availability

Type A	Level	Benefits
1. Increase in neo-natal and young child mortality	Across generations	1. Control of population size relative to food supply and ecological balance
		2. Selective survival of genotypes, social structures, and behavioural models resistant to nutritional stress
2. Stunting in linear growth, other metabolic adaptations to limited or irregular supply of energy and other nutrients	Across and within generations	Modification of phenotypes (rarely genotypes) to reduce food nutrient requirements
3. Socialization of child to be efficient member of food production and distribution system	Across and within generations	Efficient exploitation of technology characterized by simple, monotonous agricultural labour
4. Positive deviance	Household and individual	1. Healthy nucleus maintained under adversity
		2. Maintenance of vitality in social class/leadership structure
		3. Improved survival value across generations with development of more efficient behaviours, technologies, and social structures

Positive deviance can be viewed as one of several interrelated adaptations to limited food availability (table 1). This section will describe the types of adaptations that are known or presumed to occur in malnourished populations and will present a conceptual approach to research and programme design that takes confounding interactions between these adaptations into account. For a discussion of child development in the context of evolutionary theory, the reader is referred to chapter 1 of Chisholm's (1983) book on Navajo infancy. It should be noted that, as Beaton (1984) pointed out, such adjustment to a limited food supply generally entails costs to the individual and to society.

### ***Positive Deviance as Adaptation***

The first form of adaptation occurs at the population level across generations. Limited food supply or agricultural carrying capacity of the land leads to increases in neo-natal and young child mortality. This mortality serves two main functions: 1. Control of population size relative to food supply and ecological balance. 2. Selective survival of genotypes, social structures, and behaviour patterns resistant to environment limitations in food availability. Some of the mechanisms related to mortality are: decreased maternal nutrition, leading to premature births and intra-uterine growth retardation, hence to increased neonatal and infant mortality; decreased breast-milk production and food availability for the weanling infanticide and differential care (Scrimshaw, 1978, 1982). The term differential care describes the fact that parents treat unwanted or less wanted children in ways that sometimes permit them to die without the parents taking conscious responsibility for infanticide. Cassidy (1980) explains and discusses at length the first three types of adaptation presented here using the term "benign neglect."

Mortality rates typically increase in times of food scarcity. In many situations, there is now reason to believe that the modification of certain child-feeding and -rearing practices has enhanced child survival, even under the most stressful of conditions. In certain circumstances, on the other hand, current beliefs and practices may be actually exacerbating what are, for a variety of reasons, high-risk situations. Practices which are believed to protect the child, but which actually increase exposure to insult, may serve the purpose of permitting the child to die while the mother pursues highly apparent measures to save him. Withholding all fluids from infants with diarrhoea may be such a practice, as may be withholding key supplementary foods because "infants cannot digest them." These behaviours, which may not be consciously recognized as life-threatening to children, may have the effect of enhancing the survival of the group as a whole (Scrimshaw, 1978, 1982) by allowing the weakest children to die. They may thus contribute to the first form of adaptation.

The second type of adaptation occurs both across and within generations. Malnutrition in early childhood leads to stunting in linear growth. This stunting produces child and adult phenotypes with reduced food requirements and lower likelihood of overt nutrient deficiency symptoms which may occur when growth is accelerated (Hepner and Maiden, 1971). Other metabolic adaptations to reduced energy availability also occur and are introduced below on page 29.

The third type of adaptation socializes young children not to expect favoured foods or special treatment because of their low position in the family. It also sacrifices individual well-being for the survival of the group. This adaptation is in response to the inefficient subsistence agricultural production and distribution system to which child labour must contribute, and to the high reproductive burden placed on mothers who must continue to bear children every two to three years.

In agrarian societies with high fertility and high mortality, parents are usually guided by cultural modes, the goal of which is to maximize the number of surviving offspring, but not to optimize the growth and development of each one. It can be pointed out that societies in which the concept of child-spacing has not been adopted simply may not have the time, knowledge, or motivation to deal with growth and development. These models for parental behaviour are themselves adaptations, culturally evolved over the centuries to conditions of (a) labour-intensive family agricultural production and (b) natural fertility. The first of these creates a demand for child labour in the home: the more children, the more land can be cultivated and the more work distributed.

The second condition, natural fertility, creates an expectable birth succession in which a mother concentrates her efforts for child survival on the initial risk period, namely the early period of breast-feeding, especially the first year of life when mortality rates are highest. The mother then turns her attention to the next baby once he is born. This postpones risks of malnutrition and neglect to the post-weaning period, but it probably resulted - during times of better ecological equilibrium than are often seen today- in favourable survival rates despite malnutrition, chronic morbidity, and lowered life expectancy. Given the need to enhance child survival or accommodate high mortality through high fertility, it may well be that the importance of pre-weaning care of the child has failed to gain its merited significance.

In their study of the Gusii in Kenya, LeVine and colleagues (forthcoming, 1989) documented special parental care during the first year of life. They found that mothers hold and feed more frequently those six-month-olds whose actual heights and weights were less than others. This suggests that they may be monitoring the child's growth and using compensatory measures available from local cultural models to bring faltering infants up to a standard. Their time schedule for phasing out intensive attention and devoting themselves to agricultural work was also dependent on the infant's attainment of motor milestones (e.g. sitting without help, walking unassisted) at normal ages. They used physical growth and motor development (along with disease patterns), then, as individually varying infant characteristics to which they responded flexibly during the first year. Indirect evidence suggests that mothers improve with parity in this kind of sensitivity. This type of monitoring, however, did not prevent the growth failure and high morbidity rates in the second half of the first year, features that characterize developing country populations.

The weaned child is enculturated to participate in subsistence agriculture in which the family is the production unit. He or she is being prepared for early induction into the family work force (Levine, 1974). As pointed out by Caldwell (1981), such a child should be weaned cheaply. Parental goals are to produce an undemanding, compliant worker, starting work from 3 to 5 years of age. Once past the dangers of early infancy, the child must accept its lowly rank as the least productive and

youngest member of the production team. As a symbol of his entry-level status, he may receive the poorest quality and the smallest portions of food, and must not question this.

Living in a Yoruba village in Nigeria in 1966, Zeitlin observed that children learned their rank starting from the age of two or three years. They were encouraged to apply a rule of conduct that permitted any older child to give orders to and exact obedience from any younger one. Cousins differing by a few weeks in age knew exactly which of them was senior. This "game" tended to give authority for food and play materials to older children. Its enforcement was a source of fascination for the children.

Dr. E. P. Y. Muhondwa (personal communication, 1984), discussing the same ranking system in Tanzania, has pointed out its benefits. In the absence of adults, each older child is held officially responsible for the welfare of the younger ones. Older children are taught that although they have the right to exact services or food from their juniors, it is their duty to see that the younger ones get their share to eat. These rules facilitate orderly child care and child labour in situations where adults are too busy to supervise the children closely.

Harkness and Super (1977) wrote that the Kipsigis of Kenya needed children who responded to adult speech with obedient action, rather than reciprocal speech. Mothers increased their commands and insults to the child after the age of two and the child spoke less frequently.

The highly active play, assertiveness, and curiosity of well-nourished pre-schoolers may be unwelcome and difficult to handle for busy caretakers in subsistence agricultural settings. Where agriculture is particularly demanding and food supply most limited, compliant submission to leadership becomes increasingly necessary. Nondemanding toddlers who sit quietly in one spot may be most valued, even though this behaviour may in fact be indicative of chronic infection or debilitation.

Whereas in some countries children appear to demand more attention during the second year than during the first year of life, Gusii mothers in Kenya expressed fears that if an infant's demands were allowed to escalate, he would be difficult to manage when the next child was born. Those children and toddlers left in the care of a grandmother were considered to be spoiled.

The values that enculturate the young child to accept its low rank under conditions of food scarcity may be elevated to the status of moral principles. The mother may feed her child less well in order to teach the child not to be selfish. In Java, Indonesia, self-restraint in eating is an important moral virtue. The pregnant mother may already deny herself food in order to train the infant in her womb in the virtues of self-denial. Similarly, the mother of the toddler may feel that she is spoiling her child if she feeds him full meals that include generous portions of fish and other attractive nourishing foods (Dr. R. Sobekti, personal communication, 1982). In Senegal and the Gambia children are trained "not to sacrifice themselves to their stomachs" (N'Doya, 1980). Chavez and Martinez (1982) described the ways in which the practices that induced malnutrition among the Indians in Mexico also prepared the children to live placidly as adults under impoverished and monotonous conditions.

A study in Nigeria of Yoruba students' memories of childhood found that many students' strongest single memory was the punishment they received when caught by their parents "stealing" meat from the cooking pot (Levine, 1974).

By limiting the quality and quantity of food offered to young children, this third type of adaptation also contributes to the detrimental weaning practices that increase the mortality and stunt the growth of children in traditional low-income communities. These negative weaning practices are the primary target of nutrition education and growth-monitoring interventions in almost all developing countries.

We may then ask ourselves: First, do we not wish to continue to reform the negative food beliefs and practices as part of an overall strategy of socio-economic development? - to replace the old methods of population control with family planning? - to provide sufficient food to make stunting an unnecessary price to pay for group survival? - and to promote production technologies and social systems that encourage parents to stimulate and educate their children? Second, given that we owe the good health and nutrition of our children to the most scientifically advanced adaptation on the planet,

shouldn't our goal be to enable all to share its benefits? Finally, is it not paradoxical under these circumstances to start searching for positive behaviours that enhance growth overlaid against a backdrop of negative behaviours that retard it?

The answers to these questions are not simple:

1. Yes, we do wish to keep on replacing formerly adaptive practices leading to high mortality, stunted growth, and impoverished lives.
2. No, it is not strategically possible at this time to bring the full benefits of modern technology, i.e. the high standard of living of the developed world, to the majority of the world's poor. Therefore, we are looking for interim solutions.
3. No, it is not contradictory to look for factors that foster good growth and health overlaid against cultural practices that diminish survival, growth, and vitality. It is not contradictory because these factors are known to operate in both human populations and other species as a fourth type or level of adaptation.

This fourth and last positive-deviant type provides the dynamic for cultural (and/or physiological) evolution within the micro-environment. This form of adaptation occurs at the individual, household, or, in our present case, the caretaker-child dyad level. It manifests itself in forms of adaptation that permit individual households or dyads to achieve better growth rates and lower mortality rates than are average for their population, and serves to:

- maintain a healthy nucleus of survivors in the micro-community despite low food availability and other environmental constraints;
- maintain social mobility within structures of group dominance and leadership as larger and more aggressive and glib members rise, while smaller and less intelligent and enterprising individuals fall in social class (Bogin and MacVean, 1981); and
- improve the survival value of the population as a whole by developing technologies that use resources more efficiently.

### ***The Need to Combine Positive-deviance and Child-survival Approaches***

This complicated overlay of biological and cultural adaptations implies that in many or most cases one cannot search for simplistic positive-deviant solutions to local problems that have been developed by a few families and then set out to teach these solutions to the community as a whole. Some solutions may be embedded in an environmental context that needs to be changed. If a behaviour is adaptive because it helps children to survive in spite of cultural practices that stunt growth and increase infant mortality, one may first wish to change these dysfunctional infant-feeding and -care practices. After such change takes place, behaviours that previously served a positive-deviance function of protecting the malnourished child may no longer be adaptive.

The following examples illustrate positive-deviant adaptations that would not be incorporated into a child-survival strategy. Chavez and Martinez (1982) found that unsupplemented Indian infants had low activity levels and body temperatures that were half a degree lower than their supplemented counterparts. Keeping such babies almost constantly tied to the caretaker's back could have protective benefits by maintaining body temperature, psychological well-being from the presence of the caretaker, physical movement with very little energy expenditure by the child, and protection from exposure to infection and other hazards. LeVine (1974) discusses such protection in African cultures, where the child on the back is kept from being burned by cooking fires.

It might be found that Indian mothers of positive-deviant infants, in households with lower levels of infant mortality, were more consistent than others in carrying their babies on their backs, at least during certain hours of the day and up to a certain age. Yet, the change agent would probably choose not to reinforce actively the behaviour of carrying the baby on the back. The well-nourished supplemented toddler was too heavy to "back" for long periods, and resisted the confinement of being tied by the caretaker (Chavez and Martinez, 1982), except when being rocked to sleep. In such cases the mother's fatigue must also be considered. Kenyan women commenting to researchers about a photograph of a woman tea-picker at work with a large baby on her back expressed concern and pity for both mother and child (Bifani et al., 1982).

In Pakistan, the Unani (Graeco-Arabic) food-belief system prohibits pregnant women and young children from eating meat, eggs, and fish in summer. These are considered intrinsically "hot" foods that may cause diarrhoea and

vomiting, particularly if eaten in hot weather. Given temperatures of more than 40 degrees Celsius without refrigeration, the likelihood that these foods will be consumed in a contaminated state in summer is high. For mothers who do not understand the germ theory of disease and therefore have no theoretical basis for practicing simple hygiene, positive-deviant behaviour may consist of delaying introduction of these foods to infants until after the age of two, when the incidence of diarrhoea is reduced (Ahmed and Zeitlin, 1972). The change agent would not accept the Unani prescriptions for withholding foods as examples of positive deviance to be reinforced within the community.

The reason for providing these examples is to demonstrate to the reader the fact that adaptive behaviours of type 4, the positive-deviant variety, must not be viewed as adaptations that can be automatically transferred without modification (although some may be). Behaviours do not stand by themselves. They are part of a total package of adaptation and cannot be manipulated individually without setting off a chain reaction. The usual procedure must be to integrate positive-deviance factors into a consistent pre-tested package of approaches to change based on known methods for improving child survival. This package must be developed by scientific behavioural trials in the homes of the malnourished (concept testing) and with due consideration to all four of the adaptation levels discussed earlier.

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## Overview of findings from the literature

About 30 studies carried out in developing countries have specifically attempted to compare well-nourished and malnourished children and their families in the same low income communities, while differing in focus and methodology. Most of them still centre on identifying pathology in the malnourished rather than adaptive qualities of the well-nourished, although this distinction is somewhat artificial. Only one study known to the writer, the Burma study cited earlier, has divided children into well, average, and malnourished, so that the top and bottom of the curve can be contrasted with the middle. Dr. Maria Luz Alvarez of Chile has been the most active researcher in the field, with the largest number of publications, mainly in Spanish (see Alvarez in the References). She has compared parental, environmental, and behavioural characteristics of the well-nourished and the malnourished.

Table 2 summarizes in detail the results of 10 studies that characterize the type of research that has been conducted and the range of research findings. The findings will be discussed by topic area in sections that synthesize the broader research literature.

Capsule summaries of a variety of other studies are as follows:

In Thailand, a study by Somchai Durongdej of 365 children aged 0-48 months living in low-income congested areas of Bangkok found that male sex, high birth weight, low morbidity, good appetite, antenatal care, well-baby clinic attendance, consumption of colostrum, and current breast-feeding were factors that determined whether babies were well-nourished or malnourished (Durongdej et al., 1987).

In Chile, a study by Maria Luz Alvarez of more than 1,000 families, comparing low-income families with well-nourished versus malnourished infants, disclosed significant differences in the parents' own childhood history and current social-support structure and marital adaptation. Mothers of the well-nourished were more likely to come from intact homes, perceive that they were loved as children, have positive parental models, and a currently stable union with fewer arguments and more demonstration of affection. Fathers had a more stable employment history. Mothers of the malnourished were found to need models of good parenting behaviour, which might be provided by mothers of the well-nourished. Adolescent pregnancy was a risk factor for poor parenting (Zeitlin and Ghassemi, 1986). (Dr. Alvarez has reported these results, taken here from workshop proceedings, in a number of separate papers noted in the References. )

Table 2. Types of relationships reported by existing positive-deviance studies

	<b>Imesi, Western Nigeria (Morley et al., 1968)</b>	<b>Solis, Mexico (Chavez et al., 1974)</b>
Study objective	Examination of socio-medical factors affecting the lives of children and their eventual use as "indications for special care" of children at risk of malnutrition	Determination of the biological and cultural factors that give rise to adequate development among a certain proportion of the children in the adverse conditions of a poor environment. This knowledge could possibly be used for the planning of more rational applied programmes
Research design and population characteristics	Sample drawn from a longitudinal study of 405 children under five years of age living in the village of Imesi, Western Nigeria. This community from the Yoruba tribe relies mainly on farming for its living	Analysis of the differences in food, care, and health existing among two groups of children of the same social stratum but with a different nutritional status. Sample drawn from 220 children below four years of age in a rural community
Positive-deviance discriminators	Weight-for-age - Malnourished children MN(52): weight-for-age below the 10th percentile (local weight distribution) on one or more occasions at 6, 9 or 12 months of age - Well-nourished children WN (52): weight between the 50th and 75th percentile (40) or above the 75th percentile (12)	Clinical signs of malnutrition - MN(37): presented obvious signs of malnutrition - WN(36): did not present any alteration in growth, nor signs of malnutrition
Mother-infant interaction	Not reported	Greater mother-child interdependence in MN children; mothers were closely restrictive in the first group while liberal in the case of WN children
Child behavioural characteristics	Not examined	Not examined. WN children were older than MN ones.
Maternal psychosocial characteristics, nutrition/health practices	Not examined	Mothers of WN children had modern concepts regarding child illness, while MN children's mothers tended toward "magic concepts" of health and treatment. MN were isolated in comparison to WN children

Maternal and child physiology, diet, morbidity, mortality, etc.	Mothers of positive-deviant children were heavier after delivery but mothers' heights. and fathers' heights and weights, were not related to the child's weight	Mothers of WN children consumed diets superior in quantity, quality, and variety, currently and in the past, especially during pregnancy
	No significant difference in the duration of breast-feeding and time of introducing other foods between the two groups. Fathers of MN children had worse hygiene than those of WN	No difference in the duration of breast-feeding, age and type of supplementary feeding, but a difference existed in weaning practices as MN children were weaned quickly and abruptly
Family size and structure, maternal education, and other socio-demographic correlates of malnutrition	No difference in family size, fathers' occupation and religion between the two groups child ratio in the WN group	No family size difference between the two groups but family composition differed because of a higher adult/
	Significant difference in birth order MN children were more common above a birth order of 7	No difference in family income, land property & father's education (mother's education standardized), but food expenditure was higher among families of WN children. A difference was found in the degree of westernization. Mothers of WN children were more inclined towards modernization, had more contact with the external world, were out of the home and town more often, and took their children out more frequently
Community health, social services, family and social support	Marital system: low-weight children were associated with broken marriage, father's death, and lack of other family support	Not examined
	Mexico (Cravioto and Delicardie. 1976)	Kampala, Uganda (Goodall, 1979)
Study objective	Examination of the micro-environmental factors that lead to the appearance of severe malnutrition among low-income families, and assessment of the same factors in a matched group without diagnosis of clinical malnutrition	Adverse social factors are not the only factors explaining the occurrence of malnutrition since these factors occur in families with no malnutrition. This study seeks to fill the gap in the knowledge in this regard.

Research design and population characteristics	From a prospective longitudinal study of 334 children under 5 years of age, 22 malnourished children were matched at birth. for sex, gestational age, birth weight, psychomotor development and socio-economic factors, with well-nourished children	Samples were drawn from 107 children with kwashiorkor from inpatients of New Mulago Hospital, Kampala, Uganda ( 1969-1972) and from 111 controls with various diseases not attributable to socio-economic factors, infectious agents; or normal siblings of the malnourished children
Positive-deviance discriminators	Clinical signs of severe malnutrition - MN(22): 15 developed kwashiorkor and 7 marasmus - MN(22): children selected from the same birth cohort who were never diagnosed as severely malnourished	Clinical signs of severe malnutrition - MN(50): presented clinical signs of kwashiorkor - WN(50): did not present any signs of severe malnutrition or infectious disease as they were matched for sex, age, and tribe or origin.
Mother-infant interaction	WN children had significantly more favourable environments in terms of home stimulation: the amount of verbal communication, expressions of affection toward the child, mother's co-operation and reaction when the child performed well, and need gratification were significantly higher in the WN group	
Child behavioural characteristics	Not examined	Not examined
Maternal psychosocial characteristics, nutrition/ health practices	Significant differences were found in the behavioural responses of the mothers to the test situation. as mothers of WN children were more supportive. communicative, and responsive to their child's performance Mother's contact with the mass media made a significant distinction between the two nutritional groups, as mothers of WN children listened to the radio more frequently	Not examined

Maternal and child physiology, diet, morbidity, mortality, etc.	Not examined	All kwashiorkor children were weaned, even before illness developed, while 13 of the controls were still breast-fed. Statistically significant differences were found between "good" and "bad" reasons for weaning with ' bad" reasons being mostly given in the kwashiorkor group. For most of those children weaning was abrupt. Twenty-eight kwashiorkor children were sent away from home during weaning, as compared to 8 controls
Family size and structure, maternal education, and other socio-demographic correlates of malnutrition	No difference in the age, height, or weight of either parent, the mother's number of pregnancies, or the number of live children between the two groups 9 and 18 in the other control group No significant relationships between the presence or absence of malnutrition and variables of personal cleanliness, literacy, and educational level No difference between the two groups on the grounds of socio-economic factors, family size and structure (nuclear or extended)	Significantly, more children with kwashiorkor had fathers with a poor income: 23 cultivators and 4 salaried were represented in the kwashiorkor group as opposed to Stability of marriage: only 20 couples of the kwashiorkor group were found to be consistently living together, as compared to 31 in the control group Parent-child relationship: 16 MN children lived with their parents v. 33 in the control group
Community health, social services, family and social support	Not examined	Child attendant: kwashiorkor children were less likely to have their mothers as attendants in hospital than were control children. The change in attendants in case of child illness was most marked in the kwashiorkor group
	Bangladesh (Graves, 1976)	Kathmandu, Nepal (Graves, 1978)
Study objective	To explore whether differences in specific components of infant and maternal behaviour could be detected between poorly nourished and adequately nourished young children. The study deals with chronic or moderate malnutrition rather than with severe cases of malnutrition	Same objective as the Bengali study, with an additional one to test whether it was possible to reproduce the findings of the West Bengali pilot study in a different cultural setting, using a cross-sectional approach

Research design and population characteristics	Samples drawn from children attending the maternity and health clinic in Singur District, West Bengal (1971-1972). The population is mostly agricultural Age of study children ranged from 7 to 18 months	Samples drawn from children attending maternal child health clinics around Kathmandu, Nepal Same age of study children covered in the Bengali study
Positive-deviance discriminators	<p>Three anthropometric measurements were done: - weight-for-age based on local values - weight/length<sup>2</sup> x 100 mid-arm circumference/head circumference ratio MN(23):</p> <ul style="list-style-type: none"> <li>- weight-for-age below 30th percentile</li> <li>- weight/length<sup>2</sup> x 100: at or below 0.14</li> <li>- mid-arm circumference/head circumference ratio: below 0.280</li> </ul> <p>WN(39):</p> <ul style="list-style-type: none"> <li>- weight above 70th percentile</li> <li>- weight/length<sup>2</sup> x 100: at or above 0.15</li> <li>- mid-arm circumference/head circumference ratio: at or above 0.310</li> </ul>	Same 3 anthropometric measurements used in the Bengali study MN(36): Same criteria of selection as in the Bengali study WN(38): Same criteria of selection as in the Bengali study
Mother-infant interaction	Mothers of WN children were more responsive and attentive to behavioural signals but did not interfere with the children when they were involved in play. Mothers of MN children were less responsive and demonstrated a lack of mutuality in their interaction. The greater need for close physical contact with the mother may be viewed as a characteristic of insecurely attached children. Maternal distance interaction also differentiated between the two nutritional groups: WN children used this mode of communication	Maternal behaviour toward the child was not different between the two nutritional groups, and the intercorrelations between maternal and child scores showed similar or parallel patterns of reciprocity for the WN and the MN children

	significantly more frequently than MN children; a high degree of reciprocity existed between mothers and children in the WN group while it was lacking in the MN group	
Child behavioural characteristics	No difference in the intellectual performance levels between the two groups, but the intercorrelations between the development quotient and maternal scores suggested that the determinants of intellectual performance are different: higher performance levels were noticed among the WN children as they were accompanied by low levels of maternal attention, while the MN boys' intellectual performance level was directly dependent on the level of on-going maternal attention and stimulation MN children differed from WN both in exploratory and attachment behaviours: MN showed markedly less vigour when handling the toys; the amount of overall attachment behaviour and of interaction across a distance with the mother was significantly lower than among WN, and they preferred to maintain close physical contact with the mother, staying on her lap rather than moving away from or around her	MN children scored significantly lower in their intellectual performance levels. The overall time spent in play was decreased, while time spent breast-feeding increased MN children showed significantly lower levels of exploratory activity and attachment behaviour, especially distance interaction, and a heightened need for physical closeness to the mother
Maternal psychosocial characteristics, nutrition/health practices	Mothers of MN children had lower scores in 4 of 6 measures of maternal behaviour; they tended to marry and have their first child at a younger age and expressed a negative, unwelcoming attitude toward pregnancy with the study child	No difference was found in maternal behaviour between the two nutritional groups

Maternal and child physiology, diet, morbidity, mortality, etc.	Mothers of MN children had a significantly lower average weight All children in both groups were breast-fed; even though there was no difference in the age of introduction of adult foods, there was a significant difference in the inclusion of animal protein source in the children's diet between the two groups	Sibling deaths were reported more frequently among MN families. Same observation as in the Bengali study with regard to children's diet was made; the only difference between the two groups was the inclusion of animal protein food
Family size and structure, maternal education and other socio-demographic correlates of malnutrition	No significant difference in socio-economic status between the two groups. Parents of MN children had significantly lower education levels Family size and structure: families of MN children tended to have, on average, more children.	No statistical difference in family income. Educational levels of parents were lower in the MN group Larger family size among the MN group
Community health, social services, family and social support	Families of MN children were more frequently nuclear families (parents, children) rather than extended families (one or more relatives living with the nuclear family)	Although the same number of nuclear/extended families was reported in both groups, MN families were more crowded
	Jamaica (Kerr et al., 1978)	Kenya (Dixon et al., 1982)
Study objective	To examine the role of social functioning in the development of infant malnutrition and to explore the relationship between infant malnutrition and maternal psychosocial behaviour, by comparing mothers of MN children with mothers whose children were matched for age and family income but who were not malnourished	Many sub-Saharan East African countries are undergoing rapid social changes: increased population growth, accelerated conversion of traditional agricultural to partial cash-crop economy, and rapid cultural and political changes. It is the purpose of this study to examine the impact of these rapid social changes on the nutritional status of individual children and to see what characteristics and circumstances distinguish the MN children from the rest of the population, and what factors in the family unit are associated with failure to meet a child's nutritional needs

Research design and population characteristics	Samples drawn from children admitted to University Hospital (Kingston, Jamaica) for severe malnutrition (malnourished, N = 6; controls, N = 6)	Sample drawn from an agricultural Bantu tribe living in the fertile highlands of south-western Kenya (N = 597)
Positive-deviance discriminators	Weight-for-age Growth failure after excluding non-nutritional causes and rapid weight gain after dietary therapy	(a) Weight-for-age (b) Major signs of acute malnutrition (c) a and b combined
Mother-infant interaction	Not examined	The common and basic risk factor of malnutrition appears to be an alteration in the usual attachment of the child to a primary caretaker. In this study, for large proportions of the MN subsample, societal, familial, individual, and economic events combined to produce the "bonding failure," with nutritional failure as a secondary event. The malnutrition of these children should then be labelled a symptom of an "attachment disorder." Since the Gusii have no tradition of shared child care among adults, care by grandmothers, or adoptive mother, is considered a deviant pattern in their society
Child behavioural characteristics	Not examined	The MN infant himself may also have contributed to the altered attachment. Interactional difficulties between mothers and MN children were suspected to begin very early, multi-determined and perhaps self-perpetuating. For others, the onset of difficulties may happen later on, linked to a shift in family relationships around the time of weaning and the birth of a sibling Development assessment was impossible to complete in the MN subsample because of the affective characteristics of the MN children, who were sad, apathetic, and difficult to engage in the test situation. This was in contrast to the longitudinal sample children, who readily co-operated after a short warm-up period. The 28 WN children, assessed by Bailey scales, showed scores above average at every

		age for PDI and MDI
Maternal psychosocial characteristics, nutrition/health practices	<p>Both groups followed the same custom of passing on children to grandparents, relatives or other adults. Mothers of MN children (MMC) were often aware of the poor treatment inflicted upon their children but did nothing about it. They showed lack of anxiety about their children's health. Early traumatic separation had occurred with similar frequency among MMC and controls, but control mothers thought that this had resulted from major upheavals that were beyond the control of their families, and maintained positive feelings toward their parents, while all MMC perceived that they had been deserted. Of MMC who had fathers or father substitutes, 7 had encountered severe beatings and 4 had suffered from sexual abuse. By the time of adolescence, most of the controls had left home (independent) while MMC were still living in hostile family situations. In spite of an equally deprived environment, the psychosocial functioning of the MMC and controls was significantly different: MMC were apathetic, dependent, passive, and isolated, with poor self-esteem and low energy level, or aggressive, manipulative, and evasive.</p>	

<p>Maternal and child physiology, diet, morbidity, mortality, etc.</p>		<p>Three mothers of the subsample were reported chronically ill and were unable to do farm work or care for the child. This was contrasted with the vigour and consistent hard work displayed by Gusii women in general. Three mothers of the subsample were not caring for their children because of alcoholism, as compared to only one in the whole community who was known to drink to excess Unusual incidence of prematurity and small size at birth (55 per cent of cases) and significant morbidity in the pre-natal period in the subsample was compared to a quite low level of perinatal casualty in the whole Gusii village. Weaning: 13 of 20 MN children were weaned between 10 and 36 months. This early weaning pattern for the subsample children was deviant from that of their own community</p>
<p>Family size and structure, maternal education and other socio-demographic correlates of malnutrition</p>	<p>Work history of MMC was very <i>poor</i>; 10 wanted to work but were waiting "passively" for someone to find work for them Eight of 10 control mothers who wanted to work were employed for by maternal grandmothers (with 4 accepting Housing: Controls made better use of their homes and gardens. In contrast, many homes of MMC were exceedingly ill-kept</p>	<p>The economic situation of families of the subsample seemed to have no consistent relationship with the nutritional status of the child Seven out of 20 MN children were cared for primarily by someone other than the natural mother. Five were cared reluctantly) and 2 by a grown sister while 2 had no specific caretaker. The usual pattern of child care in Gusii population is through the natural mother Seven of the subsample children were illegitimate, while the whole village had only 3 per cent illegitimacy (about one-tenth the incidence in the subsample)</p>

Community health, social services, family and social support	<p>Relationships with men: Control mothers' relationships with men were more stable. In MMC these relationships were not stable, were not based on trust but on money or other compensations, and usually ended in pregnancy. In families where fathers were present, there was often intense parental conflict and physical abuse</p> <p>Relationships with family and friends: Most control mothers had mutually supportive associations with churches, neighbourhoods, and extended families. They considered existing community institutions very supportive. On the other hand, most MMC had close family relationships, characterized by dependency, close supervision, and intense attachment, followed by accusations of having been exploited</p>	
	Santiago, Chile (Alvarez, 1982, 1983)	Guatemala (Scrimshaw and Scrimshaw, 1980)
Study objective	<p>Maternal cultural and psychological deficiencies have been recognized as important intervening factors in the genesis of infantile malnutrition, but have not been adequately investigated. It is the purpose of this study to compare the non-verbal language (NVL) expressiveness of mothers of malnourished and healthy children</p>	To investigate determinants of positive deviance (positive growth status and survival of all children) among plantation wage-earning mothers

<p>Research design and population characteristics</p> <p>Positive-deviance discriminators</p>	<p>Samples drawn from children attending health centres of the National Health Service in Santiago, Chile. Weight-for-age using NCHS standards - MN(20): below 10th percentile of weight-for-age - WN(80): above 25th percentile and not hospitalized more than once in the preceding 3 months and for no longer than 10 days</p>	<p>Samples drawn from plantation wage-earning mothers (N = 100) Weight-for-age: death was reported among pre-school siblings Positive deviants: all children in the family were well nourished and there were no pre-school deaths Malnourished: low weight-for-age was accompanied by a mortality history</p>
<p>Mother-infant interaction</p>	<p>Not examined</p>	<p>Not examined</p>
<p>Child behavioural characteristics</p>	<p>Not examined</p>	<p>Not examined</p>
<p>Maternal psychosocial characteristics, nutrition/health practices</p>	<p>No difference in intellectual performance (IQ) between the two groups . . . Mothers with MN children had higher degrees of dissatisfaction or were poorly satisfied with their family life (in 70 per cent of cases), while 85 per cent of mothers of healthy children considered themselves "moderately or completely satisfied" Mothers of MN children had a low degree of NVL expressiveness 90 v. 45 per cent in healthy children's mothers) Subindex for feeding act showed that all mothers of MN children had low scores while only 45 per cent of mothers of MN children had similar scores</p>	<p>Mothers who were more successful (with positive-deviant children) were entrepreneurial and also contributed to family income by petty trading, marketing, animal husbandry, kitchen gardening, etc., whereas those with poorer children were not earning comparable additional income One of the strongest discriminators between mothers in positive-deviant households and those with malnutrition and mortality history was an <i>enterprising</i> versus a fatalistic attitude</p>

Maternal and child physiology, diet, morbidity, mortality, etc.	Not examined	Not examined
Family size, structure, maternal education and other known socio-demographic correlates of malnutrition	All families belong to a low socio-economic level (stratum 5 of Graffai's modified scale) All families were standardized with respect to: number of children; age and birth weight of study children; Job situation of the mother; and absence of other female relative living in the house There are no significant differences between the two groups with respect to number of individuals in family group, number of children, maternal age, education, duration of breast-feeding, and marital stability The only variable in the "past history" that distinguishes significantly the two groups referred to the jobs held by mothers before their infant was born: 65 per cent of mothers with healthy infants had held jobs, compared to only 35 per cent in the other group	Positive-deviant mothers contribute to family income from trading, gardening, and other hidden resources, whereas mothers of MN children were not earning comparable additional income
Community health, social services, family, social support	Not examined	Not available

In Pakistan, a comparison reported by Julian Lambert between 38 households in which all children under five were above 90 per cent of weight-for-age and 134 households having at least one child below 60 per cent, with equal income and food expenditure, found higher consumption of edible oils, dhal, eggs, and rice and longer birth intervals in the well-nourished families (Zeitlin and Ghassemi, 1986).

In Mexico, 25 well-nourished infants, aged 8.5 to 20.5 months, studied by Marian Zeitlin, F. Catherine Johnson, and Robert LeVine, were found to receive more physical assistance from their mothers in eating meals and snacks than 25 age-matched malnourished infants in the same low-income squatter community. The well-nourished also received more powdered milk, which was given in feeding bottles

and mixed with atole (sugar water cooked and thickened with corn or rice starch) (Zeitlin and Ghassemi, 1986).

In Bangladesh, a survey of 180 9- to 18-month-old infants, in one upland and one lowland rural site (Zeitlin et al., 1985), found that the mothers of well-nourished infants differed from those of the malnourished in their method of cleaning infants' faeces, mother's own handwashing after defaecation, age of introducing supplementary foods, and educational aspirations for the child. Diarrhoeal rates differed significantly between the well-nourished and the malnourished. These rates were related to the infant's contact with chickens, ducks, goats, cows, and human faecal matter while playing on the ground, and to the dryness of the earth surface where the baby was left to play.

### ***Types of Information Found by Existing Positive-deviance Studies***

The few studies that have compared well-nourished and malnourished children living under conditions of socio-economic underdevelopment and poverty have pointed to three types of variables related to good growth:

1. Socio-economic correlates of malnutrition, such as mother's education, family size and birth spacing, knowledge of modern nutrition and utilization of health services, and other factors associated with growth status in low-income environments.
2. Physiological determinants of growth, including maternal height, weight and metabolic factors, parity, morbidity, and dietary intake of nutrients.
3. Psychosocial and behavioural aspects of mother-child interaction, associated characteristics, and the social network surrounding the dyed.

The psychosocial correlates belonging to this third group are the primary focus of this paper, for a number of reasons: variables in the first and second categories are already reasonably well known, and have been addressed by the major child-survival interventions, including PHC activities. The remaining physiological determinants of growth are in the domain of basic biomedical research.

### ***Different Bodies of Literature Relevant to Positive Deviance***

Taken in isolation, the findings of the positive-deviance studies are too fragmentary to synthesize into a meaningful whole. However, each finding of these studies supports the conclusions of the broader review of the literature on pages 45-79. This review draws on a wealth of closely related literature that cannot be pigeonholed under the label of positive deviance, but that elucidates the associations that contribute to the positive-deviance concept.

Although psychosocial and behavioural characteristics will be the focus of the literature review, we will first identify the various bodies of literature relevant to positive deviance. While scanning and abstracting information from these literatures, we could not summarize them all in this paper. To do so would be to resynthesize all previous work in the field of MCH nutrition in developing countries.

It is important for the reader to know under which headings information related to positive deviance may be located. The focus on the top (normal) end of the developing-country curves makes it necessary to review literatures from both male nourished and well-nourished populations. Factors that influence child growth have been studied by a wide range of biomedical and social-science disciplines. The number of life-stages affecting growth contributes to the vastness of the topic. Positive deviance in the infant may start in the girlhood of the mother. Therefore, it becomes necessary to consider not only the nutritional status of the infant at the weaning age, but also maternal nutrition before and during pregnancy, birth weight, neo-natal status, and maternal nutrition during lactation. Figures 2 and 3 represent in simplified form three of the groups to be considered and the bodies of literature about these groups that are relevant to positive deviance. These figures have been drawn with reference to weight-for-age. However, other nutritional status indicators could have been used. It should be noted that very little attention has been given to positive deviance per se, so that studies with other agendas must be examined for their applicability to positive deviance. Figure 2 represents infants and young children. Curve A shows the distribution of weight-for-age in a typical developing-country population. Bodies of literature relevant to these curves are listed below. Subtopics with particular importance for research in positive deviance are discussed in part 2. Persons interested in any given subquestion should pursue the complete literature pertinent to their subtopic or collaborate with colleagues who are already familiar with this literature. Relevant bodies of literature are:

1. A modest number of clinical, biochemical, and immunological studies of infants at the bottom of curve A, who require inpatient treatment or nutritional rehabilitation.
2. A large number of studies of malnutrition correlates in developing countries, focusing on the bottom or the whole of the growth curve. Few have examined the phenomena at the top of the curve, beyond noting that high socio-economic status characterizes the top. These studies tend to be micro-economic, dietary, and anthropometric in nature with little measurement of behavioural and social variables expected to differentiate positive deviants. Some of these data sets could profitably be reanalysed, controlling for income and looking for descriptors that characterize children with good growth.
3. A large nutrition and infection literature, suggesting that positive deviants are protected from high levels of infection either by parental behaviours or high natural immunity.
4. A growing number of failure-to-thrive studies in industrialized countries that yield richer psychological and social information than analogous studies noted under (1)
5. A moderate number of studies correlating the size of parents and children and adopted versus natural children, comparing racial groups, breast- versus bottle-fed and low versus high socio-economic groups, and linking micro-nutrient deficiencies and maternal smoking to growth.

[Fig. 2. Young children. 6 months to 3 years.](#)

6. Infant and childhood obesity studies. This literature is relevant to positive deviance because: (a) stunting combined with obesity is a prevalent form of malnutrition in some locations and (b) some positive deviants in food-scarce environments may have characteristics that would make them obese if food were plentiful.

7. A voluminous literature on child development, mostly unrelated to nutrition but elaborating in great detail upon the psychosocial factors described in this document.

Figures 3a and 3b represent developing versus industrialized country distributions of weight gain in pregnancy and birth weight. Relevant literatures relating to those figures are:

8. More than a dozen supplementation studies in developing and industrialized countries, proving that under certain conditions weight gain during pregnancy and birth weight can be increased by interventions improving maternal food intake. Some of these supplementation projects have gone on to show beneficial effects of maternal supplementation on neo-natal behaviour and child development.

9. A large literature on nutrition and fertility, indicating that birth spacing and total family size are important to positive deviance, in part because of effects on nutritional status during pregnancy and also because of maternal workload and strain on family income.

[Fig.. 3a. Pregnancy weight gain.](#)

[Fig. 3b. Birth weight](#)

10. A moderate-sized literature, primarily from industrialized countries, relating maternal prepregnancy weight, calorie and protein intake, micro-nutrient status, smoking, alcohol and drug use, blood pressure, glucose tolerance, and infection to weight gain during pregnancy and/or birth weight and/or child development.

11. A growing number of reports on factors associated with prematurity and low gestational weight-for-age, and their sequelae. Most of these are from industrialized countries.

12. A moderate-sized literature of very uneven quality on neo-natal bonding.

13. A growing literature on neo-natal assessment of high-risk newborns, involving cry analysis, interactions between teenage mothers and their newborns, etc. This group of studies does not address the question of what proportion of low-birth-weight newborns in developing countries exhibit behavioural abnormalities. In a country such as Bangladesh, for example, where the average birth weight is very low, the percentage of infants weighing less than 2,500 grams who behave abnormally should be lower than in industrialized countries, where low birth weight is commonly due to causes other than low caloric intake of the mother. Very little or no attention has been given to the high end of the neo-natal weight curve.

14. Lactation studies: relationships involved in determining lactation performance are too complicated to represent in a simple diagram. There is a literature supporting the conclusion that malnourished women produce less milk of slightly lower nutrient density than the wellnourished. Relationships between breast-milk volume and prolactin, diet, frequency and duration of nursing, other breast-feeding behaviours and introduction of supplements still remain indefinite. These topics have obvious relevance to positive deviance.

15. Studies of metabolic efficiency and psychological adaptation to nutrient deficits and to stress have been conducted primarily on animals and obese adults.

### *Positive Deviance*

Factors that characterize infants at the high end of the growth curve in developing countries fall into a number of categories that are worth distinguishing. Typically, the distribution curve of the weights or heights of a malnourished child population is shifted to the left when compared to the distribution of an affluent country. As has been shown in many instances, the distribution does not acquire a major skew but retains a typical symmetrical or almost symmetrical bell-shaped curve. This means that all sections of the population are affected to some degree, including the so-called positive deviants, who are believed to be found at the right hand or upper part of the distribution.

The shape and position of the distribution is influenced by a number of factors. The width of the distribution is probably mostly due to genetically fixed factors affecting body size and shape, and to a minor extent influenced by the errors that occur when taking and recording the measurements. The position of the distribution in relation to that of a well-nourished population is determined by external factors which include nutritional adequacy, social, economic and behavioural variables. It is usually not possible to determine which of the many active factors are responsible for an individual child's precise place in the distribution. But it is possible, and this has been shown many times, to identify the major factors that affect the distribution as a whole. Income, for instance, usually has a positive effect on height but its influence on fatness is inconsistent from one population to another. In some societies and environments lower-income children tend to be thinner while in others they remain the same or fatter than upper-income children unless income is excessively deficient. Theoretically, it should therefore be possible to identify influences that come to bear primarily at the upper end of the distribution, where the "positive deviants" are located, but not over the whole width of the distribution.

### Fig. 4.

The main categories of factors characterizing children who grow well under socioeconomic and environmental deprivation are shown on figure 4 by As and Bs numbered from 1 to 4.

A1 on the malnourished-population curve and B1 on the reference-population curve denote in combination A1/B1 the set of factors that distinguish between children falling below and above the

internationally defined threshold for malnutrition, regardless of the population to which they belong. A1/B1 interventions would move all malnourished children upwards across the threshold dividing normal and subnormal growth. Total amount of food eaten, nutrient density of the food, and protection from infection are A1/B1 variables. Truly adequate MCH services can be expected to have an A1/B1 effect.

A2/B2 factors tend to characterize infants at the top of both the developing-country and the industrialized-country distributions. Large genetic size potential and certain types of metabolic efficiency should fall into this category. Mother-child interaction variables, child and maternal characteristics, and social-support structures described earlier are expected to fall into this category. These factors may in fact not cluster at the top end of the reference curve.

A3 factors distinguish infants falling at the top of the developing-country distribution but not of the reference curve. Good mothers living with high infant mortality and endemic malnutrition may coax their infants to eat large amounts of food (of low nutrient density) at frequent intervals and may restrict their freedom of movement in a manner that protects them from exposure to infection. These same behaviours manifested in the reference population tend to cause obesity. The Women, Infants and Children's Programs (WIC) nutritionists working with newly immigrated Hispanic mothers in the United States campaign against infant obesity by teaching the mothers not to bottle-feed the baby every time it cries and not to overly restrict its movement.

A4/B4 factors may describe characteristics of the threshold between clinical malnutrition and low average nutritional status in both malnourished and well-nourished populations. Although we picture positive deviance as falling at the top of a continuum, certain factors, such as intimate psychological support for the mother, appear to be necessary for a modestly satisfactory outcome but not sufficient for a superb result. A programme providing services for teenage mothers, for example, could be considered to be an A4/B4 intervention. These factors are important to positive deviance studies for two reasons:

1. Failure-to-thrive studies provide a starting-point for attempting to identify variables that characterize positive deviance.
2. The percentage of mothers exhibiting stress and depression, child abuse and other non-nurturing behaviours is high in some deprived communities. These variables may be characteristics distinguishing positive deviants from those below them on the growth curve. The Ik tribe of East Africa (Turnbull, 1972), for example, would represent an extreme case of a society in which non-nurturing behaviours were the norm.

### ***Physiological Factors Contributing to Positive Deviance***

Some infants and young children are physiologically better able to adjust to the stress of low energy and protein intake and high exposure to infection. Genetically, some have low nutrient requirements and/or enhanced ability to adjust metabolically to reduced food intake. Certain types of inadequate diets facilitate this adjustment more than others. Mind-body links are critical to growth, to the immune response and to most maturational processes.

Most research related to these topics is still in its infancy and is based on animal models, obese adults, cancer patients, and other subject groups rather than human infants and children. Although it is not within the scope of this paper to fully review this research, it is appropriate to orient the reader to the types of physiological mechanisms that are under investigation.

### *Energy Metabolism*

Some degree of adaptation to food scarcity appears to be genetic. Genetic characteristics that reduce the individual's ability to dispose of excess energy and predispose towards obesity and adult-onset diabetes in industrialized, energy-surplus countries serve also to protect their bearers in developing countries from the effects of food scarcity.

When energy intake is restricted, the growing child can reduce energy expenditure by becoming less active, by reducing growth rate, and possibly by reducing the amount of energy that is burned off as heat. Conversely, when energy intake is excessive, the amount disposed of as heat possibly can be adjusted upwards. Reducing the amount of energy wasted as heat should be a harmless form of adaptation unless the mechanisms that produce this reduction also are linked to lower levels of activity, growth, and development. Reducing activity levels and growth rate are adjustments that cannot be classified as satisfactory. Although they often are adaptations consistent with normal health and performance, levels of achievement tend to be below the adapted individual's genetic potential.

### *Hormones Involved in Energy Conservation*

The regulation of food energy as a supply of fuel or body heat will depend on the extent to which the child is nutritionally stressed. Further, the degree of adaptation and its successful implementation in the child will determine the form of PEM the child develops (Gopalan, 1958).

There is a spectrum of what may be called adapted PEM, which is consistent with survival and eventual maturation of the child into a functioning adult. This spectrum ranges from mild growth retardation to marasmus. The marasmic child has adapted well, in the sense that most levels of metabolic indicators are normal in marasmus. Kwashiorkor, on the other hand, displays extreme failure to adapt, as seen by severe biochemical changes in the child (Rag, 1982) and high case-fatality rates. Within the so-called adapted spectrum from mild growth retardation to marasmus, the most efficient adaptations are those that have the fewest detrimental effects on growth and development. At the lower extreme, marasmus may be considered to be an adaptation only in the sense that it is compatible with survival (barring severe infection). Developmentally, the marasmic child is retarded.

A variety of hormones affect the process of adaptation to reduced food intake. The following are some of the main hormones regulating energy utilization.

### *Thyroid hormones*

These hormones regulate basal metabolic rate and thus the heat generated by metabolism (Danforth, 1983).

During nutritional deprivation the levels of protein-bound iodine are decreased, primarily because of the decreased synthesis of thyroxine carrier proteins. The hormone thyroxine, T<sub>4</sub>, may be selectively deiodinated into either an active energy mobilizing isomer, referred to as T<sub>3</sub>, or an inactive and energy-sparing isomer, referred to as rT<sub>3</sub> (reverse T<sub>3</sub>). In pregnancy, rT<sub>3</sub> increases, permitting the pregnant woman on a limited diet to transfer more nutrients to the foetus. High levels of T<sub>3</sub> lead to high loss of energy as heat. Becker (1983) suggests that the coexistence of low T<sub>3</sub> and high rT<sub>3</sub> levels present in adults suffering from PEM is also present in children. Genetically efficient individuals may have low T<sub>3</sub> production and utilization rates or low T<sub>3</sub>/rT<sub>3</sub> ratios and hence be more successfully adapted.

#### *Hormones secreted by neurons of the sympathetic nervous system*

Norepinephrine (noradrenaline) or NE, secreted by the sympathetic nerve endings to the organs, regulates basal metabolic rate and the activity rates of many organ systems, including mental activity (Landsberg and Young, 1983). NE also is secreted by the adrenal medulla into the bloodstream, but this source of freely circulating NE is not an important part of the regulatory mechanism we discuss here. Caloric restriction reduces NE, particularly when blood glucose, insulin, and lipid levels fall. NE appears to be a major regulator of dietary thermogenesis, or the burning off of energy as heat that follows a meal (during the period when glucose and insulin levels are elevated). During fasting, reduced NE lowers the amount of energy released for necessary uses into the bloodstream (substrate mobilization). Individuals in whom sympathetic nervous system activity is genetically low and in whom adaptation to calorie restriction occurs with high efficiency would be energy-efficient.

#### *Insulin*

Insulin removes glucose, free fatty acids, and amino acids from the bloodstream into the cells, both for use and for storage. These effects are decreased under conditions of insufficient energy. A high insulin response causes wastage of energy, as glucose is oxidized or cycled about more rapidly than it needs to be (Danforth, 1983). A lower insulin response permits glucose and other substrates for metabolism to remain in the bloodstream at satisfactory levels despite relatively prolonged periods of little or no food intake. In protein-energy malnutrition, less insulin is secreted and the effects of insulin may be reduced by the mechanism described next.

#### *Redistribution of Body Fat*

Although not clearly proven, it also appears that undernourished children adjust by redistributing body fat from the limbs to the trunk (Bailey et al., 1985). This is adaptive because the fat cells on the abdomen differ from those on the limbs in having a higher rate of lipolysis in response to epinephrine and lower insulin sensitivity (Kissebah et al., 1982). This implies that fat cells in this location are better able to release energy rapidly into the bloodstream in response to food deficits than cells located elsewhere. In

pre-school children in Thailand, a higher ratio of trunk skinfold thickness to triceps skinfold thickness was associated with less stunting and less delay in bone age. Alterations in androgen metabolism may cause a greater predominance of fat to be located in the upper body (Evans et al., 1982).

### *Growth*

For the child to maintain a reduced but steady level of growth without overt morbidity and under conditions of protein-energy deficiency requires a series of hormonal adaptations (Rag, 1974), which are as yet imperfectly understood. Protein deficiency leads to a reduction in the plasma amino acids necessary for growth. Several hormones interact to maintain an increased efficiency of amino acid utilization. Under these conditions, when protein intake is insufficient to permit normal growth, increasing the intake of calories alone may not improve the rate of growth but rather destabilizes this adaptive mechanism and leads to overt morbidity in the form of kwashiorkor. Experimental restriction of protein in a high-energy diet has been shown in infant Cebus monkeys and baboons to produce a condition resembling kwashiorkor (Samonds and Hegsted, 1978). A genetically slow linear growth rate could be adaptive by reducing nutrient requirement for growth.

### *Cortisol*

This hormone, secreted by the adrenal cortex, withdraws protein from the muscles and returns it to the liver, where it can serve both to maintain the function of the liver and to make extra nutrients available to the body in response to stress. High cortisol levels in marasmus result in wasted muscles but a well-maintained liver function. In kwashiorkor, cortisol is lower, amino acids are not diverted from muscle to liver, and liver damage occurs (Rag, 1974). Cortisol levels therefore play a crucial role in the adaptation to protein-energy malnutrition. Another function of cortisol is to reduce the rate of skeletal growth by inhibiting the stimulatory action of somatomedin in the epiphyseal cartilage. Somatomedin is a serum growth factor that facilitates the anabolic actions of growth hormone. Cortisol also directly inhibits somatomedin synthesis (Smith et al., 1981).

### *Growth hormone (GH)*

Secretion of this pituitary hormone increases as a response to high cortisol, low blood glucose and low blood amino acid levels (Rag, 1974; Brasel, 1980). Growth hormone levels are systematically increased in well-adapted mild to moderately malnourished children. Increased levels of GH also trigger the stimulatory action of somatomedin on epiphyseal cartilage synthesis. Thus, in the adapted child, the effects of increased cortisol and reduced insulin keeping nutrients in the liver and bloodstream ready for use - remain in balance with the effects of increased growth hormone, which channels some of these nutrients into maintaining growth, at a lower than normal rate.

In marasmus, when growth virtually stops, some researchers have found elevated, and some normal levels of GH. Rao (1982) found that GH levels are more likely to be normal in marasmic children and elevated in children with kwashiorkor, and that they can be normalized within a few days of therapy

with milk feedings or protein containing diets. GH is also involved in lipolysis, releasing free fatty acids into the bloodstream and thus providing a source of fuel. This lipolysis becomes dysfunctional in kwashiorkor, when amino acid levels are low, and the released free fatty acids become trapped in the hepatic cells causing fatty infiltration of the liver.

### *Somatomedin*

The low levels in PEM may be due in part to the general inability of the liver to synthesize protein without sufficient free amino acids, as is illustrated by decreased albumin synthesis during malnutrition. High GH levels may suppress somatomedin synthesis as will high cortisol and low insulin levels. Soliman and co-workers (1986) found that impaired insulin secretion and elevated cortisol levels in malnourished children correlated with percent weight deficit; and that low somatomedin levels were associated with a greater height deficit. Thus it appears that somatomedin reduction is one more regulating mechanism for keeping linear growth proportional to the nutrient intake of the child.

However, Smith and associates (1981) found the same relationship between cortisol and weight deficit and a negative correlation of somatomedin levels with cortisol and growth hormone, without observing the association between decreased somatomedin and decreased stature. Thus, further research needs to focus on the effects of somatomedin on growth before conclusive statements can be made.

### *Immune Response*

All of the immune responses are to some degree genetically regulated. Infants with high response levels are inevitably protected from the severe nutritional disturbances that follow infection. This topic and additional factors, such as malabsorption, require further detailed research.

### *Psychological Factors*

It has long been known that psychological stress causes protein catabolism (Scrimstraw et al., 1966). A stressful caretaker-child interaction, therefore, can be expected to increase protein requirements while tending to decrease the amount of food that the child consumes (Scrimshaw, 1969). Pleasantly stimulating interactions, on the other hand, enhance the child's tendency to exercise its developing organ systems and, hence, to utilize nutrients for growth and development.

Stress and depression also have been shown to decrease primarily cellular but also humoral immune responses (Marx, 1985; see Calabrese et al., 1987, for a review of the role of stress in the neuroendocrine regulation of immunity). Increased cortisol levels in stress and in malnutrition suppress cell-mediated immunity, with the effect of protecting the stressed or malnourished individual from inflammatory responses that may further increase stress. The immune system increasingly appears not to be an independent body system but to be intimately linked to the nervous system, and to play an integral role in the body's overall system of hormonal regulatory responses. There is increasing evidence that psychoactive peptides, such as natural opiates, produced by the human brain in association with

psychological mood, attract immune cells to parts of the body where they are needed to fight infection or repair damaged tissues (Ruff et al., 1985). Tumour-fighting immune responses have been shown to be lower in cancer patients who suppressed their anger, lacked good social support, and were apathetic. These last two characteristics tend to typify mothers of malnourished, chronically ill infants.

### Implication of Physiological Factors for the Study of Psychosocial Aspects of Positive Deviance

If children who successfully resist malnutrition are genetically different from others, it would be reasonable to ask what was to be gained by studying the psychosocial factors linked to adequate growth amidst poverty. In fact, we have no evidence that the purely physiological components of positive deviance are strong enough to predominate over or to seriously confound the interpretation of the psychosocial components. The fact that some children are genetically more resistant than others adds to the unexplained variance in the results of psychosocial research, just as uncontrolled psychosocial factors add to the "noise" in physiological research findings. It is desirable and it should be increasingly feasible to address both psychosocial and physiological questions in the same research designs.

On the other hand, it is extremely helpful to discover that psychological stress negatively affects the body's use of nutrients and its resistance to infection, and conversely that psychological well-being may activate the immune system and stimulate the secretion of growth hormone. These mechanisms help to explain why psychosocial factors, such as a smiling happy affect between mother and child, are consistently associated with adequate growth and development.

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## Overall conclusions and policy recommendations

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Three very broad conclusions emerge from the review of the literature which follows. They concern psychological and social wholeness or good health; modernization; and behaviours, technologies, and social structures specifically adaptive for the nutrition and health protection of the infant. These conclusions and their policy implications are presented here in order to provide the reader with a framework for synthesizing and interpreting the subsections in the review of the behavioural, psychological, and social correlates of child growth. Specific programme-design recommendations are given in each subsection.

### *Psychological and Social Good Health*

A major conclusion is that the psychosocial factors associated with adequate growth amidst poverty are not specific to nutrition alone. The same characteristics that predict a good nutritional outcome also predict good cognitive development, health, and longterm development of the individual into a stable, productive member of society.

Not surprisingly, most of these characteristics are common moral virtues and social values: devoted mothering, happy marriages, close families, supportive neighbours and friends, and active communities with employment opportunities and well developed social services. Healthy communities produce healthy families with healthy children.

These indicators of psychological adjustment appear to be necessary for good growth in deprived environments. yet once in place, they also are sufficient to promote favourable child development in almost every area. These characteristics that facilitate favourable child outcomes can be considered to be measures of the psychological and social health of families and communities.

The lack of specificity of these factors implies that action to improve infant nutrition by improving the quality of care and stimulation given to infants and young children, as well as the social services and social support networks available in low-income communities, can be justified not only on nutritional grounds but much more broadly, in terms of the child's overall development and well-being.

### *Policy Implications*

The policy implications of this conclusion are:

1. Closer links are required between health/nutrition services and social and psychological services. New combined service models are needed to protect high-risk mothers and children.
2. Both health and social services should be increasingly decentralized and should be provided through community self-help programmes such as Alcoholics Anonymous or La Leche League Organization (with external technical and resource assistance). Decentralizing the management of services is desirable because the ability of a community to take responsibility for its own high-risk members appears to yield nutritional, social, and psychological benefits that are equal in value to the actual services provided.
3. Legislation that binds fathers to support their children financially, and employers to provide maternity and health benefits, is badly needed in rapidly modernizing areas where customary legal and moral obligations have broken down. Social-welfare legislation designed to protect women and young children must be realistic and enforceable.
4. Development support is needed for the small-scale and informal economic sectors. Community health in most developing regions depends on the productivity and self-esteem of individuals working primarily as small farmers and small-scale food processors, manufacturers, and service providers. Much of what we term "social support" consists of micro-scale material support in the form of help with tasks and child care and timely social interchanges of food and other necessities. Community based micro-interventions are needed to strengthen the social networks that support the nutrition and health of children.

### *Modernization*

Parents of positive deviants are more likely than others in their communities to be upwardly mobile, to discard fatalistic attitudes, to take the initiative in adopting modern practices for themselves and for their children, and to be more enterprising. They make a more effective use of health services, family planning, and educational facilities, and tend to be further advanced along the demographic transition concerning family size, as they bear fewer children, have higher aspirations for them, and invest more resources in each child.

### *Policy Implications*

The diffusion of education, non-fatalistic enterprising attitudes, and modern practices protects the nutrition and health status of young children in spite of poverty. The shift in attitudes and values towards bearing fewer children, investing more in each and consciously planning for the future of each child yields direct benefits for the feeding, health care, and cognitive stimulation given to the individual child, particularly when resources are scarce. Since attitudinal problems may be at the root of malnutrition and ill health, explicit counseling, given during the post-natal check-up, for example, should discuss the parents, goals for the baby and the type of feeding, care, education, and birth spacing needed to achieve goals. Social marketing should also reinforce these new attitudes in health and nutrition as well as in family-planning programmes.

### ***Behaviours, Technologies, and Social Structures Specifically Adaptive in Protecting Nutrition and Child Health***

In addition to global measures of psychological and social wholeness and modernization, there are also positive-deviant behaviour patterns and technologies that are specifically adaptive in protecting the nutritional status and health of infants and young children. Actively feeding toddlers instead of expecting them to feed themselves is one such behaviour (Zeitlin and Johnson, in progress). Making sure that the infant was fed by adults, not by children, supplementing the infant's diet with a flour-based porridge, and using a metal hoe to remove faeces from the compound surface were similarly positive behaviours discovered in Bangladesh (Zeitlin, 1989). Very little research has looked specifically for these factors.

The ways in which psychologically competent mothers, receiving high levels of social support, feed and manage the lives of their infants and young children under conditions of resource scarcity should reveal these methods. Once identified they can be reinforced by programmes.

### *Policy Implications*

Further research is needed to identify these behaviours, technologies and structures and then to incorporate them into programmes. The three-stage research model recommended in part 2 incorporates the search for positive-deviance factors into the development of culturally relevant child-survival programmes. This combined approach is considered essential to applied research in positive deviance, since nutritionally adaptive characteristics that are selected for programme reinforcement must be

integrated into modernizing child-survival strategies.

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## **Introduction to the detailed review of behavioural, psychological, and social correlates of child growth**

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Since the third type of finding (p. 23) concerning behavioural, psychological and social correlates of child growth is least familiar to the majority of nutrition and health professionals, the goal of this review is to acquaint them with the role of these factors so that they can collaborate more easily with social scientists and social services programmes. In part 2 (p. 86) we present a conceptual framework incorporating the full range of malnutrition correlates that must be taken into consideration in positive deviance research.

### ***Lack of Specificity to Nutrition***

As noted in the overall conclusions (p. 34), studies specifically focused only on the nutritional status of the young child have identified many of the same favourable social and behavioural characteristics found by other studies to predict cognitive development, good health, and longterm productivity and adjustment of the individual. These characteristics correspond to moral virtues taught by almost every culture in the definition of social roles. In most cases, the positive-deviant mother is recognized as a "good" mother, her husband as a "good" provider, and her community as a model community.

The fact that these social values or beneficial social conditions lead to a broad range of positive outcomes, in addition to positive deviance in nutrition, raises the question whether investment in improving the psychological and social health of families and communities might be relatively more effective for child development overall, and for nutrition, than investment in direct nutrition programmes. Obviously both approaches are important but their relative cost-effectiveness is uncertain. As recommended in the policy conclusions, fostering community-based and supported nutrition programmes promotes both goals. The community is motivated to become more cohesive and responsive to its members and nutrition services are provided.

Werner and Smith (1982) reported on an 18-year longitudinal study of the entire 1955 birth cohort of the island of Kauai, Hawaii. This study identified factors that protected high-risk infants born to poor families from developing severe psychological and social coping problems at ages 10 and 18. This was, in our terms, a positive deviance study in which the outcome was psychosocial adjustment rather than growth. Figure 5 presents a model of the findings of this study. The reader is urged to note and recall the social factors associated with good outcomes as they reappear linked to nutrition in the following pages.

A major psychological assessment instrument, the Caldwell Home Inventory (Cardwell, 1967), which was developed to assess factors in the home and in the mother child interaction that are associated with cognitive and motor development, has been found to be associated with growth (Cravioto and Delicardie, 1976; Pollitt, 1975).

### ***Associations between Nutrition, Psychosocial Development, and Modernization***

Given the fact that many of the factors predicting good developmental outcomes amidst poverty are non-specific to nutrition, it is not surprising that psychosocial and nutritional development are associated with each other. These associations exist both across and within social classes. In poor communities where food is limited and detrimental weaning practices are prevalent, the majority of children may be mildly to moderately malnourished without psychosocial abnormality. Yet, the quality of psychosocial stimulation given to these children will almost always be lower than that provided to children of higher social class and better nutritional status within the same culture. Similarly, within the low-income community, better-growing children will commonly be found to be more normal in their psychological development while male

nourished children will be more seriously impaired than the group average (Masangkey et al., 1975).

Many unresolved questions remain: why some parents differ from others living in the same environment in their psychological receptivity to new concepts, new value systems, and new lifestyles. It may be that the parents of positive deviants have become more conscious than their neighbours of the need to deviate and have been able to make more efficient use of available opportunities, such as education and health services, to modernize and become upwardly mobile.

Individuals take action in any given situation within a web of driving and restraining forces that include social and economic factors. Motivation, related to past and present experiences, lies at the root of action and can be seen as an agent of change. Future expectations, perceived outcomes, and beliefs in the achievability of various goals act as motivators or demotivators. These motivators and demotivators depend on the needs, values, and personality traits of each individual.

Within the same social structure, life-styles, thought processes, and motivations appear to evolve along developmental scales that reflect the progress of individuals and subcultures towards maturity. The most famous of many scales that have been proposed to describe the developmental process is taken from the Hierarchy of Needs by Maslow and Herzberg (1954). In this scale there are five stages, starting at the bottom with "basic needs," and progressing in sequence to "safety, belonging," and "ego-status." The top stage, achieved by only a few, is "self-actualization."

[Fig. 5. Model of interrelations between risk, stress, sources of support, and coping \(based on data from the Kauai Longitudinal Study, after Werner and Smith, 1982\). Part 1](#)

[Fig. 5. Model of interrelations between risk, stress, sources of support, and coping \(based on data from the Kauai Longitudinal Study, after Werner and Smith, 1982\). Part 2](#)

According to this hierarchy, basic needs for food and shelter precede needs for physical safety and belonging, which in turn must be met before individuals are motivated to act to enhance ego status and achieve self-actualization. Once each phase has been experienced fully, with values internalized and skills acquired, the individual is able to move from simple and least developed phases to complex and more developed ones. A person in need of food is not likely to place a high value on belonging, independence or synergy, and will not be motivated to move on through the phases.

In this document we presuppose that hierarchies of this sort exist in developing country communities and help to explain why parents of positive deviants somehow "make it," although they apparently have the same life chances as their peers. However, we cannot document such developmental stages in our review of the literature. Most of the typologies that exist have been postulated without scientific research and with primary reference to males rather than females. To the authors' knowledge, all were constructed in industrialized rather than developing countries.

The Values and Lifestyles Program of the Stanford Research Institute in the United States recently developed a typology of nine developmental life-style stages based on a nationally representative sample of males (Mitchell, 1983). The methods used in this study could usefully be applied in developing countries. One of the insights it yields is that individuals at the bottom of the hierarchy may be too preoccupied with their own personal survival to focus on the needs of their children.

One typology of women's thinking, which was developed by means of a sample survey in the United States (Belenky et al., 1986) ranks women from lowest to highest in five positions. First is "silence," or the silence of women who live in a world in which they perceive words as weapons to which the response may be physical violence. Second is "received knowledge," or the unquestioning acceptance of the authority of patriarchs and experts. Third is "subjective," where women's thoughts and actions are based on their "guts," intuitions, and experience. Fourth comes "procedural" thought, where women accept logical methods and institutional channels. Fifth and last is "constructed knowledge," in which women apply their intuitive gifts to the experience of others and apply the tools of science to their own experience. Women falling in the first and second stages of such a hierarchy would be severely limited in their abilities to make use of opportunities to modernize their own lives and the lives of their infants.

### ***The Child Development Context***

Since infants cannot survive without constant attention from the mother or another caretaker for the first two to four years of life, someone must be able and motivated to provide this care 24 hours a day, 365 days a year. The infant's physical and emotional needs must be met, and responded to appropriately. Frequently physical contact, and a warm and reciprocal interaction, are necessary for the good growth and development of the infant. It is needless to emphasize that, depending on the culture, feeding and non-feeding interactions will be expressed differently, and hence must be understood within a culturally relative framework.

Table 3. Stage-specific tasks and capacities

Psychological	Age	Nutritional
Homoeostasis	0-3 months	Major post-natal growth spurt
Attachment	2-7 months	Breast-milk supply maintained by frequent affectionate nursing
Somato-psychological differentiation (reciprocal communication)	3-10 months	Supplementary feeding established - infant and caretaker "read" each other's signals
Behavioural organization, initiative, internalization (sets own goals, makes needs known)	9-24 months	Starting to eat adult food, infant and takes initiative in obtaining food for himself, feeds self
Representational capacity (formation and elaboration of representations)	18-30 months	Understands cultural rules surrounding food; starts to be internal reinforced for appropriate behaviour

*Source:* Adapted from Greenspan, 1981.

It is known, for example, that institutionalized infants who receive insufficient stimulation may fall into a state of depression in which they lose weight, become increasingly apathetic and immobile, and eventually die (Smith and Berenberg, 1970). Between two and seven months, infants develop strong emotional attachments or bonds to their mothers and others with whom they interact warmly and regularly. Multiple caretakers appear to serve the infant's needs as well as a single caretaker, so long as the environment remains stable and emotionally nurturing. If an infant bonded to a single individual is separated from this person before the age of three or four years, depression similar to that of hospitalized infants is likely to occur.

Greenspan (1981) describes the psychological developmental agenda of the infant between birth and about two-and-a-half years. This agenda is discussed below and linked to the nutritional agenda over the same period. Although the psychological milestones probably are somewhat retarded by, and affected in quality by, malnutrition, it has been assumed that human development follows a species-typical path and that most of these stages are not culturespecific (although their expression may be culturally determined.)

The evidence on which Greenspan bases his conception of early development, however, comes largely from Western populations, and its universality should be regarded as an empirical question rather than a settled issue. Research conducted in non-Western populations reveals parents with different agendas for infant development (e.g. with respect to the auto-regulation of the sleep-wake cycle), different concepts and standards of maternal attachment, and (following their cultures' models) different styles of communicative interaction (Konner, 1977; Super and Harkness, 1981; Richman, 1983; Caudill and Weinstein, 1969).

Table 3 combines Greenspan's developmental stage-specific tasks and capacities on the left with the infant's nutritional tasks and capacities on the right. This scheme is presented in order to illustrate the types of links between developmental

and nutritional stages that should be sought empirically through interdisciplinary research in nutrition and development.

In the first stage in table 3, the infant should learn to regulate sleep/wake states and hunger cycles without becoming excessively irritable or colicky at the same time that he ingests very large amounts of food relative to his body size and gains between 0.5 and 1.5 kg per month. The baby's capacity to engage with the outside world, form affectionate attachment with his or her caretaker, and obtain sufficient milk from an abundant milk supply depends on the ability of the dyed to achieve a steady relationship that satisfies both of them.

In the second stage, mother and baby "fall in love" with each other in a pleasurable involvement. Breast-feeding is an expression of the bond that exists between the two, and helps reinforce this attachment.

In stage three, the infant and mother become more able to interpret each other's non-verbal signals. On the mother's side, the timing of introducing supplementary foods, the amounts fed, and the frequency of offering the breast or bottle and supplements depend on her interpretation of her baby's needs and desires. The baby's ability to make his desires known, and to respond to feeding opportunities offered by the mother in a manner that is not apathetic, excessively distracted, or self-assertively rejecting, may affect his growth.

Gradually, between 9 and 24 months, the emerging toddler takes increasing responsibility for seeking out and obtaining his share of the food that is available in the household. At the same time, he becomes more active and goal-directed in play and exploration. His excursions must be supervised and limited for his own safety without destroying his urge and capacity to be goaldirected. In the early part of this period, when he is able to crawl but not to walk, his exposure to infection will be very high if he is allowed to crawl in dirty surroundings shared with domestic animals (Zeitlin et al., 1985) and to put everything into his mouth.

Between 18 and 30 months, the child starts to talk and learn by imitation. He is able to evoke mental images of people and events, and to participate in social rituals. Since he is capable of visualizing the clear mental image of "mother giving me food," his vocalizations become more goal-directed. The use of the words "please" and "thank you" helps him obtain food, and the way he handles the food contributes to his ability to get "seconds."

The stage of assertiveness, known in the United States as the "terrible twos," may also enable children to persist in their attempt to obtain food from indifferent or inadequate caretakers. F. C. Johnson in Mexico (personal communication, 1986) observed that a child that had long been marasmic began by two-and-a-half to scream so loudly and persistently for food that her mentally retarded mother fed her more and the child improved.

Disruption of any stage in the developmental process retards the infant's ability to proceed to the next stage. Mild to moderate post-natal malnutrition appears to delay the emergence of developmental stages but does not make them abnormal in quality when they do emerge (Chavez and Martinez, 1982). One major exception to this general finding is that the amount of initiative and exploratory behaviour of the young malnourished child is greatly reduced when compared with that of well-nourished children.

Pre-natal malnutrition appears more likely to produce a behaviourally abnormal newborn who fails to engage properly in the post-natal developmental cycle. A breakdown of the maternal/infant relationship early, in the first year of life, indicates more severe pathology than interactional problems that emerge during the second year (Greenspan, 1981).

In affluent societies, where an abundance of nutrient-dense food is available, psychosocial dysfunction may occur without malnutrition. Psychologically healthy children are, however, almost invariably well nourished, whereas children classified as suffering from failure-to-thrive (FTT: a name for malnutrition when food availability is not a constraint) almost invariably have a pathological relationship with their primary caretaker.

Non-feeding interactions between the mother and child are significantly related to growth. Pollitt and Wirtz (1981) associated micro-behaviours of bottle-feeding mothers and infants in Massachusetts with the weight gain of the child during the first month of life. They found that infant communication (crying, whimpering, opening eyes) and mother's proximal nurturing (adjusting blankets, caressing infant) accounted for about 20 per cent of the variance in weight

gain, compared with about 10 per cent associated with nutritional activity of the mother (putting nipple in mouth, rotating, tilting bottle, grooming/cleaning baby's body).

As noted by Pollitt and Wirtz, such micro-behaviours have not been explored in depth. Given the large gaps in our knowledge of how these behaviours are linked to child growth, it is probably not useful to make a rigid distinction at this time between feeding and non-feeding aspects of caretaker-child interactions. Accordingly, this document will place them in separate categories where there appears to be good reason to do so, but will not compartmentalize them rigidly.

### *Quality of care as a continuum*

The literature linking young-child nutrition to psychosocial and behavioural correlates suggests that quality of caretaking is a continuum, ranging from absent or very poor at the low end to highly competent at the top. In homogeneous communities where socio-economic level and infant-feeding practices are relatively uniform, growth parameters during the first two to three years of life are more or less normally distributed. If weaning practices are poor and food supply restricted, the averages for the community will be low. It is known that many of the infants who fall in the bottom 5 to 10 per cent of any given local distribution will have caretakers who lack in competence; those in the middle range will have caretakers of moderate competence; and those at the top will probably be benefiting from superior "maternal technology" or the constellation of factors determining positive deviance.

Figure 6 shows both maternal and infant contributions to the outcomes of failure to thrive (by local standards) below the lower curve to the left and positive deviance above the upper curve to the right. To the far left of the horizontal axis are caretakers who are either absent or suffer from overt psychopathology and to the far right are those who have extreme maternal competence and joy in living. At the bottom of the vertical axis are infants who are organically damaged to a degree that precludes normal growth, and at the top are exceptionally mature and adaptable babies. Individual mothers vary in their skills over time. Under stress, they become less competent. Their infants may temporarily suffer, and recover when the mother's situation improves.

Discrete physiological syndromes and behavioural clusters emerge at different levels of the continuum. Scholl and associates (1980) show, for example, that clinical malnutrition in Mexico was preceded by a gradual progressive decline in growth status over several months. Failure-to-thrive infants exhibit abnormal behaviour, such as posturing and a fixed stare referred to as "radar gaze." Kwashiorkor infants appear to be in misery. These manifestations disappear as their health and nutritional status improve.

### [Fig. 6. Maternal and infant contributions to failure-to-thrive and positive deviance.](#)

Positive-deviant behaviours, attitudes, and social-support structures are expected to emerge as discrete entities towards the top of the continuum. The configurations characterizing both top and bottom may differ by culture. The father's role is an example; in some cultures the father's presence in the home is critical to the well-being of the mother-infant dyad. In others, he may remain in contact with the dyad, but live elsewhere. In still other cases a real or surrogate grandmother may provide emotional support to the mother-child pair.

Some of the factors that characterize the top of any given culture-specific continuum will be transferable by intervention to members operating at lower levels, while other factors will not. Hence, there is a need for "transfer trials" before an attempt is made to incorporate these factors into programmes.

### *Levels of Approach*

Mother-child (or caretaker-child) interactions and the technology used in weaning and health care have the most proximal effects on food intake, stress levels, child morbidity, and child growth. These interactions are affected by maternal and child characteristics, as well as by the social network surrounding and supporting the dyad. Figure 7 illustrates these relationships on the left, and shows the intervention types that may be developed to improve them on the right.

Nutrition education through growth monitoring and social marketing can be a major channel for improving these interactions (box 1). Maternal and child characteristics and the social support structure, although increasingly indirect, are no less important. Early childhood interventions provide another more comprehensive approach (Pollitt, 1984). Improved pre-natal nutrition, via education and supplementation programmes, may have the greatest impact on child characteristics (box 2). Improved nutritional status across the weaning age also enhances the child's contribution to interactions with his caretakers. Social welfare, formal education, health, and particularly family planning services are needed to improve the psychological and attitudinal characteristics of mothers (box 3).

Finally, the social-support system surrounding the dyed (box 4) has a major influence on the mother's ability to provide high-quality care for her baby. Socioeconomic and social development policies affecting the availability of employment for male heads of household and migration patterns, for example, tend to have a large impact on family-support networks. The mother's own employment prospects and the child-care facilities available to her may be equally, if not more, important.

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## Maternal/caretaker-child interactions

While the study of maternal-child feeding interactions relating to nutritional outcome has been limited, research linking mother-infant relations to psychological health and child intelligence is vast, heterogeneous, and spanned by many levels of analytic resolution (Hopkins and Kalverboer, 1983). This research has been both extensive (large sample) and intensive (small sample) and can be classified into unidirectional studies, looking at influences operating from mother to infant (M-I), infant to mother (I-M) or bidirectional (both ways). The recent trend is towards intensive fine-grained (micro) analyses investigating interactional processes. In both non-nutritional and the few existing nutrition studies, the inborn characteristics of children are increasingly recognized as contributing to the nature and quality of the mother-child relationship (Hopkins and Kalverboer, 1983; Pollitt and Wirtz, 1981). This relationship may, in turn, have an influence on the expression of the child's temperament.

[Fig 7. Conceptual framework of factors influencing positive deviance and of programme types.](#)

### *Lists of Interactions Related to Growth*

Four tabular lists are provided below in sufficient detail as not to require a parallel narrative explanation. They are divided into mother-to-infant and infant-to-mother

general non-feeding interactions; and mother-to-infant and infant-to-mother feeding specific interactions. For simplicity of presentation, bidirectional interactions are put on both M-I and IM lists. A few variables linked to nutritional status through core relations with a third variable have been included and are so labelled. The reader should be aware that major methodological problems make it difficult to generalize from the findings of many of the studies reported. These difficulties include:

1. Selection of small samples of mother-infant pairs who are not necessarily representative of the population, but who were willing to co-operate in in-depth studies. Small sample size leads to loss of statistical power.
2. Units of recorded behaviour that differ from study to study. There is an inevitable arbitrariness to the ways in which units of behaviour are defined and subdivided for microanalysis. When many minute behavioural elements are recorded and then reconstituted statistically into scales or by factor analysis, the resulting theoretical constructs, called by such names as "nutritional cluster" (Pollitt and Wirtz, 1981), may or may not correspond to the topics discussed by others. Many

documents fail to list the items that they combine into their scales, thus making it impossible for the reader to judge the validity of their conclusions.

3. Impossibility of inferring the direction of causal relationships. Most studies demonstrate associations between growth and behaviour. None the less, they are not designed in a manner that permits a clear determination of the role played by these behaviours.
4. Different age-groups from study to study. While the mother's repertoire of responses may be fairly stable, the infant's is constantly changing. The same term (e.g. verbal communication) describes different interactions when referring to younger versus older infants.

The reader will also note that the number and types of interactions linked to infant and youngchild growth are very extensive. Seen together they appear to encompass almost all aspects of mothering. The question inevitably arises: how is it possible to get a handle on these many interactions and categorize them in a way that permits their incorporation in health-education activities. The discussion that follows the set of lists will address these questions.

The list provided below refers to M-I and I-M non-feeding and feeding interactions shown in the literature as being associated with better nutritional status.

#### *M-I Non-feeding Interactions Linked to Growth in Infancy and Early Childhood*

1. Meeting physical and emotional needs, and responding to them appropriately, in order to contribute to the well-being of the infant (Cravioto and Delicardie, 1976; Bithoney and Rathbun, 1983; Graves, 1976; Morley et al., 1968).
2. Frequent physical interaction: flexible holding, adjusting posture, rocking and bouncing (Pollitt and Wirtz, 1981; Price, 1977; English, 1978; Alvarez et al., 1982).
3. Positive affect: smiling and friendly mood rather than hostile and dominating (Auba and Alvarez, 1983; Alvarez et al., 1982; Pollitt et al., 1975; Cravioto and Delicardie, 1976; Zeitlin et al., 1989).
4. Attention: looking at the infant and establishing eye contact (Cravioto and Delicardie, 1976; Alvarez et al., 1982).
5. Verbal communication: includes talking to, cooing, when in physical contact or across distance (Pollitt et al., 1975; Cravioto and Delicardie, 1976; Graves, 1976).
6. Appropriate pace of interaction: not too slow or irregular, not too intense or hectic, avoiding both overstimulation and apathy (Bithoney and Rathbun, 1983; Fleisher, 1979).
7. Reciprocal relationship permits and encourages the baby to start and control interactions, "conversations," and games. Child's cues must be responded to, contingently (Graves, 1976, 1978; Pollitt et al., 1975; Cravioto and Delicardie, 1976).
8. Socialization/safety instructions/prohibitions: verbal instructions and physical demonstrations of what is wrong before the fact, instead of harshly punishing wrong behaviour after it occurs; reward of positive achievements. Otherwise, the inability to control may be one of the reasons for the caretaker's physical dominance over the child (Pollitt et al., 1975; Cravioto and Delicardie, 1976).
9. Creation of a stimulating physical environment for the infant through toys, pictures, and books (Sheffer et al., 1981).

#### *I-M Non-feeding Interactions Linked to Growth in Infancy and Early Childhood*

1. Infant's response to handling and stimulation: the infant must not be overly agitated, distressed when handled, easily exhausted and always crying even without provocation (Lester, 1979; Fleisher, 1979; Powell and Low, 1983).
2. Close and cuddly physical interaction when held, although the infant must not be constantly clinging to the caretaker (Graves, 1976, 1978; Bithoney and Rathbun, 1983; Powell and Low, 1983).
3. Positive affect: smiling, happy, and interested infant rather than apathetic, depressed, miserable, or irritable (Powell and Low, 1983).
4. Communication, according to the different developmental stages, includes: a normal, not highly stressful sound of cry (measured acoustically) during neo-natal period; alertness of neonate, who opens his eyes during feed; cries and increasingly whimpers during feeding as infant grows older, as well as talks and vocalizes; more appropriate gestures corresponding to age; interpretation of sounds and gestures; communication occurs both when the infant is in physical contact with his caretaker and across distance, such as opposite side of the room (Pollitt and Wirtz, 1981; Pollitt et al., 1977; Graves, 1976; Powell and Low, 1983).
5. Reciprocal relationship in which the infant responds contingently to the caretaker's approach (instead of avoiding it or looking away), and to the intent of caretaker's action or communication (although in younger infants this response will tend to be more reflexive than deliberate) (Graves, 1976; Powell and Low, 1983).
6. Attachment: infant reacts to separation appropriately for his developmental stage (Gordon and Jameson, 1979; Graves, 1976, 1978), and is "securely attached" according to a defined scale (Ainsworth et al., 1978).

#### *M-I Feeding Interaction Linked to Growth in Infancy and Early Childhood*

1. Breast/bottle-feeding interactions (Pollitt and Wirtz, 1981; Pollitt et al., 1977): permits the infant to control nipple insertion and removal (e.g. mother doesn't interrupt feeding to clean the baby or because she decides that the baby has had enough, and doesn't continuously tilt or rotate the nipple in her baby's mouth) (Pollitt and Wirtz, 1981); enables the infant to control feeding schedule (i.e. feeding on demand except for sleepy or sick babies who must be encouraged to eat more often, or full babies who respond to gastric or other discomfort by eating to the point of regurgitation); allows neonate to breast-feed more frequently (DeCarvalho et al., 1983).
2. Consumption of other foods: more regular meals, better quality (nutrient density and variety), and larger quantity of food is offered; nourishing foods are not to be replaced by sweets and candies in order to placate the infant's hunger; the child must not be left to self-feed exclusively, but must be helped by the mother; the child must be encouraged to eat, while avoiding a power struggle; food hygiene must be practiced (Pollitt, 1975; Guthrie et al., 1982; Zeitlin and Johnson, in progress).
3. Positive affect: feeding the infant is a happy time for the mother (Alvarez et al., 1982; Auba and Alvarez, 1983).
4. Appropriate pace of interaction: not marked by jerky or hectic rhythms that may induce nervous vomiting (Fleisher, 1979).
5. Reciprocal relationship of the mother and child during meal time (Fleisher, 1979).

#### *I-M Feeding Interactions Linked to Growth in Infancy and Early Childhood*

1. Breast/bottle-feeding behaviours: the infant sucks vigorously and keeps the nipple in his mouth longer (Pollitt et al., 1977).
2. Appetite for supplementary foods: the infant more frequently finishes the portion of food that the caretaker tries to feed him/

her (Zeitlin, 1989).

3. Development of wholesome diet: the infant or young child may refuse new foods, as he goes through the weaning period, but should progressively get used to them. The child should not get into the habit of eating sweets, but should eat more nutritious snacks (Pollitt, 1975; Guthrie et al., 1982).

### ***The Importance of Bonding***

Mother-child interaction during the first four hours following birth may have a particular beneficial effect by bonding the mother to her infant. Some evidence indicates that if the infant is put immediately to the breast and if the mother and baby have close physical contact at this time, the quality of all the mother's later interactions with the baby will be improved. The direction of this effect appears to be M-I. Both common sense (entire populations of mother/infant pairs do pretty well without this experience) and the literature make it evident that neo-natal bonding is not critical except perhaps for some mothers who are at a high risk of forming poor relationships with their infants. Klein and Stern (1981) found in examining 51 cases of child abuse, for example, that 24 per cent of the abused infants had been of low birth weight and had had an average hospital stay of 41 days, preventing normal early parenting.

It could be, however, that such early bonding would account for small but significant differences in mother-infant behaviour for most infants. As an example of such small differences, Pollitt and Lewis (1980a, 1980b) reported data from two studies showing that children who had been breast-fed tested on average one IQ point higher than those who had been bottle-fed. Effects of this size produced by neo-natal bonding would be difficult to detect.

The second period of bonding, commonly referred to as attachment, is primarily I-M and occurs, as noted earlier, between two and seven months. The breaking of this bond by changing the child's primary caretaker(s) between the ages of about 6 and 36 months tends to throw the child into a state of depression similar to that of hospitalized children (Bowlby, 1965). Malnutrition frequently follows. The reasons for this depression are not entirely a mystery. The caretaker is the child's source of stability. At the same time, the child, who is just learning to express itself in words and gestures, may build up an intimate personal communication system that only the primary caretakers understand and share. Given to an unfamiliar caretaker, this child is like an adult lost in a strange country without an interpreter. Basic trust is broken and the child is afraid to trust again for fear of another abandonment. The child tends to show rejecting behaviour towards the new caretaker(s) and long-term developmental problems frequently develop. The mending of such broken bonds may require extreme measures such as permitting the infant to physically cling to its new caretaker(s) and/or sleep in bed with the caretakers for weeks or months. Special strategies for repairing these bonds in older adopted children are under investigation.

Among infants with many shifting caretakers in day-care centres or extended families, the child may become more attached to the stability of the environment or the daily routine than to a single individual. Such infants may respond to a radical change in routine or environment with as much distress as others display to the loss of an individual caretaker.

Dixon and co-workers (1982) found that among the Gusii in Kenya, the majority of severely malnourished children in

their study community had lost their mothers as primary caretakers and had also experienced neo-natal problems interfering with the early bonding experience. They suggest that the child's state at birth led to neo-natal bonding failure, as the malnourished, small-for-gestational-age (SGA) neonate was less able to interact with his caretaker. This early failure predisposed the vulnerable mother to leave the child in another's care or otherwise neglect him, resulting in a poorly bonded, depressed, and malnourished child.

### ***Typologies of Faulty Interaction***

Woolston (1983) describes three types of mother-child interactions that lead to male nutrition or non-organic failure-to-thrive in the United States. The extent to which this typology applies to other cultural contexts should be investigated. These are presented in table 4. Type I, reactive attachment disorder of infancy, may correspond most closely to the concept of "benign neglect" defined by Cassidy (1980), a situation where the mother believes that she is being benevolent but is in fact neglectful. "The mother both demourishes and under stimulates her infant. One would expect the mother to be emotionally unavailable, the infant to show developmental delays and an abnormal response to proximal interactions with others, and mother-infant interaction to be characterized by a paucity of warmth and nurturance."

We propose that a variant of this type occurs in developing countries where the mother is underinvesting in a child, while lacking the resources (time, food, future income, social support) to bring him up properly. The mother, herself, may not be psychologically abnormal but may feel personally conflicted and depressed over her relationship with the child, to whom she may behave warmly when not too emotionally stressed.

Anecdotal reports suggest such ambivalence in Pakistan. It is considered normal in Pakistani villages for a new mother to cry after giving birth to a daughter. These tears are believed to express both sorrow for herself that she has not delivered a son, and grief for the fate of the little one, who must endure the unhappiness of a woman's lot in life (Dr. Satnam Mahmood, personal communication. 1973).

Table 4. Three syndromes leading to malnutrition in infancy

NFTT type I (reactive attachment disorder of infancy) Infants
1. Significant developmental delays in motor, language and adaptive areas.
2. Lack of developmentally appropriate signs of social responsivity as defined by DSM-I II in reactive attachment disorder of infancy.
3. Onset of failure-to-thrive (FTT) before X months of age.
Mothers

1. Perceive their infants as sick.
2. Psychopathology characterized by depression and social isolation.
Mother-infant interaction
1. Few interactions indicative of pleasure and mutual social responsivity.
2. Infants prefer distal to proximal interaction.
3. Infants show apathy and/or active withdrawal in proximal and feeding interactions.
NFTT type 2 (simple calorie-protein malnutrition)
Infants
1. No or minimal developmental delays.
2. Developmentally appropriate signs of social responsivity.
3. Onset of FTT before 12 months.
Mothers
1. Perceive their infants as sick.
2. No characteristic psychopathology or psychosocial disruptions.
Mother-infant interaction
1. Frequent interactions indicative of pleasure and mutual social responsivity.
2. Infants prefer proximal to distal interactions.
3. Infants co-operative and vigorous in proximal and feeding interactions.
NFTT type3 (pathological food refusal)
Infants

1. No or minimal developmental delays.
2. Developmentally appropriate signs of social responsivity.
3. Onset of FTT between 6 months and 16 months.
Mothers
1. Do not perceive their infants as sick.
2. Psychopathology characterized by depression and hostility.
Mother-infant interaction
1. Few interactions indicative of mutual social responsivity and pleasure.
2. Infants prefer distal to proximal interactions.
3. Infants show angry withdrawal and active avoidance in proximal and feeding interactions.

*Source:* Woolston, 1983.

Type 2 represents simple calorie-protein malnutrition. The mother provides adequate stimulation for her infant but, as a result of misinformation or lack of resources, does not provide adequate nutrition. One would expect the mothers to appear within normal limits on psychological testing, the babies to show no abnormalities except in growth, and the mother-infant interaction to be within normal limits.

This would appear to be the model most commonly addressed by nutritionists in developing countries, where a large proportion of infants are malnourished when measured by international standards. Inadequate cultural beliefs and practices account for misinformation, and poverty for lack of resources. As infants become more severely malnourished their capacity for normal interaction is, at least temporarily, reduced.

In type 3, pathological food refusal. "the infant is struggling to create autonomy from the mother. One would expect the mothers to be angry or depressed, the babies to show specific behavioural disturbances focused on food refusal but without developmental abnormalities, and the mother-infant interchange to be characterized by negative and angry interchanges."

Yet another type that may be common in developing countries, but is not often seen in industrialized countries and is not described by Woolston, has been termed breast addiction. Towards the end of the first or during the second year of life, the child refuses solid foods and insists on breast-feeding on demand. One American mother of a 16-month-old going through this phase nicknamed her daughter "Draculina" (connoting humorously that she felt attacked by a vampire trying

to feed on her blood). From personal discussions with mothers in the United States, Nigeria, and Indonesia, whose infants displayed this pattern, the writer suggests that mother and infant are again locked in a power struggle in which the infant is trying to protect its exclusive rights to access to the comfort of the mother's body and to her attention against perceived competition from siblings or adults or from the mother's desire to terminate breastfeeding.

### ***Discussion of Mother/Caretaker-Child Interactions***

Figure 8 is a model showing that close and affectionate interactions between the mother and child (box 1) may promote growth both through greater maternal responsiveness to the child's needs (box 2) and by a direct physiological effect on the child (box 3). We have already introduced potential mechanisms for such physiological effects. This diagram also indicates that certain practices, behaviours, and technologies and their corresponding belief structures (box 6) may be more adaptive to resource scarcity than others, independently of the quality of the mother's psychological interactions with her infant.

### ***Findings that Can Be Applied to Educational Messages***

Messages conveyed to mothers encouraging them to hold, hug, play with, talk to, and kiss their babies frequently are important. Such advice may seem to some policy makers to be too obvious or simplistic or to insult the natural mothering abilities of their constituents. Yet many cultures have rules against "spoiling" infants which justify not responding to their cries and leaving them isolated for long periods. Some mothers apply these rules harshly, believing that it is for the good of the child. The rules are part of the obsolete ideology (referred to as adaptation type 3) that the infant must be taught to accept its subordinate rank in the family. The message "holding your baby will not spoil him" may be necessary.

### **Fig. 8.**

Even where the culture reinforces attentive mothering, women who have recently migrated from extended family homes or whose personal support networks are weak or unstable for other reasons may need additional external encouragement to be attentive.

Little research has been done on behaviours that are specifically adaptive to resource scarcity. The study in Mexico reported by Zeitlin and Johnson (in progress) indicated that the mother's active, persistent feeding of toddlers appeared to overcome constraints of low nutrient density of the food and anorexia associated with high rates of infection. Many mothers believed that 12-month-old infants should be able to feed themselves independently. Messages conveying the idea that children at this age cannot eat enough by themselves, and that mothers should actively feed them, appeared appropriate.

Although useful educational messages are expected to develop from the results of further research into mother-child interactions, not all beneficial mother-child interactions can be transferred through education alone. When a mother engages in less than optimal forms of emotional interaction with her child because she herself is under stress

or emotionally unprepared to satisfy the child's needs, a social-marketing approach that attacks individual behavioural elements may or may not be productive. Preaching to a depressed mother to "smile and be cheerful with your baby" could make the situation worse. On the other hand, the attempt to act cheerful with one's children even when feeling depressed is a part of good parenting. Social support that reduces the stresses in the mother's life in addition to providing her with minimal child-care counselling may be sufficient to revert the pathological interactions to normal ones.

### ***Findings that Can Be Applied to Programme Design***

Mothers who interact poorly with their infants need help. Current methods of treating interactions that are overtly pathological are very expensive. A recent estimate of the per family per year cost of intensive interventions to protect the physical and psychological development of infants in high-risk families in the United States was \$850 (Greenspan, 1982).

Table 5 (Rathbun, 1979) shows all of the members of the failure-to-thrive team in a Boston area hospital. Each child exhibiting growth failure is assessed by the entire team and a multifactorial intervention is planned. The expense of assembling such professional teams to serve all high-risk children would obviously be prohibitive in most developing countries. Yet Alvarez in her recommendations to the 1985 International Union of Nutrition Sciences Workshop on Positive Deviance (Zeitlin and Ghassemi, 1986) suggested that pairing in a "buddy" system of competent low-income mothers or grandmothers (positive deviants) with high-risk mothers could be used to reduce pathological parenting. In the United States, in the New England towns of Braintree, Lawrence, Lowell, Waltham, and Taunton-Fall River, the Massachusetts Society for the Prevention of Cruelty to Children (MSPCC) runs such a pairing system in a project entitled the Good Start Program. The Ford Foundation also supports such a programme pairing teenage parents with mature parents in New York City and in Boston under the name Alliance for Young Families. If community-based, these programmes can be inexpensive and have the potential to reduce interactional disorders, family stress and loss, poor infant feeding, and developmental delays.

Table 5. Multidisciplinary management of FFT

Problems	Area of assessment and treatment	Treatment resource	Facility
1. Inadequate nutrition	Nutritional rehabilitation	Nutritionist	Hospitalization
2. Attendant medical problems	Stabilization of medical problems	Paediatrician	
3. Developmental delay	Developmental stimulation	Developmental specialist (e.g. paediatrician, psychologist, physical therapist)	Infant stimulation programme, physical therapy and social work services
4. Family stress and loss	Social intervention	Social worker	

5. Interactional disorder	Infant behavioural status, maternal level of functioning, quality of parent-infant interaction	Child psychiatrist, psychiatric nurse social worker	Mental health services
6. Long-term growth sequelae	Nutrition counselling, close pediatric follow-up, frequent weighings	Nutritionist, paediatrician, nurse	Outpatient paediatric practitioner, visiting nurse, community nutrition service

*Source:* Rathbun, 1979.

Early childhood interventions that teach mothers to stimulate their infants' psychological development should also have a beneficial effect on growth status. A nutrition/health component in these programmes should enhance this effect.

Findings in this section also support existing recommendations that:

1. Childbirth routines should be changed (if necessary) to permit the neo-natal bonding experience (Jelliffe and Jelliffe, 1978). The infant should be put to the breast immediately after birth or as soon after as the mother's condition permits. Although such bonding may not be needed by all mothers, it is physiologically natural, it helps to establish breast-feeding, and it may serve to prevent abnormal interaction patterns from developing in mothers who are at high risk of neglecting or abusing their children.
2. Practices of abruptly sending older infants and newly weaned toddlers to live with "grannies" or in other fostering arrangements away from home should be discouraged. Day care that permits the older infant to return home each night is better than foster care.

## **Child characteristics**

Although many writers mention in passing the fact that a child's innate activity level, initiative, aggressiveness, ability to communicate, and appetite will affect his nutrition-related interactions with his mother, few studies have looked at the ways in which child characteristics affect nutritional status.

### ***Innate Differences between Children***

Innate differences between children may affect nutritional outcome through a variety of mechanisms. Developmental psychologists continue to explore the contribution that innate characteristics make towards invulnerability,

or the ability of the child to develop normally despite the presence of biological and social factors that increase the risk of behavioural disorders (Anthony and Cohler, 1987). The invulnerable child is a positive deviant with respect to psychological rather than nutritional outcomes. As we noted earlier, many factors that contribute to positive deviance in nutrition appear to be non-specific, in the sense that they also contribute to positive behavioural, cognitive, social, health, and other developmental outcomes. It is therefore reasonable to suspect that there are innate psychological capacities that predispose the child to establish an interaction pattern with its environment that is globally positive and therefore fosters good feeding interactions. Popular wisdom agrees that some babies are easy, good-natured, affectionate, friendly, and clever in getting what they want.

Psychological studies of invulnerability or resilience have focused on older children. The traits that they identify as contributing to the child's coping capacity may exist, however, in embryonic form in the infant. One such list is from Garnezy and associates (1975):

1. Effectiveness in work, play, and love.
2. Expectancies that "good outcomes" will result from effort and initiative.
3. Self-esteem and the belief that one can control events rather than being a passive victim.
4. Self-discipline, as shown by an ability to delay gratification and to be future oriented.
5. Control and regulation of impulsive behaviour.

Behaviours specifically related to obtaining food also differ innately. One of the few studies relating feeding behaviour to food intake, by Pollitt and associates (1977), demonstrated that the infant's sucking behaviour regulates close to 40 per cent of the variance in his fluid intake (from the bottle) in the first month of life. The more vigorous and the more persistent the sucking, the more the infant drinks. The sucking strength of the newborn also influences the rise in serum prolactin in the mother which in turn is part of the feedback mechanism regulating breast-milk production. Research by Khin-Maung-Naing and co-workers (19X0) in Burma, in which malnourished mothers were studied in a clinical research centre, showed that more milk always remained in the breasts after the infant voluntarily stopped nursing. This milk, excreted manually immediately after each feed, was of significant volume even in the case of older malnourished infants.

Out of 20 well-nourished children between 8.5 and 20.5 months in a Mexican squatter settlement, Johnson and Zeitlin (in progress) found one little girl whose persistent demands for food and voracious appetite kept her growing normally despite very poor caretaking.

### ***Associations between Good or Improved Nutritional Status and Child Behaviour***

There are a large number of studies that have a bearing on the contribution of child characteristics to positive deviance although the innate characteristics of the child are not their focus. These are research efforts relating:

1. Nutritional status and nutritional supplementation during pregnancy to behavioural characteristics of the newborn, and nutritional status of the newborn to its behavioural competence.

## 2. Nutritional status and supplementation of the infant and pre-school child to behaviour and performance.

One of these studies (Chavez and Martinez, 1982) links the changed behaviours back to the child's performance in obtaining food.

This section will briefly review these effects. Figure 9, taken from Lester (1979), shows the hypothesized effects of pre-natal malnutrition on the infant's behaviour and its subsequent nutritional status. The malnourished infant has poor eliciting behaviours. Specifically, underweight newborns in Lester's study showed poorer performance than controls on the four Brazelton scale dimension scores of social integration, motor processes, organization of state, and physiological organization. Undernourished newborns have also been found to have low activity levels (Chavez and Martinez, 1982) and low tolerance for mild stress (More et al., 1977; Vuori et al., 1980). Lester (1979), Zeskind (as cited by Greenberg, 1983), and others have found underweight infants to have abnormal cries. These cries tend to sound more distressing to the mother than normal cries and may be less effective in eliciting her car responses. Zeskind suggests that the balance between the sympathetic and parasympathetic nervous systems is disordered in the "subtly malnourished" infants, who also display abnormal cardiac and respiratory rhythms. The quality of the infant's cry at 40 weeks gestational age has been found to predict its mental development at 18 months and at five years (Lester, 1987).

### [Fig. 9. Synergistic model of the effects of pre-natal malnutrition \(after Lester, 1979\).](#)

Since many of these studies were done on relatively well-nourished populations, simple protein-calorie undernutrition may not be responsible for all of these disorders. Landers (1983), who conducted a longitudinal study of an undernourished group of infants in South India, does not report the deviations from normal development that might be expected if all lowweight infants displayed the above afflictions.

Nevertheless, the evidence overwhelmingly supports the conclusion that the positive-deviant infant is more likely to be of normal than of low birth weight. The neo-natal mortality rates of normal-weight newborns are many times lower than those of low birth-weight infants; their behavioural responses, better on average; and their long-term growth performance is also significantly better.

Supplementation of lactating mothers and of infants and pre-schoolers has been associated with:

- much higher activity levels - up to six times as high in 18-month-olds (Chavez et al., 1971);
- more rapid motor development (Chavez and Martinez, 1982; Waber et al., 1981; Joos et al., 1983);
- more rapid language development (Chavez and Martinez, 1982; Freeman et al., 1977);
- better perceptual analysis (More et al., 1977);
- better memory (Freeman et al., 1977);
- superior ability to adapt to new stimuli, more demand for stimulation (Chavez and Martinez, 1982); and
- more active demands on the parents for supplementary food (Chavez and Martinez, 1982).

The authors suggested that these demands occurred because the supplemented infant had experienced supplementary feeding and therefore knew enough to demand to share what the parents were eating. The supplemented infant also did not undergo the progressive loss of appetite experienced by infants kept only on the breast.

### ***Discussion of the Role of Child Characteristics in Positive Deviance***

The overall implications of these studies is that better nutritional status during pregnancy and infancy, achieved either naturally by the positive deviants in the population or by interventions such as supplementation or nutrition education, produces the potential for an upwards spiral - a more vigorous, demanding, perceptually capable child who is more efficient in obtaining food.

Researchers tend to agree that most effects of improved nutrition on young-child behaviour are short-term responses to improvement, contemporaneous with supplementation (Waber et al., 1981). At least one study does report, however, long-term benefits of short-term intervention, where supplementation during the first two years was associated with significant IQ differences at 8.9 years. Improved nutrition affects performance more than cognitive structures, by improving the child's ability to elicit and sustain attention (More et al., 1977). The belief that malnutrition causes irreversible loss in brain function because it diminishes the number of brain cells has not received strong scientific support. Although irreversible developmental lesions have been found in association with early malnutrition' nothing is known about their functional significance. Malnutrition in children living in developing countries is, however, consistently related to other environmental factors that may also interfere with the development of the brain.

Another principle of child development, important for understanding the longer term effects of pre-natal and young-child malnutrition, is that the effects of multiple sources of deprivation on development are more than additive. A child may develop entirely normally despite one form of deprivation (organic malnutrition in the absence of poverty, poverty in the absence of malnutrition, loss of father if mother is functioning well, etc. ) Nevertheless, if two or three types of deprivation or disability are added together simultaneously, the developmental process is likely to go off track. Infants who are not in optimal biological condition have been found to be at higher risk than biologically optimal infants of failing to develop normally in poor-quality post-natal environments (Breitmayer and Ramey, 1986). Nutritional state at any given point in time may play the role of the straw that breaks the camel's back with respect to longer term development.

The likelihood that nutrition will play this critical role probably is highest during pregnancy for the reason that pre-natal nutrition affects so many systems simultaneously, including:

- sucking and other eliciting/bonding behaviours of the newborn; mother's breast-milk supply;
- infant's energy stores (to withstand temporary food shortage); and
- infant's longer-term growth potential (Gam et al., 1977).

The interrelationships between sucking strength and breast-milk supply illustrates the multiplicative nature of

these relationships. Either adequate sucking or an abundant first milk supply is necessary to initiate functional breastfeeding. When both are simultaneously compromised lactation failure may occur.

If malnutrition compromises all of these systems at once, the child's chances for a favourable outcome may be reduced. Therefore, the likelihood of producing long term improvement through short-term intervention is probably highest during pregnancy. Of course, where pregnant women already are reasonably well-nourished, as in much of North Africa and the Middle East, such intervention would be much less effective.

Evidence that positive-deviant status depends on the nutritional state of the mother comes from the Emesi village study in Nigeria (Morley et al., 1968). At three months postpartum, mothers of the group who were subsequently above the 50th percentile of the local standard were on average 4.6 kilograms heavier than those whose infants later fell below the 10th percentile. Twenty-six per cent of the later malnourished group (50 infants total) and less than ] per cent of the later well-nourished fell below the 10th percentile for birth weight.

The preceding description of effects of nutritional status or nutritional supplementation on child characteristics applies to the intensity of reactions in children presumed to be psychologically healthy. As noted earlier, when the developmental process does go off track psychologically, in asynchronous dyads, the characteristics displayed by the child take on a qualitatively different, pathological character. Newberger et al. (1976) have described how the child's food refusal and withdrawal contribute to its own malnutrition in these circumstances.

In evaluating the child's contribution, the helplessness of the human newborn automatically implies that the mother's characteristics are more significant than those of the child in determining the quality of their interaction, and that she has a far greater repertoire of verbal and non-verbal gestures which are likely to stimulate responses in the infant.

### ***Findings Applicable to Programme Design***

Nutrition programmes appear to have strong potential for strengthening the infant's behavioural contribution to dyadic interaction and thereby increasing the chances of positive-deviant outcome.

Pre-natal nutrition affects the infant and mother simultaneously and may have a preprogramming effect on the child's growth and development through the pre-school years and later. Consequently, pre-natal nutrition programmes have a higher probability than short-term post-natal interventions of producing long-term effects on infant characteristics. Effects of postnatal weaning-food programmes on infant behaviour are likely to last only so long as the child's improved status is maintained during the period of programme intervention. A programme that continues, however, to reach the child until the end of the second or third year protects him across the most vulnerable period. Food-eliciting behaviours, even of malnourished children, tend to improve spontaneously by this age.

In the future, when the child's own contribution to nutritional outcome is better understood, it may be practical to screen

for infants who are at high risk of becoming malnourished because of their own behavioural characteristics. While some characteristics of high-risk newborns are known, they have not yet been systematically linked to subsequent growth and development.

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## Maternal characteristics

In order to provide continuous high-quality care for the first two to four years of the infant's life, the mother or other primary caretaker must have adequate ability and motivation.

Figure 10 represents a conceptual framework illustrating maternal characteristics that contribute to the ability and motivation that are required to sustain the favourable interactions described earlier and to carry out appropriate child-feeding and health care practices. These characteristics apply not only to the mother but to the infant's entire immediate care environment.

We will use the term mother here as an abbreviation for: mother, other primary caretaker, or caretaking group. In practice, several people often care for an infant jointly. In a recently conducted survey in the United States, the writer found that mothers frequently respond to the question, "Who is taking care of the baby?" with the reply, "His father and I together."

These characteristics intimately affect the changeable proximate determinates discussed in the section on mother-child interactions. They may be relatively uniform in stable societies and may therefore be taken for granted. Yet their importance becomes evident if social structure is destabilized either for the group or for the individual household. When rapid changes occur, these factors are seen to be linked to anomalies in mother-child interaction and in child growth and development.

In the diagram, a circle has been drawn around the term socio-economic level to indicate that research on positive deviance assumes that this level is both low and controlled with regard to macro-indicators such as type of neighbourhood, housing, and approximate household income. In fact, within the same low socio-economic level, parents of well-nourished infants tend to have more positive maternal and paternal employment histories and greater material resources than those of the malnourished (Auba and Alvarez, 1983; Alvarez and Wurgaft, 1982). In general, the reproductive history and domestic work burden of the mother, and her productive work burden at an income-generating job or in farm labour, both affect her ability to care for her infant through time and energy constraints.

Her psychological characteristics, including mental health and personal developmental history, influence the quality of care she is able to provide and the amount of initiative that she applies to problem-solving. Her attitudes and behaviour - either helpless and fatalistic or responsible and enterprising - affect her ability to cope with adversity. These attitudes interact with her motivation to care for the infant. The more formal education, nutrition and health education, and exposure to modernizing influences she receives, the more likely she is to be enterprising and responsible and vice versa.

The mother's education, both formal and specific to child care, and her exposure to modernization affect her ability and her motivation. These variables also influence her strategy of investing in childbearing. The perceived value of the child and the child's role in the mother's expectations for her own life-course are interrelated. Both affect the strength and quality of her motivations to care for it. Finally, the urgency of other agendas that compete with care of the child affect her day-to-day motivation to sustain care. Conceptually, ability and motivation both are conceived as having innate components - i. e. some individuals are inherently more competent in parenting and more highly motivated to engage in infant care than others.

[Fig. 10. Conceptual framework illustrating maternal characteristics that influence positive deviance in nutrition.](#)

This section will briefly review the literature relating the characteristics in Figure 10 to positive-deviant outcomes, in order

of presentation from left to right.

### ***Reproductive History and Domestic Work Burden***

The number and spacing of children born to the mother are closely related to her domestic work burden and also affect the physiological ability of her body to provide nutrients to the foetus and the nursing infant. Yoder and Berggren (1987), looking specifically for causes of positive deviance, found well-nourished children in Haiti more commonly in families with four or fewer children and with mothers below the age of 35 years. A substantial body of research linking nutritional status to fertility (see Zeitlin et al., 1982, chap. 4, pp. 46-53, for a review of this literature) confirms that infants with fewer siblings are better nourished than those with many siblings. Infants born so late that their mothers have many older children to help with the domestic workload sometimes are exceptions to this rule.

Moreover, differences in nutritional status between children in small versus large families are greater than differences usually achieved through nutrition interventions. Chavez and associates (1974), in their positive-deviance study in Solis, Mexico, found a higher ratio of adults to children in the homes of the well-nourished. The fact that height of children consistently declines with increasing birth order in all but the most affluent groups (Wray, 1971) suggests that at the same economic level (within the same household) infants with fewer siblings are more likely to be positive deviants as defined here.

Goodall (1979), reporting on a Ugandan study, notes that the urban child starts to displace the next older sibling before his birth, increasing the risk of kwashiorkor. In China, on the other hand, Dr. Zhi-Chien }lo reported, in response to a mail survey (results of which are presented in part 2, table 9) that the "only one child" policy had improved parents' receptivity to the nutrition and health education advice provided by the health services.

Chavez and associates (1974) also found that mothers of positive-deviant children themselves had better-quality diets than mothers of malnourished children. A good maternal diet may obviously mitigate the nutritional cost of frequent births but may not eliminate these costs. Favourable household structure and child-care arrangements mitigate the negative impact of maternal time constraints.

Mothers who start childbearing in their teens are in some societies at a greater disadvantage since they may be still growing physically, their formal education may be incomplete, their social support systems may be inadequate, and they may tend to be psychologically unready for motherhood. Jones and associates (1980) found that mothers below the age of 19 were significantly less responsive to their newborns than older mothers, suggesting there is a critical age at which mothers may develop "maternal readiness" contributing to a strong maternal-infant bond.

### ***Productive Work***

Although child malnutrition is often associated with the overburdened mother (Hepner and Maiden, 1971), no generalizations can be made concerning the effects of the mother's income-generating employment or her participation in farming. These effects depend entirely on the quality and costs of child care available to her and on her income and the ways in which she spends it. In nineteenth-century England, women's work in factories was associated with appalling levels of infant mortality (Hewitt, 1958). Throughout nineteenth- and early twentieth-century reports, the height of rural children was greater than that of urban children, a situation which has now been reversed, but that probably reflected women's and children's roles in the rapid industrialization of the earlier period.

The fact that some studies in rural areas of developing countries (e.g. Engle, 1982, in Guatemala) find maternal employment positively associated with child survival indicates that poverty and under development per se do not preclude the existence of social-support systems that permit the mother to work without harming her child. Women's unemployment is so consistently associated with large family size that unless women are increasingly engaged in the labour force the prospects for achieving population goals are low. Recent studies in the United States (Zeitlin et al., 1984) and in Thailand and Indonesia (Latham et al., 1984) indicate that women of high educational levels and high socio-economic status are leading a trend towards early re-entry into the labour force following childbirth.

A study by Scrimshaw and Scrimshaw (1980) rated plantation wage-earning mothers on the basis of the health and growth status and survival of all their children. They found that mothers who were most successful were entrepreneurial and that they also contributed family income from petty trading, marketing, animal husbandry, kitchen gardening, etc., whereas those with poorer child outcomes were not earning comparable additional income.

An excessive work burden may negatively affect the nutritional status of children whose mothers work at home. Repeated spot observations conducted in the homes of 185 4- to 27-month-old children in the Bangladesh positive-deviance study (Zeitlin et al., 1989) show that well-nourished infants have less income-generating work going on around them and are more likely to be in the care of adult women who are available to help the mother.

### *Psychological State of the Mother*

Failure-to-thrive is associated with poor mental health of the mother. Positive deviance may, by contrast, be a result of excellent psychological adjustment and functioning. The psychological conditions most clearly linked to infant malnutrition are character disorders, depression, stress, and abnormal parenting responses attributed to poor parenting experience during the mother's own childhood (Wurgaft et al., 1984).

### *Character Disorders*

The term character disorder implies rigidity and inflexibility of mental mechanisms, and less overall effectiveness in maintaining an adjustment and assuring development (Fischhoff et al., 1971). The mother's capacity for successful adaptation to changing environmental circumstances or stresses is limited by an inflexible personality and inability to assess the stresses or changes in her environment, her internal needs, or the needs of her children. The American mothers in Fischhoff's study had: "literal, concrete thinking patterns, with limited capacity for abstraction or planning for the future; the use of denial, isolation, and projection as major mechanisms of defence, and a predisposition toward acting out as opposed to thought."

A study by Kerr and associates (197X) in Jamaica found similar characteristics among mothers of severely malnourished children. Their "relationships were more stereotyped, transient, and focused on material aspects. The mothers' narcissistic concerns took precedence over the needs of their children." Fischhoff and associates (1971) and Greenspan (1981) describe such mothers as need-oriented, competing with their children for concrete as well as psychological and social supports, and attempting to reverse the dependency relationship that should exist during early childhood. Kerr and co-workers (1978) described these mothers as falling into two types: apathetic and dependent or manipulative and evasive.

The "multiple-risk-factor families" to which such mothers tend to belong, as described by Greenspan (1981), require expensive intervention in the form of infant mental-health programmes. Given the fact, however, that families such as these are self-perpetuating and very costly to any health-care system, such expenditure may be cost-saving in the long run. Greenspan, citing the report of the congressionally authorized Joint Commission on the Mental Health of Children (1965), estimates that 6 per cent of the US population use approximately 70 per cent of all public expenditures for health, social, and auxiliary services. In traditional societies with high infant mortality, such families were less likely to perpetuate themselves from generation to generation. To the extent that PHC strategies succeed in reducing mortality, the number of "multi-risk-factor families" might be expected to increase. Their presence increases the need to link health and nutrition with psychological and social services.

### *Depression and Stress*

Table 6 (Longfellow et al., 1982) shows correlations between maternal behaviour, three measures of stress, and one measure of depression. The definition of the word "mand," used in this table, is: "The attempt by one individual (the subject) to change the behaviour of another (the object) in order to realize a goal." The scales of stress and depression measured the mother's subjective state - feeling stressed or depressed. Objective measures of stress did not show correlations with maternal behaviour. The table shows clearly the mothers experiencing depression or stress were more hostile towards their children and less nurturing. This study was conducted on pre-schoolers rather than on infants. Breznitz and

Sherman (1987) reported that depressed mothers engaged in less conversation with their three-year-olds, particularly when eating lunch with them.

Table 6. Correlations of maternal life-conditions stressor score, life-conditions stress and depression

	Events stress	Conditions stressor score	Conditions stress	Depression
Dominant mends	-.24 <sup>b</sup>	-.16	.04	.19
Nurturant mends	.00	-.22 <sup>a</sup>	-.38 <sup>c</sup>	-.36 <sup>c</sup>
Prosocial mends	.16	-.30 <sup>b</sup> ,	.39 <sup>c</sup>	.34 <sup>c</sup>
Compliance to child's dependent mends	.04	-.30 <sup>b</sup>	-.45 <sup>c</sup>	-.52 <sup>d</sup>
Hostile and dominating mend styles	-.04	.03	.12	.44 <sup>c</sup>
Friendly-affiliative mend styles	.13	-.06	-.05	.00
Positive-response styles	.10	-.11	-.19	-.35 <sup>b</sup>
Negative -response styles	-.24 <sup>a</sup>	.08	.32 <sup>b</sup>	.37 <sup>b</sup>

<sup>a</sup>= $p < .10$ ;

<sup>b</sup>= $p < .05$ ;

<sup>c</sup>= $p < .01$ ;

<sup>d</sup>= $p < .001$ .

Source: Longfellow et. al., 1982.

Cohn and Tronick (1983) found that three-month-old infants reacted with negative facial expressions, crying and arching backs, or with wary expressions to their mothers' simulation of depressed behaviour. Crnic and colleagues (1983) present data confirming the negative effects of stress on maternal-infant interactions. According to Bithoney and Rathbun (1983), loss, stress, poverty, and marital strain can be causal factors in the genesis of HTT. Stress can come from any source that might influence family functioning.

### *Early Experience*

Most studies of failure-to-thrive (Leonard et al., 1966; Pollitt et al., 1975; Kerr et al., 1978; Wurgaft et al., 1984) have found that mothers of FTT children experienced less adequate parenting themselves than mothers of the well-nourished.

If the above forms of psychological condition are used to derive opposite descriptors that might characterize the mothers of positive deviants, they would have:

1. Highly flexible, adaptable, and well-integrated personalities and a high degree of success in satisfying their own personal emotional needs.
2. Innate joy in living, resistance to depression, high tolerance for stress.
3. Exceptionally good personal parental role models and nurturing early emotional experience.

### *Helpless/Hopeless versus Enterprising Attitudes*

Guthrie and associates (1982) concluded that mothers in their rural Philippines sample of malnourished children "showed many features of learned helplessness" that prevented or delayed them from adopting improved child-care and feeding practices taught by an intervention programme. Seligman (1975) explains that when outcomes are not contingent on

efforts, subjects develop an inability to learn new and more effective actions. He reports: "Our mothers usually see little relationship between what they feed their babies and the babies' growth because growth is delayed, and they see illness and death which bear no apparent relationship to diet or care. . ."

Hepner and Maiden (1971) quote Cecily Williams's characterization of mothers of kwashiorkor children in Ghana as hopeless and apathetic. Fischhoff and colleagues (1971) characterize the mothers of FTT children as having "fantasies that reflect no hope." Kerr and co-workers (1978) describe mothers of the severely malnourished as behaving towards their infants as if they were helpless to improve their situation. They "were often aware of poor treatment in day-care or other homes but did nothing about it. Three malnourished babies were hospitalized after such experiences and on recovery were returned to the same situations. Seven mothers of malnourished children described encountering malnutrition in other offspring and apparently had not been able to change feeding patterns."

Positive deviance defined as type 4 adaptation, by which individuals and households succeed in "beating the system" of poverty and deprivation that surrounds them, would seem to depend heavily on the ability to take effective contingent actions in response to new information and new challenges. It is no surprise to find enterprising, non-fatalistic attitudes associated with positive deviance. Not all problem-solving needs to be, however, the result of conscious effort. Chance discoveries may also lead to beneficial behaviours and social structures.

### ***Formal Education, Nutrition and Health Education, and Modernization***

Formal education, and nutrition and health education, as well as modernization, are considered together in this section as the channels through which populations learn to stop practicing the first three types of adaptation described on pages 10-34. If internalized, family-planning education relieves the necessity for adaptation type 1, nutrition education, concerning weaning in particular, removes the mechanism holding adaptation type 2 in place. Formal education greatly increases receptivity to health/nutrition/family-planning education. Moreover, formal education and other modernizing opportunities together introduce new child-rearing practices more adapted to individual expression and mobility, and in so doing remove the need for adaptation type 3.

Caldwell (1981) explains mechanisms through which schooling releases the African mother from a relatively helpless, passive role in child care, in which she depends on decisions made by grandparents within a traditional belief system. 'The education of a female is likely to convert her maternal indulgence into maternal protective action' and she feels that the school and the larger community expect this of her even if the older people do not. She is more likely than her uneducated counterparts to feel personal responsibility." Caldwell also mentions that education changes intra-household food distribution. Under the rules of adaptation type 3, the father, who is head of the family's agricultural production unit, gets the best food, and the youngest children the left-overs. With changing aspirations for employment, mothers perceive they must prepare their children to compete for higher education and modern sector jobs. Better food must be invested in the child to prepare him for this competition (Zeitlin et al., 1982).

LeVine (1980) states that education is "assertiveness training" for girls in traditional societies, and discusses other mechanisms by which women's education leads to smaller family size and reduced mortality. He and his research team also find that mothers with more education give their children more psychosocial stimulation. The great majority of traditional nutrition surveys looking for determinants of malnutrition in developing countries do find that maternal education is a significant correlate of good nutrition. Bairagi (1980) found in Bangladesh an interaction between education and income, indicating that more educated women were better able to use incremental income to improve the nutritional status of their children.

Spot and event observations conducted on 185 4- to 21-month-old rural infants, as part of a Bangladesh positive-deviance study (Guldan, 1988), found that education had a significant effect on child-care and feeding behaviours after controlling for family wealth. As fewer than 20 per cent of the mothers had attended school, a measure of the highest level of education in the immediate family was constructed. On this scale only 30 per cent of households had no exposure to schooling. With increasing education, infants were less likely to be found playing in the dirt, men were more likely to hold and feed the babies, the babies were more likely to eat foods specially prepared for them and less likely to eat food that had been cooked more than eight hours earlier. With more education, infants were also fed more times per hour of observation,

were better nourished, more active, and more developmentally advanced.

Education promotes modern beliefs. Most formal education systems in developing countries make fun of the superstitious health benefits purveyed by "witch doctors," etc., as being old fashioned and erroneous, and therefore train their pupils to be receptive to modern health education. Chavez and co-workers (1971) found that mothers of malnourished children had more 'market magic' concepts of health and nutrition, while mothers of the well-nourished had more modern ideas regarding child illness and corresponding treatment.

As noted by Zeitlin and Formacion (1981), educated mothers are likely to feel more comfortable with nutrition and health workers and vice versa. Nevertheless, the effectiveness of nutrition and health education in improving young-child nutritional status does not necessarily depend on the formal education of the mother. Zeitlin and coworkers (1981) found in an evaluation of the pre-school clinic programme in Ghana that mothers' educational level was no longer significantly related to nutritional status of 6- to 24-month-olds after adjusting for the mother's knowledge of nutrition and health education messages taught by clinic nurses. Zeitlin and associates (1984) found that the pilot programme run by the Nutrition Education and Behavioural Change Component of the World-Bank-supported Indonesian Nutrition Improvement Programme appeared to be of most benefit to the infants of mothers with 1 to 5 years of formal schooling, bringing their nutritional status up to the level of children of more highly educated mothers. Zeitlin and Formacion (1981) and Chulankarangka and Onate (1980) both found in the Philippines that mothers' nutritional knowledge was related to the growth status of their children.

Other manifestations of a psychological predisposition to modernize are also associated with positive deviance. Cravioto and colleagues (1967) found in Guatemala that Cakchiquel Indian mothers who spoke some Spanish when talking to their child had infants with better weight gains than those who spoke to the child in Cakchiquel only. Zeitlin (unpublished) found in surveys in rural areas of the Philippines, Burkina Faso, and Bangladesh that mothers who wanted their infants to have more formal education and more modern occupations had significantly better nourished children than those who expected the child to remain uneducated or to continue in a traditional occupation.

The term modernization is used here generally to refer to the attitudes and practices of segments of the population who are attuned to more advanced technologies and who tend to be oriented towards urban life-styles. Further study on this topic (see Bernard and Pelto, 1987; Poggie and Lynch, 1974) should be incorporated into positive-deviance research.

The configuration of psychosocial characteristics found by Rogers and Shoemaker (1971) to typify early adoption of innovation may also characterize households of positive deviants. Early adopters typically are more enterprising, more cosmopolitan, and of relatively higher socioeconomic status than their later adopting neighbours. What is being adopted with modernization may in fact be a new outlook concerning the role and value of children, as explained in the next section.

### ***Investment in Childbearing***

Modernization, as noted earlier, affects the mother's strategy of investing in her children (see Zeitlin et al., 1982, for a discussion of demographic transition theory as it relates to nutrition). As families see options for supporting themselves outside of traditional subsistence agriculture, they tend to have fewer children and to invest more in each child, in order to prepare them to compete for modern-sector occupations. A common and very ancient strategy of investing in childbearing changes with the demographic transition (as child death-rates and birth-rates decline). In subsistence agricultural communities, where the demographic transition process has not yet begun, each child provides a material return to his or her parents from an early age, and the direction of intergenerational investment flow is from child to parent. In general, the less efficient the agricultural technology, the more heavily the children need to be involved in agricultural work in order to produce enough food for the family.

As the demographic transition occurs, the direction of the intergenerational investment flow is reversed. Children become very costly to their parents. In economic terms, the child changes from being an "investment good" to being a "consumer good." The stage of the family in this transition influences child care and feeding. The mother's own investment strategy - whether she plans to have many children who will farm for the family, or few children who will

attend school and compete for civil service or other modern jobs - affects her level of motivation to provide care for each individual child.

### *Satisfaction with Life-course*

Self-esteem and overall satisfaction with life may affect maternal behaviour. Alvarez and associates (1982) in Chile found that mothers of 20 malnourished infants were more dissatisfied with their family life than the mothers of 20 well-nourished controls. In this study, the only variable in the past history of the mothers of well-nourished and malnourished children that differed significantly was the jobs held by the mothers prior to the infant's birth: 65 per cent of mothers of well-nourished children had held jobs, compared to 35 per cent of the malnourished. This job experience may have contributed to their higher self-esteem. Kerr and associates (1978) found in Jamaica and Leonard and associates (1966) in the United States that mothers of HTT children lacked self-esteem.

While lack of satisfaction with life may often be difficult to distinguish from depression, lack of satisfaction with life-course may be worth distinguishing from other sources of depression because it helps to explain mothers' reactions to individual children and may help in designing programme approaches. Mothers in all societies have been found to have a vision or plan for the course they would like their lives to take (Neugarten, 1964, 1969; Neugarten and Danton, 1973; Neugarten and Hagestad, 1976). This plan may include time of marriage, type of employment, number of children, sex of children, level of wealth, types of possessions, etc. Individuals develop a mental map of the life-cycle. By such and such an age one should marry; by another age one should have a certain number of children, be a grandparent, and so on. It is likely that people everywhere internalize a social "clock" by which they determine if they are "on time" or "off time."

Women who perceive themselves "on course" generally express satisfaction with their lives. Those who fail to approximate their course because of adverse circumstances experience dissatisfaction, depression, and low self-esteem. In particular, a badly timed pregnancy, a child of the unwanted sex, or a sickly or difficult child may deflect the mother from her desired course and have negative effects on the care that she is able to give this individual infant. Graves (1976) found, for example, in West Bengal, that 78 per cent of the mothers of the malnourished versus 33 per cent of the well-nourished had a negative attitude toward their pregnancy with the study child. Maginnis and associates (1967) found, among mothers of 50 FTT children, that 30 stated that they wanted a child of the other sex and 32 claimed that they did not want a child at all.

The mother's motivation to care for an unwanted child, whose presence is inconsistent with her life-course agenda or overburdens her resources, may be very low. Nag (1983), in a review of the ways in which modernization affects fertility, explained that unwanted children are born when the physical, psychic, and monetary costs of practising family planning are perceived by the couple to be higher than the benefits of small family size. He cites Johnson-Ascadi and Weinberger (1982), who noted that, in 17 out of 20 countries where the World Fertility Survey was conducted, at least 40 per cent of "exposed" women (currently married, non-pregnant, and fecund) who said they did not want more children were not using any contraceptives.

Scrimshaw (1982) shows that unwanted children in previous eras frequently were eliminated via culturally sanctioned infanticide. She questions whether the current situation, where they more frequently die slowly from malnutrition and ill-health caused by lack of maternal attention, is more humane than rapid neo-natal death.

Traditional life-course agendas are rapidly becoming obsolete in developing countries such as Mexico and Indonesia. Life-course agendas for women are also in rapid transition in industrialized countries, such as the United States (Schlossman and Zeitlin, 1988). It would seem important to determine the topographical features of the life-cycle "map" for women and men in positive-deviance study populations, since such a map would provide insight into the ways in which members of a given group monitor and evaluate their own and other people's performance, progress, and status in the community. Differences in perceived agendas between positive-deviant families and those having malnourished children should be instructive. Unrealistic goals might yield to change through communications strategies or counseling. The writer knows, for example, of a little girl brought for speech therapy, named "Killjoy." The child started to talk soon after the mother had been persuaded to rename her "Joy."

## ***Urgency of Agendas Competing with Care of Child and the Ability to be Self-sacrificing***

Not all mothers are mature enough to put aside their own interests sufficiently to care for a helpless infant. The personal developmental agendas of very young mothers in particular sometimes appear to be too urgent to permit them to care for the child consistently. Mothers who have been severely deprived socio-economically - who have never in their lives owned a nice dress, for example - may not be able developmentally to put the child's needs before their own. Lady Health Visitors in Peshawar, Pakistan, complained to the writer that the low-income mothers of malnourished children attending their clinic were more concerned with their own aches and pains than with the growth or illness of their babies.

In many non-Western societies "good mothers" are perceived to be self-sacrificing.

The concept of good motherhood includes the ability of the mother to give her child's needs higher priority than her own. Responses on the mail survey from China, Japan, and Turkey, published reports from Bangladesh (Rizvi et al., 1984), and personal observations from India, Pakistan, Tunisia, and Mexico support the concept that a good mother is self-sacrificing. Dr. Ayse Baysal of Hacettepe University in Ankara wrote the following Turkish proverb on her response to the positive-deviance mail survey: "It is said of the mother: She does not eat, but feed; she does not wear, but clothe; and she makes her hair a broom for her children." Western society has exchanged this value for the belief that sacrifice should be avoided if possible and certainly shared by both parents if needed.

## ***Findings Applicable to Programme Design***

Many of the maternal characteristics discussed above fall into the category of known malnutrition correlates. Programme approaches developed for dealing with the problems identified in this section include family planning, female education, women's income-generating projects, provision of child care, and community development along Freierian lines to combat fatalism and attitudes of helplessness.

Additional outreach components, taking existing health/nutrition and other programmes into the homes of mothers who do not voluntarily participate, should greatly improve their effectiveness in combating malnutrition. The mothers of malnourished infants typically are more psychologically passive, socially isolated, and suffer from more hopeless/helpless attitudes and behaviour patterns than mothers of the well nourished. Since those at greatest risk are least likely to participate spontaneously, the programmes must seek them out.

In existing programmes that include components such as primary health care, growth monitoring, family planning, female education, women's income-generating activities, etc., the psychological quality of the interaction between the programme staff and the participant mothers should be of primary concern. To the extent that the interaction between the provider and the mother is psychologically supportive for the mother, this support, per se, should significantly enhance her maternal competence. These benefits will not occur if the worker fails to involve the mother emotionally in working together with her to achieve a favourable outcome.

Where traditional practitioners provide psychologically supportive care, they should be incorporated into the formal primary health-care system, if possible.

Growth-monitoring programmes are a powerful means of combating child neglect and teaching mothers to invest more in each infant. The unspoken message of growth monitoring is that each and every infant is important to the community and that mothers are publicly accountable for each infant's growth and development. Dr. Harold Rice (personal communication, 1987) observed a growth-monitoring programme in Thailand which appeared to be effective in motivating mothers to invest more in their infants. The worker in this programme specifically sought out the mothers of the malnourished and the mothers who did not spontaneously attend the weighing and spent most of her time counselling them.

Programmes using community-level lay workers to reach the malnourished should use the good nutritional status of the children of the proposed candidates as one criterion for the selection. The attempt to enlist mothers of the malnourished in reaching out to each other is less likely to succeed because they are less likely to have the necessary social skills.

Mothers whose own children are well-nourished also have a greater likelihood of transmitting skills and attitudes that contribute to a favourable growth outcome.

Prevention of teenage pregnancy prevents adverse child outcomes because in most societies teenage mothers are psychologically as well as physiologically immature and have less stable social networks supporting themselves and their infants.

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## Socio-cultural support

Price (1977) found in a study of mother-infant reciprocity that the relationship between mother and infant deteriorated significantly in reciprocity from one to five weeks of age in families in which the father was rated low on availability. Fathers who had low ratings had either just lost their jobs, were "seldom around," or appeared to compete with the infant for the mother's time and attention. She cites an example in which the mother of a five-week-old infant began to play a somewhat sadistic game with her baby a week after she became seriously estranged from her husband. In this game the mother "brushed the nipple over the infant's mouth several times quickly, then drew it out of reach, stating, 'It's no fun when he doesn't snap for it.'"

A number of studies provide evidence that the social network or support system available to the mother is important in determining the quality of care she is able to give her infant. Figure 11 outlines a conceptual framework for the relationships involved. In this diagram, the social support network is shown to affect the quality of the maternal-child relationship both directly and through maternal characteristics. The type of society and the rate of social change influence social networks.

There is a large and recent literature linking social support to health in industrialized countries (Cohen and Syme, 1985). Social support may be instrumental, providing cash loans, food, or other goods and services, such as child care and job referrals. Social networks providing instrumental support are particularly relevant for low income persons (Pelton, 1982; Wills, 1985). The traditional extended family, particularly in Africa, is a primary channel for instrumental support, according to conventions that tend to conflict with the demands of urban life. Social support also provides esteem, status, motivation, information, companionship, emotional empathy and understanding (Wills, 1982; Crnic et al., 1983).

It is useful to divide social support into intimate versus community and structural versus functional support. Intimate support comes from members of the immediate household while community support may come from neighbourhood or workplace associations. Social structures such as marriage, the church, and the health centre are sources of support. However, they may or may not function in a supportive manner for individuals (Cohen and Syme, 1985). The distinction between intimate and community support is taken from an article by Crnic and associates (1983), which reviews a number of studies showing that social support tends to buffer mothers against the effects of stress and depression, in addition to presenting original findings relating social support to maternal attitudes and mother-child interactions.

Structural support is more or less enforceable, legally or through social pressures, exerted by an intact community. The literature describing the effects of rapid social change on traditional communities is full of examples of the disintegration of traditional social and legal support structures. Emecheta's (1979) novel *The Joys of Motherhood* describes the decomposition of women's traditional childbearing role and the disintegration of the support built into customary tribal law that protected the welfare of mothers and young children in traditional Ibo culture in Nigeria.

Some of this literature is in the formal scientific domain and describes the effects of loss of previous support structures on mother-child interactions and child health and nutrition. Such social change is a feature of almost all developing-country societies, occurring most acutely with rapid urbanization. Contractual support may be strengthened by social policies and programmes but requires an understanding of the nature of the contracts involved. Nonstructural support is more a matter of individual enterprise and personality.

[Fig. 11. Conceptual framework illustrating socio-cultural support systems that influence positive deviance in nutrition.](#)

### *Intimate Structural Support*

The husband, other immediate and extended family members, and hired help all may be sources of intimate structural support for the mother, depending on the particular social structures involved. Expectations of what the structure should provide within a given culture are partially susceptible to individual negotiation and may vary by social class. Zeitlin and co-workers (1983, 1984) and Schlossman and Zeitlin (1983) found that more educated, higher-income, breast-feeding mothers both expected and received more help with housework and child care from their husbands than lower income, less educated, bottlefeeders.

Mothers with malnourished children have often been found to lack the consistent support of a husband or partner (Kerr et al., 1978; Dixon et al., 1982; Goodall, 1979). Morley and coworkers (1968) found in a positive-deviance study in Nigeria that the mothers of malnourished children received less support from both their husbands and from their families than mothers of the well-nourished. In this setting where polygamy was common, more marriages among the well-nourished group were monogamous.

Where support is present, it may compensate for high-risk characteristics of the mother. The Jamaica study by Kerr and associates (1978), for example, notes that three of the control mothers had "personalities similar to those of the MMC (mothers of malnourished children found to have problems that could be classified as character disorders). Each was receiving, however, considerable structural support."

The functional quality of structural support, as well as its presence or absence, conditions its effects on the mother-child relationship. The "unavailable" fathers in Price's study were living with their wives and infants, but were psychologically remote or unsupportive. Social support is generally considered to have a number of dimensions, including instrumental assistance, information provision, and emotional empathy and understanding (Crnic et al., 1983). There is a voluminous literature that cannot be reviewed here covering ways of measuring these dimensions and the effects that they have on an individual's psychological and physical health. The Crnic study found that a measure of mothers' intimate support, received primarily from their husbands, was directly related to their affect in interactions with their infants at the age of four months. The affect scores for the infants of these well-supported mothers also were higher.

The quality of intimate support may be drastically eroded by social change. As an extreme example, Schaeffer and Metayer (1976) discuss the disastrous effects of exposure to modernization on family relationships among the Eskimo. Table 7 presents the contrasts they found between the past versus the present. They note specifically that "intimate infant-mother interaction and understanding (are) lost."

The extended family is an important part of the intimate structural support system in many societies. The part the grandmother plays in most Mexican households is critical to the quality of child care, according to work in progress by Sarah LeVine (personal communication, 1984). Once her own childbearing is over, she devotes herself to her grandchildren. Without her help the task of raising families of 8, 10, or 12, which is still the rule in many rural and working-class urban Mexican households, might be an impossibility.

The bond between a Mexican mother and daughter is extremely strong, and whether or not a woman is geographically separated from her natal family is likely to have considerable bearing on her psychological adjustment and sense of well-being. Mestizo villages in central Mexico are primarily endogamous, which means that after marriage a young woman continues to live very close to her own parents. Although the wife usually lives with her husband's family, if they have insufficient land she may bring him to live with her own parents.

When the move to the city occurs, the husband's parents are much more likely to accompany the young couple than are the wife's, since sons rather than daughters are expected to be responsible for their aging parents. In the city, a woman then faces not only a totally new environment but also the loss of her own mother's constant practical and emotional support. By the second generation, the city-dweller may very well have re-instituted the rural pattern of husband, wife, and husband's parents in a three generational household, but with the wife's parents now living nearby. This example illustrates the complicated manner in which social change, such as urbanization, may affect a mother's intimate

contractual support system.

Table 7 Contrast between past and present roles and functions of Eskimo family members

In the past	Now
Father	Father
Highly respected. The provider of food, on whose hunting skill the life of every member of the family depended. To be known as a good food provider for his own family, the elderly, and neighbours in need was a source of pride and satisfaction	Feels useless and worthless. Eskimo men have lost the independence of the traditional hunter. Work is often for and under a non Eskimo agent, doing menial, despised, and degrading jobs or, even worse, the Eskimo may be shamed into the status of a welfare recipient. He finds transient emotional redress from feelings of frustration, idleness, dependence, and hurt pride in drinking. Alcohol un masks pent-up hostility feelings leading to violence. The hangover is accompanied by remorse and suicidal behaviour
Mother	Mother
Loved and needed. Preparer of shelter, food and clothing. Indispensable centre of family, always busy making and repairing fur clothing, tents, and utensils, tending seal-oil lamps day and night, nursing, training, and playing with children. Giving and receiving stimulation and satisfaction in intense interaction with child carried skin-to-skin for three years on her back or breast	Has lost central family role, feeling dispensable and idle. Clothing and food bought in store.  Infants bottle-fed and deposited with siblings, grandparents or left unattended in corner of bed. Idleness whiled away in movies, dances, bars, and "friends." Becoming impatient and punitive, with less well understood and less well trained children
Children	Children
Loved and cared for, feeling secure and satisfied, with ideal parent figures to imitate.  Grew up on mother's back, first three years in intimate contact, receiving response and satisfaction to every urge, motion. and demand in sheltered and secure position, allowing participation in mother's and family's activities and progressing from playful imitation to useful participation in parent's chores	Intimate infant-mother interaction and understanding lost. Less secure shelter, inferior nourishment. Emotional and sensory deprivation when left to stare listless at empty ceiling or screaming frustrated in soggy diapers. Later, loss of parents' ideal image and respect. Feeling useless and frustrated, having lost functional role in Eskimo world while unable to realize desires awakened by school and movies. Becomes confused and rebellious
Interaction in family	Interaction in family
Very close. Complete and unquestioned interdependence but with extreme personal tolerance	Drifting apart. Not needing each other so much. Expressions of anger and intolerance: wife and child beatings. Children rebelling against elders

Source: Schaeffer and Metayer, 1976.

Its importance for nutrition is borne out by the finding in a Mexican periurban squatter settlement (Zeitlin and Johnson, in progress) that 80 per cent of well nourished, versus 40 per cent of malnourished. infants had maternal

grandmothers available.

### ***Community Structural Support***

This term refers to the social services and group activities within the community that the individual is entitled to, either through formal legal rights or by social convention. Health and nutrition services, church activities, clubs, adult education, recreational facilities, day-care assistance, political youth groups, traditional work parties, block associations, women's cooperatives, the advice of elders, etc., may be available. Societies differ vastly in the presence or absence of such community support mechanisms. At one extreme, in Central Tunisia, isolated homesteads are located so far apart that a mother may never interact with individuals outside her family. At the other, socialist countries and particularly East Asian societies have highly structured communities- so highly structured in China, for example, that each woman's menstrual period is monitored by a neighbourhood "granny." Western countries now have large numbers of voluntary associations by problem area, e.g. single parents' group, Alcoholics Anonymous, etc., that to some extent simulate "natural" family arrangements.

A study in Toronto (Dellcrest Children's Center, 1985) found that low-income mothers with sparse social networks were more likely to use and receive emotional support from formal support services, such as health-care professionals. There is ample evidence that inadvertent social support, as provided by projects that do not wish to change the social environment, create a beneficial Hawthorne effect. The Hawthorne effect occurs when subjects respond not to treatments but to the excitement or prestige of participation (Grosf and Sardy, 1985). In creating programmes that provide such support, however, health workers should be aware that individuals with very deficient social skills may not be greatly helped. Their lack of support may be more a consequence of their own inability to interact positively with others and may not indicate that their environments are non-supportive (Kiesler, 1985).

Intervention programmes designed to provide more support for mothers can either build on existing support structures or create new ones. As mentioned on page 54, the Ford Foundation in New York City and Boston, for example, runs a programme under the name Alliance for Young Families, which pairs high-risk teenage mothers with mature volunteer mothers. The mature mothers provide the young mothers with intimate support on a voluntary but contractual basis. This is an example of a "buddy system."

There may be a time lag before traditional groups learn to use the modern services that are made available to them. Dugdale (1980) reports on a 20-year study of an Australian Aboriginal community in which infant mortality dropped from 280 to about 40 per 1,000. Growth, infant-feeding method, and health facilities remained almost the same over this period. The author proposes that ability and willingness to use existing community health facilities, as well as other attitudinal factors characterizing the Aboriginal group, changed over this period. As a result, the Aboriginal families were much better able to take advantage of the contractual support structures within their neighbourhoods.

### ***Functional Social Support***

Individuals vary in their ability to obtain functional benefits from social-support structures and to generate functional support for themselves where social structures have broken down or do not exist. Kotelchuck and Newberger (1983) found American families with FTT children were more isolated from their neighbours. Bithoney and Newberger (1982) found them to be characterized by social isolation. Chavez and associates (1974) in Mexico observed that mothers of malnourished children had less contact with the external world. Similarly, Kerr and colleagues (1978) found the mothers of their malnourished group had fewer social contacts except with extended families. A passive, depressed, not particularly competent individual is less likely to be effective in establishing friendships and personal loyalties, and less likely to obtain social approval from the community. Similarly, a newcomer to an established community may suffer the psychological effects of isolation, although this individual is socially competent.

The Crnic study found that a measure of friendship support (non-structural) was related to a measure of satisfaction in parenting but not directly to mother-child interaction. Community support (a measure of perceived informal support by the community) was directly related to a social-emotional-growth fostering dimension of the mother-child interaction. Moreover, this sense of community support reduced the effects of stress on the mother-child relationship.

One of the interactions between structural and functional support is probably worth noting. Where structural support systems have failed to develop, have broken down or are nonenforceable, the mother tends to be thrown back on ad hoc functional arrangements, which need to be constantly renegotiated. Her life-style tends to become incompatible with consistent child care. Gussler (1975), writing on the adaptive strategies and social networks of women in St. Kitts<sup>7</sup> describes a defective social structure in which young men are not contractually obliged to support the children they father. Therefore, the young mothers tend to need to expend large amounts of energy recruiting boyfriends and bearing children by a series of men in the hope that one or more of the relationships will pay off either in remittances or in a long-term alliance later in life.

It is also worth noting that for reasons related to adaptation types 1 to 3, the community may psychologically support its members to pursue practices that do not favour the growth and development of the child. The writer recalls a Dinka primary-school teacher in the Sudan who had resisted persistent pressures to place her children in the homes of extended family members. By keeping them with her she became overworked and the same time lacked sympathy from the community.

### ***Importance of Intact Normative Reference Groups for Maintaining Moral Behaviour***

Encompassing both the structural and functional aspects of social support is the concept of a normative reference group. This is the set of other people from whom one takes social values and ideas of what is good and bad, right and wrong. The degree to which individuals behave morally in such matters as responsibly caring for their children is in part determined by the strength of their normative reference groups (Naroll, 1983). Common examples of such reference groups are the extended family, religious groups, and intellectual schools of thought. Where social change and urbanization proceed rapidly, such reference groups may be destroyed or may lose their influence on individuals.

### ***Findings Applicable to Programme Design***

The strongest implications for intervention in this section lie in the area of social legislation. Almost all pre-industrial cultures enforce laws or customs requiring men to provide continuing material support for the children they father. In matriarchal systems, as among the Akan in Ghana, the support may go to the sister's children. Other variations in role may occur, but the mother in almost all intact traditional groups receives both material and social support for the child.

Legislation in modern industrialized societies also encompasses child support both by the father and by the state if no paternal support is forthcoming. It is primarily in newly urbanized cultures and among populations who were formerly slaves that customary law and formal legislation protecting mothers and children has broken down or is non-existent.

In many locations positive deviants appear to be children with intact social-support systems because their mothers and fathers happen to be congenial enough to stay together in spite of divisive social pressures. Changes in social legislation and stricter reinforcement of existing formal and customary laws obviously are needed.

Legislation for working mothers regarding maternity and health benefits and the provision of day care is also important.

In the attempt to improve social legislation it is important not to propose unenforceable laws that will backfire against the groups they are trying to protect. A law requiring all companies to provide maternity benefits to women who have been in their employment for more than 90 days, for example, could:

1. Influence companies not to hire women.
2. Lead to the practice of firing and rehiring new employees every 90 days.

With regard to programme design it was noted earlier in this paper that it is sometimes possible to induce groups of individuals with similar problems to work together on a voluntary basis, in their own interest. This is not an ideal approach to take with the mothers of malnourished children. As the literature indicates, these mothers are characterized by social isolation, passive helpless attitudes, and poor interpersonal skills. It is unlikely that they can carry the burden

of organizing and conducting an outreach programme.

The Indonesian growth-monitoring projects implemented by mothers' clubs or women's associations such as the UPGK (National Women's Association) may have succeeded so well because they are not targeted to the malnourished. Rather, these programmes enlist positive-deviant mothers in the communities to be trained in nutrition and to conduct monthly weighing sessions for the entire community. Although attempts are made by the Indonesian Growth Monitoring Programmes to reach all mothers, particularly those of the malnourished, there still tends to be a 15 to 40 per cent non-participation rate. Those who participate less have children who are less well-nourished (Zeitlin et al., 1984).

Churches and other community organizations that are strong and altruistic in orientation should be encouraged to extend outreach to unenrolled community members and to provide health and nutrition services. There are individuals at great risk for whom the church is much less intimidating than the hospital. The writer had a Yoruba friend in Nigeria whose two infant sons died of measles. On both occasions the mother had taken the child to the church instead of the hospital. The church could also serve as a liaison between community members and the health services.

The Government of Indonesia has strengthened organized religion in a nonsectarian manner by urging all citizens to worship God in the religion of their choice, whether Islam, Hinduism, Buddhism, or Christianity. Strengthening religious institutions increases the moral authority of normative reference groups.

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## Research considerations

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## Introduction and purpose

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One of the purposes of this document is to share research approaches and solutions to methodological problems in studying positive deviance with the network of scientists working on this topic.

Most prior research has focused on problems. Positive-deviance research centres on solutions. From an applied perspective, the purpose of studying positive deviance is to design interventions that incorporate and capitalize on existing success factors - on the adaptive behaviours, social-support systems, and

physiological mechanisms that already operate to protect well-nourished children in deprived communities.

From a scientific point of view, it is necessary to study beneficial adaptations to nutritional stress in order to discover the types of adaptation that occur and how they function. A similar adaptive capacity, moreover, would be expected to operate across socio-economic levels, generating healthful outcomes amidst overnutrition. The majority of existing health and nutrition surveys do not provide such information. Conducted primarily for needs assessment, most nutritional field research has described problems in nutritionally deprived or imbalanced populations in terms of biological reference standards, levels, or rates achieved in favoured reference groups. This research is indispensable. However, it sheds little light on the mechanisms that buffer and protect human beings from the negative effects of food scarcity or imbalance and highly contaminated environments.

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## **Underlying assumptions or hypotheses for research in positive deviance**

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The study of positive deviance in young-child nutrition rests on the following assumptions:

1. In impoverished or less socio-economically developed communities there exist adaptive parental and child characteristics that distinguish between the households of children whose growth performance is at the top of the distribution and those whose children are malnourished. These characteristics may be behavioural, social, psychological, or physiological.
2. Certain of these characteristics will be useful for developing:
  - screening indicators to identify infants at high risk of malnutrition and ill-health, and specific low-cost targeted interventions or social services for these infants and their families;
  - nutrition and health education "messages teaching and reinforcing adaptive, protective behaviours and social characteristics among the population as a whole;
  - technologically appropriate interventions and approaches to service delivery that integrate existing adaptive wisdom into the structure and orientation of programmes;
  - social policies and legislation to protect mothers and children.

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## **Relationship of positive-deviance research to epidemiological methods**

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The positive-deviance research approach falls within traditional epidemiological methods of studying prevention, and it is applicable to all types of diseases and risk factors. However, positive-deviance studies differ from the majority of epidemiological studies in three respects.

First, most epidemiological research focuses on identifying the agents and pathways of transmission that cause disease states and on preventing exposure to these agents and pathways. Positive-deviance research applies to cases where exposure already has occurred. It focuses on identifying sources and pathways of natural immunity or adaptive resistance. For example, positive-deviance research on AIDS (acquired immune deficiency syndrome) would work to determine why some individuals who have positive antibody tests to the AIDS virus do not come down with the disease and how others who are antibody positive can benefit from the same sources of resistance.

Second, the majority of epidemiological studies have yes/no outcomes. Positive deviance research, particularly in nutrition, tends to have a continuous range of outcomes. In most epidemiological research the individual either has an event or condition or doesn't have it (e.g. stroke, infection, heart attack, accident, burn, cancer, infant death). Such clean distinctions lend themselves to relatively simple retrospective case-control study designs.

Positive-deviant children, with respect to nutritional status or childhood illness, such as diarrhoea, do not fall into such either/or classifications. They rank at the high end of a continuous distribution of nutritional status or the low end of a distribution of sick days with diarrhoea, for example. Case-control methods that pool together the children at the worst end of the distribution (cases) and contrast them with a pooled group from the top (controls), as was done by Clemens and Stanton (1986) in a study of infant diarrhoea in Dhaka, Bangladesh, may lose critical information about individuals ranked intermediate between the cases and the controls. They also lose information from the variability between children within the top and bottom groups.

For example, a study of maternal feeding behaviours, directed towards 9- to 20 month-old children in Mexico, showed a highly significant positive correlation between active maternal feeding behaviours and growth status, when growth status was measured as a continuous variable (height-for-age). However, when tall children in the top third of the distribution (controls) were contrasted to short infants in the bottom third (malnutrition cases), the difference in active maternal feeding behaviour between the groups was much less significant (Zeitlin and Johnson, in progress). This drop in apparent significance occurred because the mothers of the tallest children were relatively less active in feeding them than those of children in the middle range. Examination of the top and bottom groups only would not have discovered this important information.

Third, positive-deviance studies tend to require complicated designs and analyses, because many psychological and behavioural factors contribute to resistance. Traditional epidemiological methods establishing the links between disease agents and disease states can be relatively simple. The main requirement for testing the relationship between dietary fat and breast cancer, for example, is to obtain large amounts of data on two variables: dietary intake of fat and breastcancer incidence. To identify the

factors that protect women with high fat diets from developing cancer (positive deviance) would be much more complex and would involve psychological testing.

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## **Definition of terms and specification of research goals**

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Behaviours and social structures may be either informal - or without cultural rules or institutionalized services - or they may be formally prescribed in cultural rules or social structures. Positive-deviance research seeks to discover functional informal supports for nutrition and health that can be transformed, by means of programmes, into formal structural supports. It also seeks so strengthen formal supports, such as child support legislation, that provide nurturing environments in which wholesome informal social interactions will normally develop.

### *The Transformation of Behaviours into Practices*

In the realm of personal behaviour, practices are formalized behaviours. Practices are clusters of informal behaviours for which common words and cultural rules already exist. A practice is based on normative prescription, whereas a behaviour can be idiosyncratic. The set of rules governing infant feeding and care can be referred to as practices. For example:

- breast-feeding as opposed to bottle-feeding;
- introducing solid foods between 4 and 6 months;
- preparing multimix weaning foods of sufficient nutrient density; and continuing to coax the sick child to eat.

At a more macro-level, patrilocal family structure is the practice of living with the husband's parents after marriage.

The word practice is sometimes used to described what is done; and the word behaviour, how it is done. The term behaviour is much more general, however, than this would imply and may be considered in its broadest sense to encompass all actions, including practices. The how part can be dissected into any number of individual actions. A video tape of people in action can be stopped any number of times and any of these still frames can be described. Behaviour can be dissected into infinitely small segments. Quality of mood or intent may not be captured by such dissection, however.

In the case of positive-deviance research. we are not looking for infinitely small hits, which we could not deal with usefully, but for clusters or units of behaviour that are:

- significantly related to positive-deviant nutritional status; and

- not yet dictated by rules that are endorsed by scientists and health professionals.

Where personal behaviours are concerned, the goals of positive-deviance research are to discover beneficial behaviours and styles of behaviours and transform them into practices that can be generally recommended and supported by nutrition, health, and social services. The specific cluster or units that we discover and test to see if they can profitably be transformed in this manner may be:

- aspects of behaviour that have not been explicitly examined before;
- variations of the rules that govern existing practices; or
- practices that exist or have been proposed but have been insufficiently evaluated.

As an example of behaviours not examined before, a study of mother-infant pairs shortly after birth (Pollitt et al., 1977; Pollitt and Wirtz, 1981) found that mothers who interrupted the baby's bottle-feeding in order to clean milk from his mouth or body had infants who gained less weight during the first month of life. This is one of the types of behaviour sought by positive-deviance research. It should not be difficult to test whether weight gain in the neonate could be improved by teaching both bottle- and breast-feeding mothers not to interrupt the nursing infant, who should be permitted to terminate the feed himself. If effective, the behaviour "not interrupting or distracting the nursing infant" could become a practice taught by nutrition educators.

Another example of a behaviour that has the status of a practice in some cultures but not in others is the mother's role in feeding toddlers - whether she should actively feed the 18-monthold or place the food beside the child and let it feed itself. In Bangladesh (Rizvi et al., 1984) there is a cultural practice of not hand-feeding the child, in the belief that the child will digest better what it picks up and feeds itself. This is suspected of being one of the destructive, culturally dictated weaning practices mentioned in part 1 (behind which lie hidden agendas of limiting population growth and reducing body size). In most other cultures this is a behaviour to which no rules have been attached. Evidence from Mexico (Zeitlin and Johnson, in progress) demonstrates that active feeding by the caretaker plays a significant role in positive deviance and that active feeding should be elevated to the status of a practice.

An example of a positive-deviant modification of a traditional practice comes from the research of D'Alois (1980) in Liberia, where there is a traditional taboo against sexual intercourse for the duration of the breast-feeding months, based on the belief that semen poisons the milk and makes the baby ill. In traditional farming communities where the extended family exerts social control over polygamy, this taboo guarantees birth spacing without endangering the continuing marriage bond between the parents, who resume sexual relations two or three years after each birth. In newly urban areas, polygamy is no longer governed by traditional rules. The new father who wanders off with another woman may not return. D'Alois found that mothers in periurban Monrovia had re-interpreted the traditional taboo to mean that a sexual relationship with the baby's own father was safe, but that semen from any man who was not the father would poison the milk. This new practice served to reinforce a monogamous lifestyle which is better suited to urban living than polygamy.

## *The Transformation of Informal Functional Social Support into Formal Structural Support*

Historically, in all societies the extended family has provided informal social support for its dependent members, including mothers with infants and young children, the elderly and the disabled. There are many reasons why such informal support fails to function for certain individuals and households. The thinning out of families that occurs with the reduction in family size that goes with the demographic transition forces society to institutionalize most of the informal-support functions of the extended family.

Typically, resource-scarce communities in developing countries have lost many informal supports without yet evolving new formal social structures to replace them.

In many areas of the developing world, grass-roots voluntary self-help movements with political or religious ideological backing are working successfully, despite local poverty, to replace old structures with new systems. Many of these movements support village-level health and nutrition programmes. Where such community-based programmes do not exist, government and private health and social-welfare projects also seek programme designs that will maximize social outreach to their clients.

With regard to social support, the goals of positive-deviance research are: (1) to discover the types of structural and functional support that are most indispensable for maintaining adequate child growth and health amidst poverty; (2) to develop and test programme models that can reinforce or provide these supports; and (3) to devise legislation that strengthens such social support networks both with and without programmatic interventions.

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### **Three-stage research and pilot-project model**

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This paper proposes a three-stage model for research and programme development comprising: (1) basic social-science nutrition research; (2) behavioural analysis and trials, or concept testing, and operational research; and (3) pilot implementation. Behavioural trials and operational research are methods used to develop, test, and perfect procedures before putting them into operation. The historic sequence in programme development has been to include only steps 1 and 3 in relative or complete isolation from each other. Step 2, which links 1 and 3, is a recent development which has been applied to nutrition and health-care programming since about 1975. Separation between these steps often is unavoidable for administrative and other reasons.

These steps are considered together in this paper because, under favourable circumstances, they can be linked, and much time and effort can be saved. When the purpose is to develop effective applications, concept-testing, using behavioural trials, and operations research should in fact substitute for basic research whenever possible. Industry developed these procedures because they were more rapid and

efficient than basic research methods. Commercially they have proven immensely profitable. When the three stages are considered as part of an integrated series of procedures, issues of a practical nature that do not require large samples to permit the derivation of statistical confidence intervals can be solved by concept-testing and the answers can be provided in forms that are immediately usable in pilot-project applications.

Some of the factors contributing to positive deviance are sufficiently well known for programmers to incorporate them directly into projects and policies without a pilot project stage. In the majority of cases a pilot is needed to solve remaining problems of service delivery, to ensure feasibility, and to evaluate these applications.

***The three stages should achieve the following objectives.***

First, basic research identifies beneficial child-feeding and health-seeking practices that currently operate to protect positive-deviant children in spite of severely limited household income, food resources, maternal time availability, and community service structures. This research concurrently analyses nutrition problems of the community using traditional epidemiological, functional classification, dietary, and other approaches where appropriate.

These more traditional methods must be applied in any case in order to determine whether factors hypothesized as contributing to positive deviance really do improve nutritional status after confounding variables have been taken into account. An expected product of these more traditional approaches is identification of changes in behaviour and in programme structures along PHC lines that will be recommended for concept-testing and operations research. In locations where much previous research has already been done, traditional research may be limited to those variables needed to control for confounding factors in positive-deviance studies.

Second, concept-testing and operational research develop transferable sets of beneficial behaviours, programme procedures, and community activities that blend local mothering wisdom and local social-support structures with the new insights embodied in the accepted strategies for enhancing child survival. The behaviours would be developed into communications messages and materials, taught and distributed during health/nutrition worker training programmes, and disseminated using mass media. The procedures would be incorporated into programme routines. New community programmes or support groups might be tried on a preliminary basis.

Third, pilot projects apply the messages, programme-design features, and support groups developed in stage 2. Evaluation of these pilot programmes determines whether the newly developed approaches are effective in improving nutritional status within the context of normal programming procedures. Preferably, the pilot projects are imbedded in the national maternal child health (MCH) and nutrition programme, so that expansions of successful methods can proceed through normal channels.

The three stages noted above are logical phases that may overlap each other in practice, as in the

positive-deviance research project recently conducted by Tufts University under the direction of the first author of this paper in collaboration with the Bangladesh Rural Advancement Committee (BRAC) and the Institute of Nutrition and Food Science (IFNS) of the University of Dhaka, in Bangladesh.

The Bangladesh study on diarrhoeal infection and malnutrition in 9- to 18-monthold infants selected matching basic research (stage 1) and behavioural trial (stage 2) sites from the beginning. The study began by rapidly collecting and analysing baseline data from both sites. This (simplified stage 1) analysis identified about 15 behavioural factors statistically associated with diarrhoeal infection and malnutrition in infants.

The results of the baseline were used to design a detailed 10-month study of behaviours, growth, diet, and morbidity (sophisticated stage 1) at the research site and a parallel behavioural trial, message development, and intervention project (stage 2) focused on diarrhoeal disease control at the trial site. A year after the baseline survey a cross-sectional resurvey compared health and nutritional status and knowledge, attitudes, and behaviours at the two sites, with the research site serving as a control for the intervention site. The intervention was found to improve hygiene knowledge and behaviours and reduce diarrhoeal infection (Ahmad and Ahmad, 1987).

During the following year messages from the diarrhoeal-disease control trials were incorporated into BRAC's primary health-care programmes (stage 3), and a second round of behavioural trials and concept-testing on supplementary feeding and other MCH nutrition messages took place at the trial site. Results of the year two data analyses will feed back into the development of new messages and interventions.

In this project the reason for not waiting for the results of carefully conducted basic research (sophisticated stage 1) before starting the concept-testing, behavioural-trial phase was that many of the simple baseline survey stage 1 results already were actionable. For example, the majority of infants were found to be crawling on dirt surfaces contaminated with animal and human faeces. They were also found to receive inadequate amounts of supplementary foods until the age of two years or later. Both of these conditions were known to be undesirable without need of further research results.

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## Research design for stage 1

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The comments here on research design are not intended to take the place of meeting with a statistician to work out the design best suited to the research. They are tips to fellow investigators based on experience in the field and in data analysis.

### *Design*

For very low cost studies, a retrospective, case-control design probably is best, comparing wellnourished children with malnourished children matched for age. Such studies may either be indepth small-sample ethnographic investigations or larger sample cross-sectional surveys. In either case, they should use forms that combine questions to the child's caretaker with direct observation of the environment and of caretaking behaviours. The advantages of the retrospective case-control model is that the data can be collected and analysed rapidly, by hand if necessary. The design is simple and clear, so that the purpose of the study and its results will be clear to everyone involved. Such studies should yield an understanding of important factors associated with positive deviance. As noted earlier on pages 81-82, they will not reveal all the information it would be useful to know.

The next step up, at a slightly higher level of expense and sophistication, is a crosssectional study design that covers a representative sample of all of the children in the age-group and the socio-economic groups of interest. This model tends to take the form of a survey of at least 80 to 100 households, because the sample needs to be big enough to make statistical comparisons. It also requires an observational component to obtain behavioural and environmental data. One advantage of including children whose nutritional state is average is that it becomes possible to describe the full distribution of values within the population. The descriptive information can also be used as a baseline for designing interventions. Collecting a full continuum of values also permits multivariate regression, which is the analytic procedure most frequently applicable to nutritional data.

Longitudinal studies are desirable but many times more expensive and time consuming than cross-sectional designs. They require advanced computer capabilities for analysis. Funding agencies and researchers frequently do not take into account the fact that collecting and analysing six months' worth of data may cost up to ten times as much as the amount required to conduct and analyse a cross-sectional survey that collects the same information only once. Reasons for the additional expense include: extra time spent in designing longitudinal measures; the need for a long-term field office and full-time staff; and extra time and expertise needed for all aspects of the data analysis, as will become apparent in the section on measuring growth (p. 97).

### ***Qualitative versus Quantitative Designs***

Qualitative methods are needed to identify the types of behaviours and social networks that exist in households and communities. These methods include long openended interviews and observations as well as group interviews, known as focus groups. A problem is that results of qualitative studies tend not to be replicable in a strict scientific sense, and do not provide descriptive statistics. Policy-makers frequently do not regard qualitative results alone as sufficient evidence to justify a programme.

Therefore, it is usually desirable to combine qualitative and quantitative methods in positive deviance studies. While this can be done in a variety of ways, the simplest and least expensive way to combine qualitative and quantitative research is to start with a three-week qualitative research module, using a rapid-appraisal methodology (Scrimshaw and Hurtado, 1987). The results of the rapid appraisal are written up on their own. Simultaneously, the rapid-appraisal exercise functions as the design phase for

developing and pre-testing the questionnaires and observational protocols to be used for quantitative-data collection.

For example, this qualitative module may have the following steps:

1. The research team develops a conceptual framework and several lists of potentially interesting variables (see pages 88-106), by reviewing the literature and discussion with other professionals.
2. Research-team members take these lists into the homes of well-nourished and malnourished children. In the village, they walk from door to door with village guides. Using arm-circumference strips to select equal numbers of well-nourished and malnourished children, they visit the homes of 10 to 20 of each.
3. Inside the home, they enter into friendly conversation with the child's caretaker. During this conversation they either ask or attempt to directly observe information about each item on the lists, writing their results into notebooks. They also look for new aspects of family life that may affect nutrition and add these to the lists.
4. The research team meets to analyse its findings together. The principal investigator summarizes the results for each item on the lists on a blackboard, eliminating all items that were found to be less important and adding new items discovered in the homes. New revised lists are recorded.
5. The items on the new lists are drafted into focus-group question guides.
6. Research-team members use the question guide to conduct focus-group discussions separately with groups of village women, village men, and health workers, recording the results in their notebooks.
7. The research team meets to discuss the focus-group results. This discussion is recorded.
8. Information recorded from the group discussion and in the team members' notebooks is used to write the report of the qualitative-research findings.
9. The same information is used to draft pre-coded questions and observational protocols for the quantitative survey.
10. The survey instrument is pre-tested and revised.

### ***Sample Size and Unit of Analysis***

Observational methods are frequently too resource-intensive to permit the collection of data from large samples. In basic ethnographic studies, for example, one observer may cover only 20 households per year (20 working days per month; one day per household per month). A full year may be needed in order to record seasonal changes and the sequential development of the child.

An obvious answer to the problem of insufficient sample size is to turn to behaviours or events as units of analysis. Instead of 25 infants, for example, one may wish to analyse the 350 feedings received by these infants during the observation period. Moreover, the feeding may be the theoretical unit of interest if one is studying the effects of the interactions or the amount of food eaten during the feeding. In moving to events or behaviours as units of analysis, it is imperative to involve a statistician to figure out whether the procedures used are statistically legitimate. Unfortunately, feeding events may not be stable

units of analysis. Behaviours summarized at the event level in the Mexico study turned out to be highly non-normal in distribution (Zeitlin and Johnson, in progress). Different statistical methods used to cope with their non normality tended to yield different statistically significant results. Thus, the behaviours were finally summarized and analysed at the child level despite the small sample size.

It is also important to distinguish between statistical significance and biological significance. In the same Mexico study, the fact that the 25 well-nourished infants received on average oneand-a-half more bottles of cow's milk per child per day than the 25 malnourished was not statistically significant, but could well have been biologically significant.

### *Accuracy and Replicability of Observational Research*

Replicable observational research must be based on structured methods of observation. Developmental psychologists and anthropologists have devised and tested numerous formats for structured observations. A time-saving strategy is to adapt and pre-test some of these formats during the same period when the qualitative research is being conducted. Once these new instruments have been developed, it is essential to test them for internal reliability and validity.

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## **A conceptual framework for the design of positive-deviance studies**

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This section discusses the co-variables that must be considered in research on positive deviance in nutrition in the context of a general conceptual framework. This framework represents a broad statement of the causal relationships at work in the environment. It is presented because a general understanding of the nutrition system is required for the design of studies of this nature.

[Fig. 12. Conceptual framework: effect of mother's background, mother's child-care "wisdom," and child's characteristics on child's nutrition and health status.](#)

The variables under investigation are listed below in categories I to 4. Figure 12 represents the interactions of these categories or constructs. Box 1, parental and household characteristics, strongly affects boxes 2, parent's child-care "wisdom," and 3, child's characteristics, and also influences variables in box 4, child's nutrition and health status. Boxes 2 and 3 both interact and individually contribute to the outcome variables in box 4. Social and environmental factors impacting on the household have been subsumed under household characteristics.

The exact subset of variables within these constructs that will be selected for intensive study and the ways in which they will be operationalized will depend upon the area where the study is conducted and the focus of the study. The primary outcome variable is growth status, determined by anthropometric

measurements. Indirect measures of the child's nutrition and health status will include dietary intake, morbidity experience, and developmental status.

### ***Parental and Household Characteristics (Box 1)***

#### **Parent's Characteristics, Health, and Nutritional Status**

1. Mother's age.
2. Mother's anthropometry: height, weight, etc.
3. Activity level.
4. History of diseases: medical records, recall, etc.
5. Number of pregnancies, number of live births, number of living children, child spacing.
6. Household food consumption, mother's diet.
7. Family-planning practices.

Each of these factors may affect the child's growth either directly or indirectly. For example, a mother's health and nutritional status will not only determine a child's size at birth but will also affect the amount of energy a mother has to devote to the care of

her child. Ill-health of the father, including conditions such as alcoholism, will have severe effects on the family's resources. A mother's age and childbearing history will affect her knowledge, attitudes, and behaviour toward child care. An older mother might provide better child care because of her experience; she may also have less time to devote to a new infant. The number of children that parents have, along with the length of the birth-spacing interval, also influences the child's chances of survival and nutritional status.

#### ***Parent's Educational /Psychological Status***

1. Number of years of education.
2. Literacy.
3. Cognitive performance.
4. Locus of control and other attitudes.
5. Psychosomatic indicators.
6. Contact with outside world: radio and television.
7. Social network.

Each of these variables is likely to influence the parents' child-care knowledge, attitudes, and behaviours, and thus ultimately affect the child. A mother's level of education has been shown to correlate with child mortality (Caldwell, 1981) and with child nutritional status. It is possible that education increases the parents' ability to deal with new ideas and judge the seriousness of illnesses. Radio and television can also be an important source of information concerning child care. Studies reviewed in part I have also indicated how certain personality characteristics and attitudes of mothers are

associated with their tendency to have malnourished children.

### ***Stress Factors in Parents' Lives***

1. Childhood experiences, i.e. separation from parents, child abuse.
2. Social disruption, i.e. conflict with a partner or separation from family and friends.
3. Dissatisfaction with job/work activities.
4. Number of times moved household in last year.
5. Number of deaths in last year.
6. Number of children and other dependent family members.

Certain stressful events, such as those outlined above, are likely to influence the parents' ability to provide good child care. Stressful incidences can influence both character and mood. A study in Chile found that mothers with malnourished children had a higher degree of dissatisfaction with their family life (Alvarez et al., 1982). In Jamaica, mothers of malnourished children have been shown to lead stressful, disorganized lives (Kerr et al., 1978).

### ***Household Structure and Socio-economic Status***

1. Income/wealth: cash income; income in kind; quality/quantity of land owned and/ or cultivated; own/tenant farmer/landless labourer; household density (number of rooms/number of persons).
2. Household size and structure: number of persons and their relationship to each other.
3. Occupation of household members: type; status.

Austin and Zeitlin (1981) reviewed an extensive literature from developing countries attesting to the correlations between the above indicator categories and malnutrition.

### ***Parent's Child-care "Wisdom ": Knowledge, Attitudes, and Behaviours (Box 2)***

#### ***Nutrition and Health***

1. Parent's nutritional knowledge.
2. Parent's knowledge of general health, hygiene, and sanitation.
3. Use of nutrition and health services.
4. Use of traditional remedies, e.g. hot/cold solutions to health disorders.
5. Preventive and curative health behaviours.
6. Breast/bottle feeding behaviours (duration/type).
7. Weaning food behaviours (types/timing/amounts).
8. Mother's role in family food acquisition and intrafamily distribution.

The parents', and particularly the mother's, nutrition knowledge and practices determine what a child eats and thus affect the child's nutritional status and growth. It is important to investigate both traditional

and new food practices, since both can be beneficial as well as harmful. According to Chavez et al. (1971), mothers of male nourished children in rural Mexico tend to carry out more traditional feeding practices. However, it is important to determine which of these traditional practices are harmful. The intrafamilial distribution of food is also important in determining the quality and amount of food that a young child receives. In Barbados, young children did not receive enough food although sufficient supplies were available (Pan American Health Organization, 1972).

A child's growth is not affected only by the amount and type of food eaten but also by disease. Gastrointestinal infections such as diarrhoea cause less food to be absorbed and can thus lead to a dramatic weight loss. A mother's health-care knowledge and practices will affect her child's health by making him more or less susceptible to diseases. For example, in Mexico the practice of boiling water seems to be strong indicator of a household's health status. Both traditional and new health-care practices should be investigated in order to identify those that are beneficial and those that are harmful. For example, the "hot and cold" classification system should be considered in Mexico, in order to determine which traditional beliefs are still held. The idea that it is important to health to maintain a proper balance of hot and cold foods is no longer believed by everyone (Molony, 1975). The use of traditional healers and modern health-care facilities is also an important consideration. Fathers often determine when the child is taken for treatment.

### *Mental and Behavioural Development*

1. Knowledge of stages of child development.
2. Attitudes toward child.
3. Parent-child interaction: stimulation and attention mother gives child (emotional and physical); time spent with child.

A mother's child-care knowledge and behaviour can greatly affect her child's mental and behavioural development, which is linked to the child's growth. The father may affect the child through direct interaction, or, primarily, through his economic and emotional support of the family unit. It is thus important that parents provide their infants with adequate care for optimal development.

### ***Child's Characteristics (Box 3)***

#### *General Characteristics*

1. Age.
2. Sex.
3. Birth order.
4. Birth weight, gestational age.
5. Number of siblings and ages.

This information is likely to influence the kind and amount of care that the child receives. In Mexico, a

child's sex is important in determining the amount of food received. A study (Chavez et al., 1971) carried out in poor rural areas of Mexico suggested that far more girls were malnourished than boys. As a general rule in developing countries, children of higher birth order tend to be malnourished. The child's birth order can also influence the caretaker; the last-born child is sometimes the most spoiled.

#### ***Child's Nutritional and Health Status (Box 4)***

1. Anthropometry: height, weight, etc.
2. Dietary intake: 24-hour recall, food frequency.
3. History of diseases: recall, medical records, etc.
4. Mental and motor development tests such as Bayley infant scale, etc.
5. Activity level.

Each of the variables in this box measures an aspect of the child's nutrition and health status. They will be investigated as dependent variables to determine whether the child's status is affected by the parent's background and "wisdom." It is also important to consider the degree to which the child's nutrition and health status influence his treatment. A child's health, physical appearance, or behaviour influences the care and food received by that child.

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## Important variables: results of the positive-deviance mail survey

Between December 1983 and May 1984, a mail survey on the topic of positive deviance was sent to almost 700 nutrition and health professionals. The survey questionnaire listed variables that were known or hypothesized to contribute to positive deviance and asked the respondents to rate their importance. The researchers requested survey responses from those health professionals with an active interest in this topic. Responses were received from 68 persons in 36 countries in time to be included in the analysis (and from 25 more thereafter). This response rate of about 13 per cent indicated to the research group that a relatively large proportion of professionals in the nutrition field have an active interest in this topic.

Table 8. Topics ranked by percentage of "important", items

Topic	Percentage
Child's resistance to infection	100
Mother's diet during pregnancy	75
Curative health care	71
Household resources	67
Mother-child interaction	60
Preventive health care, child's physiological and dietary characteristics, family size and structure, family attitudes, each	50
Psychological characteristics of mother	47
Fathers role	25
Behavioural characteristics of the child, characteristics of other caretakers	0

### Results

The results of the survey, including the regions and countries of the respondents and descriptive statistics by rural and regional location, are presented in Appendix I in tables A to F. Table G summarizes the open-ended observations, suggestions, and comments written onto the questionnaires. The names and addresses of the respondents are listed in Appendix 2 in order to provide an informal reference group of professionals interested in the topic of positive deviance.

It is important not to overanalyse these data, which are subjective in nature and based overwhelmingly on personal observations by a selected group. One of the primary purposes of presenting the results is to provide researchers with a comprehensive list of variables and to enable them to refer to the survey responses on an item-by-item basis when designing their own field-studies. Items ranked as important by the survey respondents should clearly receive serious consideration in both research and programme design. It is interesting to note that 44 per cent of the questionnaire items received average rankings greater than 3 on a scale ranging from 0 to 4.

By topic area, in descending order of importance, the percentage of items under each topic with rank averages above 3 is shown in table 8.

Table 9 presents all items ranked as "very important" (score of 4) by more than 50 per cent of respondents in the total sample or in either the rural or urban subsamples. The writers believe these items should serve as a useful "shortlist" of factors that should be taken into consideration when studying positive deviance.

Both tables show that our experts gave highest importance to the role played by infection in positive deviance.

Some rural/urban differences emerged from the results. In general, variables reflecting modernization were ranked as

being more important in the urban setting. Greater contact with the outside world, fewer visits to traditional healers, and less use of home remedies were ranked as significantly more important for urban than for rural mothers. Characteristics of other caretakers also ranked higher (quite possibly because urban employment tended to require separation of mother and child). In the rural areas, presence of siblings old enough to help the mother ranked higher. With respect to attitudes, mother's satisfaction with her life was ranked more important in

Table 9. Survey of expert knowledge and opinion on positive deviance in nutrition of young children (items agreed to be very important by 50 per cent or more of respondents in overall, rural, or urban categories)

Item	Percentage		
	Overall (N = 62) <sup>a</sup>	Rural (N = 19)	Urban (N = 14)
<i>Mother-child interactions</i>			
Early bonding between mother and infant	63	44	69
Positive "affect" or smiling happy mood between mother/child	52	53	39
Prompt response to child's hunger cues	53	44	62
Frequent psychosocial stimulation	53	53	39
Lack of prolonged separation of child from mother	58	56	40
<i>Behavioural characteristics of the child</i>			
Rapid adaptation to new stimuli	31	11	70
<i>Psychosocial characteristics of the mother</i>			
Satisfaction with her life in general	52	39	58
Low levels of psychological stress	51	46	46
Not overburdened by work	44	50	25
Ability to put child's needs before her own needs or desires	53	50	50
Absence of psychiatric problems (anxiety, depression, etc.)	44	40	62
Positive attitude towards child (child of desired sex)	51	69	25
Maturity: 20 years old or more	36	50	39
<i>Preventive health care</i>			
Attention to hygiene and sanitary conditions of child's environment	63	59	57
Greater use of modern preventive health services (e.g. pre-natal care, immunization)	61	53	57
Less practice of dietary taboos	41	28	50
<i>Curative health care</i>			
Prompt visit to modern health services	52	35	64
Continuing to seek help until child recovered	47	25	50
Continuing to give prescribed care and medication throughout the illness	49	29	54
Less restriction of diet during illness	54	57	50
<i>Father's role</i>			
Providing financial support for child	60	56	50
<i>Family attitudes</i>			
Recognition of special nutritional needs of young child	59	43	50
<i>Household resources</i>			

Presence of informal social network whose support the mother can draw upon	44	53	40
<i>Maternal nutritional status</i>			
Weight gain during pregnancy	45	55	55
<i>Dietary intake during pregnancy</i>			
Calories	65	67	82
Protein	50	55	36
Iron	48	46	63
<i>Dietary intake during lactation</i>			
Calories	71	67	73
Protein	58	33	55
<i>Child characteristics</i>			
Birth weight (large or average weight for date)	47	58	43
Normal gestational age (38-42 weeks)	50	67	43
Absence of complication/stress during pregnancy	42	55	23
Age supplementary food started	54	75	36
Age breast-feeding stopped	47	50	64
Calories in supplementary food	62	71	54
Greater than, average stress tolerance	43	25	61
<i>Child's resistance to infections</i>			
Diarrhoeal	83	88	85
Respiratory	81	73	69
Parasitic	55	39	54
Measles	67	36	50

<sup>a</sup>. Not all responses could be included in this calculation since some were respondents who wrote out their information in longhand rather than answering the items. urban areas. Sex of the child was ranked less important, and timing of the birth more important in the urban setting.

The numbers representing the different regions are too few to permit statistical comparisons, although the regional values may be worth reviewing for individuals interested in specific items. For example, the practice of discrimination against female children was ranked as more important in Middle South Asia (Bangladesh, India, Nepal, Sri Lanka, and Turkey) than in other regions.

### **Discussion**

In summary, the survey results underscore the importance of nutrition-infection interactions for the study of positive deviance. These high ratings given to health may in part reflect the fact that many of the respondents were clinicians who encountered malnutrition in sick children attending health facilities. The results confirm that many nutrition and health professionals acknowledge the importance of psychosocial factors contributing to child growth and particularly to the ability to thrive under conditions of adversity. They also illustrate the fact that conditions contributing to positive deviance differ significantly from one setting to another.

An interesting example of this difference is that sex of the child was ranked more important in the rural areas, while timing of the birth was more important in the urban areas. In many rural areas, particularly outside of Africa, land is passed down from father to son and the multigenerational patrilocal family is the production unit. Under these circumstances, a primary parent-son emotional bond may be required to ensure intergenerational commitment to the economic unit. The need for such preferential bonding would diminish with urbanization. However, timing of births increases in importance as couples begin to limit their fertility and mothers enter paid employment.

## Micro-level variables measuring caretaker-child interactions

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Researchers should consider but should not be overwhelmed by the list of behavioural interactions on pages 56-60. This long list of behaviours linked to nutritional status came from numerous studies in different sites. In cases of overt psychopathology many items on these lists might be expected to apply simultaneously, as in the syndromes described earlier. In any given developing-country setting, however, one would expect to find the majority of behaviours falling within normal range. With luck, only a few would be expected to differentiate between positive deviants and less well nourished infants. The complete lists, plus hypothesized adaptations to resource scarcity, would have to be taken into consideration by researchers. Yet, many items should be eliminated as irrelevant to the particular setting, age-group, or nutritional problem. By this process of elimination the scope of research is reduced to manageable proportions.

Nutrition researchers should work with developmental psychologists to obtain and adapt scales for measuring the quality of mother-child interaction and of the child's environment. Alvarez (1983) has produced scales for "non-verbal language" which discriminated strongly between mothers of well-nourished and malnourished children. These scales may be requested from her in Chile (see Appendix 2 for her address).

Caldwell (1967) created an Inventory of Home Stimulation, commonly referred to as the HOME Inventory, which was adapted by Pollitt (1975), to discriminate between FIT children and normal controls in the United States, and by Cravioto and Delicardie (1976) in Mexico. The investigators showed in the Mexico study that modified Caldwell scale ratings at the age of six months predicted severe malnutrition at a later age, although only one child was already severely malnourished at this first time of testing. Sheffer and co-workers (1981), found by contrast in Jamaica that their use of the Caldwell scale did not distinguish well between children admitted to hospital for male nutrition, those admitted for treatment of other conditions, and a healthy neighbourhood comparison group. The HOME scale has recently been adapted to Indonesia and applied to 400 children ranging from 0 to 30 months. This Indonesian adaptation may be available from Dr. Satoto at Diponegoro University in Semarang, Central Java.

Researchers also should be aware of the Bayley (1969) scales for measuring infant development and with the Brazelton (1973) scale for neonates. The Bayley has also been applied by Dr. Satoto's group at Diponegoro University in Indonesia.

Simpler measures of developmental milestones are available from any textbook of pediatrics. Bee and associates (1982) discuss a number of psychological and developmental tests that might be useful in suggesting items for research instruments linking nutritional status to motherchild interactions (the Ainsworth et al., 1978, measure of attachment).

Currently used in North America for assessing infant feeding interactions up to one year of age is a set of scales entitled the Nursing Child Assessment Feeding Scales (NCAFS, n.d.). Researchers are encouraged to adapt these for use in developing countries but should be aware from the start that they may not be highly useful for the following reasons: (1) they were not developed for studying food intake but rather for studying psychological reciprocity related to the cognitive and social development of the child; (2) they are extremely detailed and require video-tape training sessions; (3) they are biased towards detecting maternal behaviours that could lead to overfeeding and identifying these behaviours as abnormal. They have no items to detect underfeeding. This bias is appropriate in North America where infant obesity is a major problem. But it was found by Laurine Brown (personal communication, 1987) to be a drawback to adapting them for Bangladesh, where the problem is undernutrition.

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## Variables measuring maternal characteristics and socio-cultural support

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Maternal characteristics discussed in part I on pages 61-72, and measures of social support discussed on pages 72-79, should be reviewed during the process of research design. Focus groups should be used to identify the areas on the lists in these sections that are most problematic in a given environment. Major problems should be the focus of intensive research procedures, while less critical characteristics should be described more briefly.

Other researchers who investigate these topics could profitably apply a positive deviance approach. Research on women's employment, for example, should contrast the time-use and child-care arrangements of mothers with well-nourished versus average versus malnourished children.

The psychological state of the mother, strategy of investment in children, and perceived lifecourse agendas are areas of interest that have received little study in developing countries. Since they may critically influence the quality of the mother-child interaction, it is proposed that they receive high priority in research.

## Measuring growth

Measuring growth is particularly important to positive-deviance studies because the growth variables identify the children who are positive deviants. As of 1987, growth should be measured and assessed using the WHO methods and NCHS standards presented by Lavoipierre and colleagues (1983). Well-nourished (W), average-nourished (A), and malnourished (M) may be categorized using methods that differ according to the nature of the study design, as indicated in the following sections.

### *Cross-sectional Designs*

It is legitimate to compare infants measured at one point in time, contrasting those whose length or weight falls below given cut-off points with those who are larger. On a probability basis, the group of larger children will undoubtedly be better nourished than the smaller ones. If, for example, we pick -2 SD in height-for-age z (HAZ), based on the NCHS reference population, as our cut-off point, the probability that a truly well-nourished pre-school child will fall into our malnourished group is only about 2.5 per cent. This cut-off point has excellent specificity for identifying malnourished children. Children in our well-nourished group have a higher probability of being misclassified because some may have experienced recent growth failure without dropping below our cut-off point.

If children are classified into groups on the basis of a single measurement, comparison between the caretakers of the two groups would be expected to yield significant differences, since the caretakers' long-term behaviour patterns would have contributed to the cumulative status of the children. A comparison between the short-term eating behaviours of the children themselves might be more confounded because some of the big children may be losing weight and some of the small ones may be undergoing catch-up growth at the time of the study.

### *Age-matching in Cross-sectional Designs*

In cross-sectional designs and other studies where sophisticated methods are not used for the classification of positive deviance, well-nourished (W), average-nourished (A), and malnourished (M) children must be matched for age. In most developing countries, the entire growth distribution shifts downwards in comparison to international reference standards at about six months of age. The most accurate simple method of dividing children into W, A, and M groups is to sort out children within each month of age separately during the period when nutritional status is falling off rapidly: i.e. the top third of the seven-month-old children are defined as W, the middle third as A, and the bottom third, M. This means that the W children in the 12-month age-group may actually be more poorly nourished than the A group of seven-month-olds, according to international reference standards. Over age periods when nutritional status is relatively stable, e.g. 12 to 21 months, it is possible to pool all children across the agegroup for sorting purposes, so long as the classification procedure produces the same age distribution in the W, A, and M groups.

The alternative, of sticking to a strict definition of good nutrition according to international standards, classifies more of the younger children as well-nourished, and more of the older ones as malnourished. Thus the W, A, and M groups are noncomparable in average age, and the percentage of children falling into W, A, and M categories changes as the children get older. A consistent definition of malnutrition across age-groups was maintained in the Burmese study cited earlier (Nutrition Research Division, 1985). This analysis defined Ws as  $> 1$  SD in weight-for-age z (WAZ), As from  $-1$  SD to  $-2$  SD, and Ms as  $< -2$  SD. For 3,298 children aged between 0 and 36 months, the percentages falling into the W, A, and M categories by agegroup are shown in table 10.

Because the overall sample size was so large in the Burmese study the small percentages falling into the W category in the older age-groups still left sufficiently large groups of children for analysis.

### **Table 10**

Age-group (months)	Percentages		
	W	A	M
0-3	36	45	18
4-6	29	44	22
7-12	17	67	16
13-24	5	69	26
25-36	4	77	20

### *Classifications and Analyses on the Basis of Different Anthropometric Indicators*

The different anthropometric indicators change differently over time. Average HAZ in a population often drops rapidly while weight-for-height Z (WHZ) remains more nearly normal. Ideally, the well-nourished should be near the top of their distributions on all three indicators: WAZ, HAZ, and WHZ.

In fact, this may not be possible. Where classifications diverge, the indicator most affected by malnutrition should be the main criterion indicator. Where children are stunted but chubby, this tends to be HAZ; where they are stunted and thin, WAZ.

The way in which a preliminary subset of the Burma study data was analysed with technical assistance from Zeitlin (1983) provides an illustration of the manner in which indicators can be combined in classification criteria, as well as demonstrating how the criteria for nutritional status groups can shift downward with age if the W, A, and M groups are to be age-matched. Infants and young children were classified into W, A, and M categories according to the following criteria, applied to three measurements WAZ, HAZ, and WHZ, calculated according to the NCHS/WHO standards, where  $W \geq -1SD$ ,  $A < -1$ , and  $\geq -2SD$  and  $M < -2SD$ .

W = W W W (applied to all three indicators).

A = (1) any combination of W and A or AAA in children below 7 months;  
(2) any combination with A in final place above 7 months.

M = (1) any combination with M below 7 months;  
(2) any combination with M in final place above 7 months.

Because true Ws were scarce, the As were further divided into high As and low As. Two matching procedures were used by hand to form triplets consisting of: (1) a true W, and A, and M child; (2) any child in the top third of the distribution (Ws plus high As), matched with a low A child from the middle third and an M child from the bottom.

In Burma, weight-for-age was the main criterion used for matching, yet problems arose in classifying children who were normal in height but very thin or very short but chubby. To avoid problems encountered in applying a single classification system, such children were excluded from the pairing procedure when pairmates would have been very different in WAZ, HAZ, and WHZ.

If multivariate methods are used, e.g. regression or analysis of covariance, using age as a covariate, elaborate pairing may be avoided and separate analyses can be conducted for positive-deviance classifications defined by WA, HA, and WH. Attempting to use statistical methods to control for the effects of age is not fully satisfactory when many phenomena change qualitatively, not simultaneously, with age. In adjusting for age effects, the procedures described below for longitudinal analyses can also be applied to cross-sectional data.

### ***Longitudinal Designs***

Longitudinal designs are desirable in the interests of accuracy but tend to require advanced computer capabilities for their analysis. It is not necessary to use longitudinal methods. The complexities described in this section can be very time- and resource consuming. Therefore, longitudinal positive-deviance studies probably should not be undertaken by researchers lacking a computer with a statistical package and an accessible statistician to provide ongoing guidance.

## *The Value of Longitudinal Growth Measures*

Rate of growth is a matter of concern in the definition of positive deviance. Infants who grow well during one period may falter and grow poorly subsequently. The behaviours and circumstances that promoted their growth in the good period may disappear or prove maladaptive during the poor growth phase. When resources are abundant, it is desirable (though still not necessary) to measure growth longitudinally and to define positive deviance versus poor growth over a time period of six months or more. Cross-sectional studies that measure the child at one moment in time cannot tell whether the child's condition has recently improved or deteriorated.

### *At Least Six Months of Longitudinal Growth Data*

Rate of growth can be different or impossible to measure over the short term. Between one year and two years of age, the reference growth-rate for weight is only about 200 g per month. Short-term variability in weight due mainly to differences in stomach, bladder and bowel content has been reported to be 290 g at 30 months (Habicht, 1983). Therefore, if the child is weighed once monthly, it is difficult to tell with certainty whether she has gained weight from one month to the next. At least six months' worth of longitudinal data should be collected in order to assess growth in length (height) or weight.

### *Adjusting for Age and Season in Longitudinal Data*

An adjustment has to be made for changes in growth with age and sex. A useful first stage of adjustment frequently consists of transforming anthropometric raw scores to Z-scores according to the NCHS Standards.

A second stage of adjustment is then necessary. In many developing-country populations, almost all infants are well-nourished between about 1 and 4 months and malnourished by the age of 18 months. If no further adjustments are made, the youngest children will appear to be the positive deviants, as noted earlier. Similarly, where there are seasonal changes, infants at given ages will be consistently betternourished in some seasons than in others. In order to compare the growth status of children it is important to subtract from each child's growth measurement (in Z-scores if a Z-score adjustment has been used) at each month of age a value that represents the average growth measurement of the other children in the sample at the same age in the same season. The subtracted value left over is a residual Z-score that measures how well each particular child is doing compared to the others at each month in time. To adjust adequately for age and season requires a sufficient sample size of children at each given age in each given season.

### *Developing Summary Scores from Longitudinal Anthropometry*

Two summary scores should be constructed representing the child's absolute size and his growth rate. The absolute size must be considered because a normal rate of growth at a very low Z-score (or percentile) may be maintained on a diet that would not support the same growth-rate at a higher Z-score (or percentile). Therefore, it is not possible to assume that a child who maintains a normal growth rate at  $-2.5$  SD in HAZ is as well nourished as a child with the same growth rate at  $-1.5$  SD.

For the first summary score, the average overall measurement points of each child's residual Z-score, as described above, provide an adequate ranking of the child's size relative to others in the group.

The second summary score for growth-rate over the measurement period must adjust for regression to the mean. The term regression to the mean describes the fact that the largest children tend to grow more slowly and the smallest more rapidly over a longitudinal measurement period. Causes of regression to the mean include measurement error, temporary illness, differing maturation rates, and environmental influences. The simplest way to make the second summary score with this adjustment is to construct a "value-added" score, using a method first introduced into the literature by Heimendinger and Laird (1983). This procedure involves the following steps:

1. Construct a correlation matrix of the residual Z-scores at each age against all other ages.
2. Find the  $r$  value of the correlation of the residual Z at age of first measurement and residual Z at final age of measurement for each child.
3. Multiply this  $r$  value with the child's initial residual Z-score to get his final expected residual Z-score.
4. Subtract this final expected residual Z-score from the child's actual final residual Z-score.
5. This is the raw value-added score. It should be divided by an age-specific constant to correct for the different rates of growth of the children at different ages. This constant is calculated by dividing the expected growth of the child (in cm or kg) at the age at which the final measurement is taken. The raw value-added score divided by this constant is the summary score measuring the child's growth-rate relative to the growth-rate of the others in the group.
6. If the standard deviations of the study population differ significantly from those of the reference population, which is

not usually the case, other procedure may have to be applied to the residuals before undertaking step 1 of this process.

If a large sample of children have been measured monthly from the starting age to the same final age the raw value-added score may be used without adjustment, or a different second summary score can be obtained using some variation of the approach of Johnston and colleagues (1980). This approach pools all the anthropometric data points of all the children into a file in such a manner that they are arranged as cross-sectional data, as if each monthly measurement represented a separate child. It may then divide the children on the basis of their starting Z-scores into 4 quartiles for HAZ, WAZ, and WHZ. Within each quartile, it regresses  $HAZ = a + b \text{ age}$ ;  $WAZ = a + B \text{ age}$ ; and  $WHZ = a + b \text{ age}$ . Squared or cubic or log terms and seasonal dummy variable can be put into these regressions if they describe the data. Within each quartile, each individual's residuals can be taken from these regression lines. The slope of the linear regression through each child's residual scores can serve as the summary measure of growth-rate. Rather than using quartiles, if computer facilities permit, a separate regression may be calculated for each child, including in his regression equation the 60 children whose measurements were closest to his at the first measurement date.

Yet another approach, principal components analysis of the children's difference scores from month to month of the age- and season-adjusted residual Z-score variable, may also yield summary scores describing growth. However, these scores would be more likely to capture different patterns of growth spurts rather than growth-rates.

### *Statistics for Longitudinal Analysis*

The statistical procedures currently available for longitudinal analyses are far more limited than those for cross-sectional approaches. This is the main reason for deriving summary scores of the longitudinal growth measurements, so that these summaries can be used cross-sectionally with summaries of other variables.

In theory, longitudinal methods such as repeat-measures multivariate analysis of covariance (MANCOVA) should be able to handle the covariates that are of interest to nutritional epidemiology. In practice, as of 1987, the existing statistical packages cannot accept as many covariates as one would wish, the manipulation of the covariates by the computer programs is difficult to control according to the needs of the analyst, and the results tend to be difficult to interpret. Time-series analysis cannot handle many individual cases.

### *Avoiding Shifts in Classifications*

Prospective longitudinal designs in which children are classified as W and M at the beginning of the study will run into problems because some of the children will change in category over time. Therefore, prospective studies are advised to take children of all nutritional status categories and classify them according to their final measurements, or to sort them retrospectively into growth categories during the analysis.

### *Household versus Dyad-level Status*

Innate child characteristics are confounded variables for household-level analyses, where the research goal is to compare mothers and families who produce wellnourished children versus those who do not. Some children are born survivors who thrive despite unfavourable environments.

For household-level studies, only families in which all children show satisfactory nutritional status and in which none have died should be classified as positive-deviant. This restriction minimizes the likelihood that the individual child, rather than the mother or the environment, is responsible for the favourable outcome.

Positive-deviant interaction patterns between caretaker and child may still occur regardless of which member of the dyad is more responsible for initiating them. For some research purposes, for example to determine the child characteristics associated with positive deviance, well-nourished children should be selected from homes in which another sibling is malnourished or deceased.

Because of the extreme immaturity of the human infant compared to the mother, it is only reasonable to expect that the mother's characteristics are more important than those of the child in determining the quality of their interaction. She has a far greater repertoire of responses as well as complex reasoning ability at her disposal. A study of cognitive development that did attempt to separate out the relative importance of the mother's versus the child's role (Ruddy and Bornstein, 1982) found the mother's contribution to be more significant than the child's.

### *Genetic Differences in Child Size and Growth-rate in Malnourished Populations*

The issue of the degree to which malnourished children are genetically influenced by the short stature of their parents always comes up in positive-deviance studies. The best evidence currently available indicates that stunting below -2 SD of the NCHS standards cannot be considered to be genetic in origin. If variability in length and weight of young children in malnourished populations were predominantly determined by genetic growth potential, it would be very difficult to classify some as wellnourished and some as malnourished. Given the potential importance of this problem, this section discusses the heritability of growth in some detail.

Let us first examine whether uniform cross-generational stunting could be created in laboratory rats, for example, by making sure that the rat parents and rat pups in sequential generations all received exactly 60 per cent of their nutrient requirements from identical lab chow. In this case, one might assume simplistically that parents and pups would both be 75 per cent (or some consistent proportion) of their potential genetic lengths for their ages. In this case the parent-pup length correlations would be identical to those of well-nourished rats. If this were true, it would be possible to say that some of the malnourished rats were worse nourished than others. All would be equally malnourished' compared to their genetic potential.

In actuality, however, some of the rats would be more metabolically efficient than others, so that some would find the diminished ration adequate and would grow at or close to their genetic potential while some would experience severe growth retardation because their higher nutrient requirements were not met. Therefore, the small ones would in fact be less well nourished than the large ones.

Moreover, if they lived freely in colonies with a limited food supply, some would establish dominance over others and get more of the food. Some would experience more growth failure caused by illness than others. Some rat dams would manage their newborn pups less stressfully than others and have bigger pups with lower mortality rates. Each of these metabolic or behavioural sources of variability could contribute to significant positive parent-pup correlations in length (e.g. less stressed dams would be likely to be bigger and to have less stressed, bigger pups). However, these correlations might imply little or nothing about the genetic length potential of the rat, had they been raised on diets adequate for all members of the colony.

[Fig. 13. Parent-child correlations for stature in well-nourished population \(after Tanner and Israelsohn, 1963\).](#)

There is a body of research concerning parent-child height correlations that should be reviewed before drawing conclusions concerning the genetic component of child size in deprived communities.

Height is known to be highly heritable according to a primarily additive polygenic model (Carter and Marshall, 1978). Numerous empirical studies have confirmed predicted correlation coefficients of about  $r = 0.5$  for stature between siblings and between parent and child, and about 0.7 between child's stature and midparent height (the average of the two parents' heights). Figure 13 (Tanner and Israelsohn, 1963) shows that parent-child correlations in wellnourished populations are low at birth, but are well-established by one year of age and fairly stable after two years. Paediatricians in industrialized countries have been advised to use parentadjusted growth standards to assess the growth of young children (Tanner et al., 1970).

A number of studies found parent-child correlations in stature to be low in developing countries where environmental variables prevent the full expression of genetic growth potential. Two studies in 1977 (Martorell et al., 1977; Mueller and Titcomb, 1977), however, reported that parent-child correlations for stature (and other physical dimensions) remained high in endemically malnourished populations in which diet and health-related environmental variables had remained stable from one generation to the next.

The study populations in the latter studies may have differed from those that preceded them in the amount of intergenerational change that had occurred and in the homogeneity of the environments in which they lived. In the later studies showing high correlations, environmental influences appeared to exert very similar effects on the sets of families included in the analyses.

Mansour (1985) approached this issue using national level data from Tunisia collected from diverse regions of the country. The sample was divided into two groups of 2- to 6-year-old children whose heights fell above and below the regression line of height-for-age (HAZ) on age (between 2 and 6 years this line was nearly horizontal at about -1.1 SD according to the NCHS standards). Because the child HAZ distribution was somewhat bimodal this division into halfdistributions did not make each half too narrow for further analysis. Multiple-regression analyses regressing child's HAZ against mother's height, socio-economic factor score, and sex of the child within each half showed mother's height to be the only significant correlate of child's height in the children of normal stature, and socio-economic score and child's sex the only significant correlates among the stunted children. Yet other analyses by Mansour showed that mother's height and child's height were correlated within more homogeneous subgroups of stunted children.

These findings strongly suggest that parent-child height correlations between stunted preschool children and their parents are due not to the biological expression of the children's genetic height potential but rather to cross-generational similarities in socio-economic status, metabolic responses to given diets, and other variables. When families entered into correlational analyses were taken from a homogeneous community, the correlations between parent and child height were inflated by local environmental, dietary, and behavioural/cultural features and morbidity patterns that affect both parents and children consistently. When families entered into the analysis were taken from many disparate regions within a country' the divergent effects of microenvironmental factors from different communities cancelled each other out.

These findings should not be taken to imply that genetics do not operate in stunted populations with high morbidity rates. Rather, the genetically regulated responses to multiple environmental insults are very complicated. Therefore, the height of stunted parents and children may be highly correlated but may not reflect their genetic height potential.

As an example of the conclusions that may reasonably be drawn from parent-child size correlations in malnourished groups, we cite Johnston and co-workers (1980) who found that parents' heights, and shoulder and hip widths, were highly correlated with the growth-rate of malnourished Mexican children. They concluded "that the etiology of chronic malnutrition, indicated here by growth failure, involves a significant generational aspect. These parents apparently replicated the conditions which led to their own malnutrition, so that their children are significantly more likely to display the failing growth which is characteristic of chronic malnutrition."

Mansour (1985) found that within the stunted group of children, parent-child height correlations began to become significant after age five, versus age three within the taller groups. This and other findings from his analysis support a model for older children and adults in which quantity of food is calorically sufficient for all, but come position of the diet is systematically low in protein and micro-nutrients needed to promote optimal growth. Under these conditions growth of individuals might indeed be significantly correlated to genetic potential but at a lower level than would occur if genetic height were fully expressed.

In children below five, and below three years of age particularly, irregularity in growth-rate caused by frequent infections with erratic catch-up growth, and by faulty weaning diets, would appear to obliterate any consistent relationship between actual size and genetic size potential among the malnourished.

Given the evidence referred to above, we conclude that genetic heritability of size should not be a predominant consideration in positive-deviance research in nutrition on infants aged 0 to 3 years. We concur with Johnston and colleagues (1980), however, that tall versus short stature among parents may be considered as rough screening factors for identifying households having historically good versus poor crossgenerational adaptations to poverty and resource scarcity.

### ***Genetic Differences in Growth in Well-nourished Populations***

Variables affecting growth operate in a dose-response relationship. Above a specific threshold, further increases in a given variable will not increase body size. In nutritionally normal populations, correlation coefficients of close to 0.9 between the heights of identical twins imply that about 80 per cent of the variance in height between normally nourished children is genetically determined. Therefore, positive-deviance research in normal populations may yield relatively few psychosocial or dietary differences between large and small infants.

The twin studies indicate, however, that environmental influences still play some role in determining growth achievement even with identical twins within the same household, whose heights are correlated at an  $r$  value of about .95 (Newman et al., 1937). Identical twins reared in separate homes in presumably well-nourished environments show height correlations with  $r$  values closer to 0.8 (Shields, 1962). This suggests that certain maternal-child interaction characteristics still potentiate the expression of genetic size among well-nourished groups. Such growth-promoting characteristics would be expected to be more frequent among families whose children ranked high on the growth distributions of both developing-country and industrialized-country populations.

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## Controlling for socio-economic status

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No two households will maintain exactly the same per capita income. Moreover, income and wealth are notoriously difficult to measure accurately. Assumptions underlying the concept of positive deviance are that (1) the level of income is more or less the same in very poor neighbourhoods; (2) fairly simple indicators, such as land ownership, housing, and visible possessions can be used to identify families living at approximately the same level of poverty; and (3) additional statistical adjustments made for income can more or less remove its confounding effects.

The studies classified as true positive-deviance research in table 2 did find some variability in family wealth, although they tried to compare homogeneous groups. Morley and associates (1968) concluded, for example, that the fathers of the well nourished were "better farmers" than those of the malnourished. Such variability may be critical to positive deviance when additional small amounts of income are earned by an enterprising mother and used to feed her child.

The point to be made here is that positive-deviance studies must make the attempt to control for socio-economic status. The Kanawati and McLaren (1973) study of failure-to-thrive in Lebanon, for example, was not included in table 2 because large socioeconomic differences were found between the malnourished and well-nourished groups. Given the difficulties of measuring income, total household expenditure is often used as a proxy variable for income and can be analysed by subcategory.

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## Limiting the number of covariables: restriction by age and topic

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As noted many times in this document, an extremely broad range of covariables contribute to child growth amidst poverty. A large number of these interrelate in ways that make it impossible to omit them from consideration without biasing the results of research. Therefore, it is necessary to seek ways to confine research studies in positive deviance to manageable proportions. Studying a narrow age-group is one method of restricting variables that also makes sense from a child-development perspective. Young children change so rapidly that the environmental and behavioural factors that contribute to positive deviance at one developmental stage may differ vastly from those that are important earlier or later.

Seven-month-olds have very different needs and characteristics from two-year olds.

Suggested age ranges are: pre-pregnancy; pregnancy; neonates (0 to 1 month); first three months; 4 months until the child starts to crawl; the crawling stage, with its high exposure to dirt from the ground; first walking to start of nutritional recovery (15 to 21 months depending on population); and the early recovery period (21 to 30 months). The exact range should be specified to fit the research question and the location.

Restricting the main topics of investigation to one (or two) item(s), such as breast feeding, is a necessity, although it doesn't remove the need to measure or control for other related factors, such as supplementary food intake, etc.

As with all research on living subjects, it is necessary to ignore factors having effects that are relatively independent of the main relationships being tested by the research study. It is never possible to study or control for all variables.

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## **Rationale for existing behaviours and social structures**

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Behaviours that appear to have negative effects on the growth and health of young children may serve other purposes related to the survival of the household, or may be caused by constraints that cannot be changed, or by historical developmental disorders within the family that do not respond to short-term programme approaches. Behavioural and social factors that contribute to positive deviance must be tested for transferability before they can be incorporated into programme design. Behavioural trial methods developed by social-marketing and communications professionals are suitable for tests of behaviour-change messages recommended as part of stage 2 in our research model.

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## **Timeline for change**

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Some factors contributing to positive deviance go back to the childhood of the parents or to earlier circumstances in the history of the parents or to earlier circumstances in the history of the family or the subculture. Cross-sectional research approaches should not ignore these historic factors. Different types of change also require different lengths of time to achieve. Programmatic trials should not assume that attitudes and behaviours that prove resistant in the short run will not yield to change over longer periods.

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## **Nutrition and infection**

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Because nutrition and infectious illness are so closely related, the resistance of the mother-child dyad to infection, the degree to which the environment exposes the dyad to infection, and the mother and other caretaker's preventive and curative health related behaviours may greatly influence the child's growth status and vice versa.

### ***Aspects of Health Research that are Necessary for Research in Positive Deviance in Nutrition***

The mother's overall health-seeking behaviours- how soon she goes for treatment, where, in what order, how persistently she follows treatment instructions, whether administering treatment herself, for the prescribed period, etc. - are topics for research on positive deviance in nutrition. Child-feeding during illness and convalescence belongs to this research domain.

Scrimshaw and Scrimshaw (1980) found, for example, that the mothers in their positive deviant families persisted in seeking health care for their infants until the child had recovered. They also were more likely to take care of the child personally when he was sick, staying home from income-earning activities in order to do so.

Morbidity cannot be ignored in nutritional studies. Similarly nutritional status cannot be disregarded in morbidity studies. At the very least, the effects of morbidity must be controlled or adjusted for the studies of growth outcome.

The micro-behaviours and environmental factors associated with the transmission and cure of specific diseases fall outside the domain of this paper. A positive-deviance approach should definitely be taken to disease-specific studies of infant and young child morbidity. However, the growth of the child will be a secondary outcome variable in such studies. The primary outcome should be the incidence and duration of the particular infectious illness that is under scrutiny. It is possible and desirable to conduct combined studies of both nutrition and morbidity outcomes. Information for the design of the morbidity component of such studies must be obtained from appropriate medical researchers and epidemiologists.

### ***Checklist of Nutrition-Infection Relationships***

What follows is a checklist of nutrition-infection relationships that are important for the design of research in positive deviance. For the sake of brevity, this checklist is not referenced.

- Nutrition-infection interactions start in utero. Sexually transmitted infections of the placenta and

chorionic membranes reduce nutrient transfer and lead to premature birth. Other maternal infections must also be considered.

- Breast-milk of well-nourished mothers has been found to contain more immune factors than that of the malnourished.
- Breast-feeding contributes to resistance to infection in a large number of physiologically complicated ways.
- Protein-energy malnutrition impairs numerous aspects of the immune system. Cell-mediated immunity is most severely affected.
- Iron deficiency and vitamin A deficiency reduce immunity function.
- Resistance to infection increases greatly with age. Malnourished children aged two years plus have greater immunity than younger better-nourished children. Well nourished exclusively breast-fed infants below four to six months can be expected to be relatively healthy.
- Infant and young-child morbidity is highly seasonal. Respiratory infections tend to peak in cool dry seasons, and diarrhoeal infections in hot and/or wet ones. Different regions have distinctive seasonal patterns. Infants selected for comparison in positive-deviance studies should be matched both for age and season of the year in which the data are collected.
- Most studies have found that the incidence of infection does not differ significantly between the well-nourished and the malnourished, but the severity and duration are greater for the malnourished.
- Diarrhoeal infection is much more strongly associated with poor growth than respiratory or other types of infection.
- Measles, pertussis (whooping cough), and tuberculosis may precipitate malnutrition.
- The effect of parasites on growth status depends on the degree of infestation, with light worm loads having almost no effect, but heavy worm loads being quite serious, for example.
- Age of exposure determines the virulence of some infections. Measles and pertussis are both believed to cause higher rates of malnutrition and mortality in Africa than in the Asian subcontinent, for example, because age of incidence is significantly lower in Africa.
- Children lose their appetite and almost invariably lose weight when they are sick. Exceptions to this rule are very minor colds, and skin and eye infections.
- During recovery the child's appetite increases and its catch-up growth rate may be up to 19 times the reference rate, depending on its degree of depletion and the nutrient density and quantity of the food it receives. Protein requirements increase during recovery because the stress of illness catabolizes protein stores.
- The rate and duration of catch-up growth during recovery from illness is critical to the child's long-term growth rate. For this reason, positive-deviance studies may wish to weigh infants frequently and monitor their diets during illness and convalescence.
- Morbidity recall for a longer period than the two weeks prior to interview is not considered reliable. One week recall is better. Daily checks are most accurate, although frequent visits to the home produce a Hawthorne effect. Health history questions regarding infants should go back to pregnancy and birth.
- If morbidity data are collected from the mother's recall, more educated mothers will give answers that differ not only in the type of illness entity reported but in the amount of ill-health they report. Educated urban samples may appear to be more sick than traditional rural ones because the

educated mothers report more minor problems.

- Perceived illness entities differ greatly with degree of modernization and ethnic tradition. Therefore, the list of symptoms on a morbidity questionnaire must be thoroughly pretested to assure that it elicits consistent answers from different subgroups in the sample. Mothers should not be asked open-ended questions of the sort: "What health problems did your child have last week?" Rather, a list of commonly understood symptoms should be read to them and they should be asked if the child had any of the symptoms on the list.
- Physicians do not usually make the best data collectors or morbidity or anthropometry data. The doctor's training is focused on evaluating the state of the whole individual with a view to prescribing treatment. Data collection, by contrast, requires a level of precision and attention to minute detail that is irrelevant in clinical diagnosis and curative care. This difference is a source of misunderstanding that tends to lead to high levels of recording error. Data collection also is the tedious and repetitive type of work best assigned to lower-level but welltrained and standardized technicians. Physicians are indispensable, however, for diagnosis of unusual conditions and for emergency treatment of severely ill infants.
- Mortality rates are difficult to relate to nutritional status. In most cases official figures cannot be trusted to apply to a given study population. The most common source of error stems from failure to report either the birth or death of children who die shortly after they are born at home.
- Very large samples are needed to estimate accurately birth- and death-rates, although reproductive-history questions can be used to approximate these rates.

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## Management of multidisciplinary teams

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The different disciplines relating to positive deviance have different vocabularies, theoretical assumptions, and standards for quality control. Therefore, when persons representing these disciplines attempt to work "in committee" the negative aspects of "committee" efforts (slowness, lack of agreement, etc.) are greatly exaggerated. For these reasons it is desirable to have strong leadership for such teams. A strong principal investigator (a single person representing one discipline) should personally integrate the contributions from each discipline into a single study design. Alternately, a strong project director or contract manager with a technical background may provide sufficient leadership to ensure that principal investigators from different disciplines integrate their work effectively.

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### Appendix 1. Descriptive Statistics from Positive-deviance Mail Survey

#### Table A. Countries included in regional groupings

1. *Suh-Saharan Africa (East and West Africa)*  
Kenya, Lesotho, Tanzania, Cameroon, Senegal, Sierra Leone, Gambia (11)
2. *Middle South Asia*  
Bangladesh, Nepal, India, Sri Lanka, Turkey (14)
3. *South-East and East Asia*  
Thailand, Philippines, Taiwan, Malaysia, China (10)
4. *Latin America (Middle America and South America)*

Mexico, Argentina, Brazil, Chile, Colombia, Ecuador, Peru (15)

5. *Other developing*

Haiti, St. Kitts, North American Eskimo, Papua New Guinea, Tunisia (11)

6. *Industrialized*

In most instances respondents in this group probably based their answers on experience with developing-country populations, but neglected to specify these groups in the questionnaire:

Greece, Germany, Sweden, New Zealand, Japan, United States (7)

**Table B. Survey of expert knowledge and opinion on positive deviance in nutrition of young children: rural areas only**

	Percentage responding				Number responding to item	Number mentioning information source			
	Very unimportant	Very important	3	4		a	b	c	d
<b>A. BEHAVIOURAL, PSYCHOSOCIAL, AND CULTURAL FACTORS</b>									
<i>1. Mother-child interactions</i>									
Early bonding between mother and infant	0	5.6	15.6	44.4	18	1	4	1	1
Positive "affect" or smiling happy mood between mother/child	0	5.9	11.8	29.4	17	1	17	1	1
Prompt response to child's hunger cues	0	0	11.1	44.4	18	1	16	1	1
Mother's coaxing or stimulating child to eat	11.8	11.8	11.8	47.1	17	1	17	1	1
Mother feeding older infant rather than letting infant feed self	13.3	26.7	26.7	20	15	0	16	1	1
Frequent close physical contact	0	5.9	5.9	41.2	17	1	14	2	3
Frequent physical care,	11.1	5.6	23.3	38.9	18	1	14	1	2
Frequent psychosocial stimulation	10.5	0	15.8	21.1	19	0	15	1	4
Lack of prolonged separation of child from mother	6.3	6.3	0	31.3	16	2	12	1	2

Consistent reinforcement of child's developmental achievements	7.1	0	35.7	28.6	28.6	14	0	0	12	1	2
<i>2. Behavioural characteristics of the child</i>											
Strong sucking reflex (ininfants)	0	18.2	18.2	27.3	36.4	11	0	0	14	0	2
High neo-natal assessment score	16.7	16.7	33.3	16.7	16.7	6	0	0	10	0	1
Large appetite	6.7	0	26.7	26.7	40	15	0	0	14	2	0
Willingness to eat new foods or variety of foods	6.7	6.7	13.3	40	33.3	15	0	0	15	0	0
Well-defined hunger cues	8.3	0	0	66.7	25	12	0	0	13	0	0
Aggressive approach to obtaining food	0	14.3	14.3	28.6	42.9	14	0	0	13	0	0
Regular sleeping pattern	16.7	0	25	41.7	16.7	12	0	0	11	0	0
Rapid adaption to new stimuli	0	0	22.2	66.7	11.1	9	0	0	9	0	1
Enjoys interacting with people	0	0	26.7	40	33.3	15	0	0	13	0	1
<i>3. Psychosocial characteristics of the mother</i>											
Satisfaction with her life in general	5.6	16.7	22.2	16.7	38.9	18	1	1	15	1	0
Low levels of psychological stress	0	15.4	23.1	15.4	46.2	13	0	0	12	1	0
Not overburdened by work	5.6	11.1	22.2	11.1	50	18	2	2	14	1	0
Ability to put child's needs before her own needs or desires	0	0	28.6	21.4	50	14	0	0	11	1	1
Good relationship with child's father	0	5.9	17.6	47.1	29.4	17	1	1	14	1	1
Absence of psychiatric problems (anxiety, depression, etc.)	0	0	20	40	40	10	0	0	12	0	0
Enterprising, non-fatalistic attitude	7.7	7.7	7.7	46.2	30.8	13	0	0	12	1	0
Positive attitude towards child	0	0	6.3	25	68.8	16	1	1	14	1	1
Positive attitude (child born at desired time)	13.3	6.7	6.7	53.5	20	15	1	1	13	1	0
Less practice of favouritism or discrimination against female child	6.7	13.3	6.7	26.7	46.7	15	0	0	12	3	2
Maturity: 20 years old or more	6.3	6.3	12.5	25	50	16	0	0	12	1	1
Life-stage: not older than 35	6.3	25	18.8	25	25	16	0	0	12	2	1

Higher educational level	6.3	6.3	43.8	31.3	12.5	16	0	12	3	0
Higher natural intelligence	8.3	0	41.7	25	25	12	0	12	1	0
Greater contact with the world outside the home	11.1	5.6	33.3	38.9	11.1	18	1	15	1	0
<i>4. Preventive health care</i>										
Attention to hygiene and sanitary conditions of child's environment	5.9	0	5.9	29.4	58.8	17	1	15	1	4
Greater use of modern preventive health services(e.g. pre-natal care, immunization)	11.8	0	11.8	23.5	52.9	17	1	13	1	3
Less use of traditional preventive measures(e.g. charms, amulets)	30.8	7.7	38.5	7.7	15.4	13	0	15	1	1
Less practice of dietary taboos	22.2	22.2	16.7	1.1	27.8	18	4	15	1	4
<i>5. Curative health care</i>										
Prompt visit to modern health services	5.9	5.9	17.6	35.3	35.3	17	2	7	1	2
Continuing to seek help until child recovered	6.3	0	12.5	56.3	25	16	2	13	2	2
Fewer visits to traditional healers	37.5	12.5	18.8	25	6.3	16	3	12	3	1
Continuing to give prescribed care	7.1	7.1	0	57.1	28.6	14	2	12	1	1
Fewer home remedies	14.3	28.6	35.7	7.1	14.3	14	2	13	1	1
Fewer restrictions on diet during illness	7.1	0	7.1	28.6	57.1	14	1	12	3	1
Mother stays with sick child - does not leave with others when sick	0	0	26.7	46.7	26.7	15	2	13	1	0
<i>6. Characteristics of other caretakers</i>										
Mature, at least 15 years old	14.3	0	7.1	57.1	21.4	14	0	13	1	2
Experienced in child care	21.4	7.1	21.4	28.6	21.4	14	0	13	1	1
Better educated	26.7	20	20	26.7	6.7	15	0	13	1	1
Less burdened by other tasks	15.4	15.4	30.8	23.1	15.4	13	0	12	1	1
<i>7. Father's role</i>										
Living at home	11.1	5.6	27.8	27.8	27.8	18	2	14	1	2

One wife only	14.3	7.1	28.6	14.3	35.7	14	3	15	1	0
Providing financial support for child	0	6.3	0	37.5	56.3	16	1	12	3	4
Better educated	11.8	17.6	17.6	35.3	17.6	17	2	13	2	1
<i>8. Family size/structure</i>										
Children separated by birth interval of at least three years	0	6.7	0	53.3	40	15	1	12	3	3
Not more than four children	0	0	0	64.3	35.7	14	1	11	4	2
Higher ratio of adults to young children	25	0	33.3	41.7	0	12	0	11	0	1
Presence of siblings old enough to help mother	6.3	6.3	12.5	50	25	16	0	14	0	2
<i>9. Family attitudes</i>										
No preference for male and older family members in distribution of food	0	11.8	11.8	52.9	23.5	17	2	13	1	1
Recognition of special nutritional needs of child	7.1	0	14.3	35.7	42.9	14	1	13	0	1
Ambitions for child to receive post-primary education	7.1	0	21.4	50	21.4	14	0	12	0	0
Ambition for child to succeed in modern occupation	7.1	7.1	23.1	53.8	7.7	13	0	12	0	0
<i>10. Household resources</i>										
Significant hidden/intangible resources (given the low socio-economic status of the family)	7.7	7.7	15.4	23.1	46.2	13	1	9	1	0
Greater access to community services	7.1	0	0	50	42.9	14	1	11	1	0
Presence of informal social network whose support the mother can draw upon	6.7	0	0	40	53.5	15	1	10	2	0
Small amount of supplemental income earned by enterprising mother	7.1	0	14.3	35.7	42.9	14	0	10	0	2
<b>B. GENETIC AND PHYSIOLOGICAL FACTORS</b>										
<i>1. Maternal nutritional factors</i>										
	0	1	2	3	4	N	a	b	c	d

Height	7.7	15.4	7.7	30.8	38.5	13	0	8	5	0
Pre-pregnancy weight-for-height	0	9.1	18.2	27.3	45.5	11	0	8	2	1
Weight gain during pregnancy	9.1	9.1	9.1	18.2	54.5	11	0	8	1	1
Weight-for-height during lactation	7.1	7.1	14.3	57.1	14.3	14	0	8	2	2
Female obesity (contributing protective effect to infant nutrition in some societies)	33.3	33.3	0	0	33.3	9	0	7	1	2
Iron status	0	11.1	33.3	33.3	22.2	9	0	7	0	1
<i>2. Dietary intake during pregnancy</i>										
Calories	0	8.3	8.3	16.7	66.7	12	1	7	2	3
Protein	9.1	0	9.1	27.3	54.5	11	0	7	1	2
Iron	0	9.1	9.1	36.4	45.5	11	0	7	1	2
Folate	0	9.1	18.2	54.5	18.2	11	0	7	1	2
<i>3. Dietary intake during lactation</i>										
Calories	0	0	22.2	11.1	66.7	9	1	7	1	1
Protein	0	22.2	11.1	33.3	33.3	11	1	8	0	1
Iron	0	20	20	20	40	10	1	8	0	1
Folate	0	11.1	22.2	44.4	22.2	9	1	8	0	1
Fluids	0	22.2	0	44.4	33.3	9	1	8	0	1
<i>4. Child characteristics</i>										
Birth weight (large or average weight-for-date)	0	0	8.3	33.3	58.3	12	0	9	2	2
Normal gestational age (38-42 weeks)	0	0	0	33.3	66.7	12	0	9	1	4
Absence of complication/stress during pregnancy	0	0	0	41.7	58.3	12	0	10	1	2
Age supplementary food started	0	0	0	25	75	16	1	11	3	4
Age breast-feeding started	5.6	0	16.7	27.8	50	18	2	12	2	3
Age other milk stopped	21.4	7.1	42.9	14.3	14.3	14	0	10	1	2
Calories in supplementary food	0	0	5.9	23.5	70.6	17	1	11	2	3

Protein in supplementary food	11.8	11.8	0	41.2	35.5	17	1	10	2	4
Lower than average activity level	15.4	15.4	15.4	30.8	23.1	13	0	9	0	1
Greater than average stress tolerance	0	37.5	12.5	25	25	8	0	7	0	0
Lower than average caloric requirement	20	30	20	20	10	10	0	8	0	0
Lower than average protein requirement	10	40	20	20	10	10	0	8	0	0
<i>5. Child's resistance to infections</i>										
Diarrhoeal	0	0	6.3	6.3	87.5	16	1	11	2	5
Respiratory	0	0	6.7	20	73.3	15	0	10	2	4
Parasitic	0	7.7	15.4	38.5	38.5	13	1	10	2	3
Measles	0	7.1	0	35.7	57.1	14	1	11	2	4

a = anecdotal reports; b = personal observation; c = unpublished research; d = published research.

**Table C. Survey of expert knowledge and opinion on positive deviance in nutrition of young children: urban areas only**

	Frequencies for urban areas only (setting eq. 2)									
	0	1	2	3	4	N	a	b	c	d
<b>A. BEHAVIOURAL, PSYCHOSOCIAL, AND CULTURAL FACTORS</b>										
<i>1. Mother-child interactions</i>										
Early bonding between mother and infant	0	0	7.7	23.1	69.2	13	0	7	0	9
Positive "affect" or smiling happy mood between mother/child	0	0	23.1	38.5	38.5	13	1	8	1	5
Prompt response to child's hunger cues	0	0	15.4	23.1	61.5	13	1	9	1	1
Mother's coaxing or stimulating child to eat	9.1	36.4	18.2	18.2	18.2	11	3	9	0	1
Mother feeding older infant rather than letting infant feed self	40	20	20	10	10	10	1	9	0	1
Frequent close physical contact	0	0	23.1	46.2	30.8	13	1	8	0	5
Frequent physical care, cleaning, grooming	0	15.4	30.8	38.5	15.4	13	2	9	0	2

Frequent psychosocial stimulation	7.7	7.7	7.7	38.5	38.5	13	0	8	1	7
Lack of prolonged separation of child from mother	10	0	20	40	30	10	0	7	1	4
Consistent reinforcement of child's developmental achievements	16.7	0	25	41.7	16.7	12	0	10	0	4
<i>2. Behavioural characteristics of the child</i>										
Strong sucking reflex (in infants)	0	8.3	33.3	41.7	16.7	14	2	10	0	3
High neo-natal assessment score	8.3	8.3	16.7	58.3	8.3	12	0	7	0	3
Large appetite	8.3	8.3	16.7	33.3	33.3	12	1	9	0	2
Willingness to eat new foods or variety of foods	7.1	7.1	28.6	42.9	14.3	14	1	11	0	0
Well-defined hunger cues	7.1	7.7	30.8	38.5	15.4	13	1	9	0	0
Aggressive approach to obtaining food	0	20	20	40	20	10	0	9	0	0
Regular sleeping pattern	0	9.1	9.1	72.7	9.1	14	0	9	0	1
Rapid adaption to new stimuli	0	0	0	30	70	10	0	9	0	1
Enjoys interacting with people	0	30	10	40	20	10	0	8	0	1
<i>3. Psychosocial characteristics of the mother</i>										
Satisfaction with her life in general	0	0	0	41.7	58.3	12	1	7	0	3
Low levels of psychological stress	0	0	23.1	30.8	46.2	14	0	7	0	4
Not overburdened by work	0	0	25	50	25	12	0	7	1	2
Ability to put child's needs before her own needs or desires	0	0	16.7	33.3	50	12	1	7	0	3
Good relationship with child's father	0	0	0	69.2	30.8	13	1	7	0	3
Absence of psychiatric problems (anxiety, depression, etc.)	0	7.7	0	30.8	61.5	13	0	7	0	5
Enterprising, non-fatalistic attitude	11.1	11.1	0	55.6	22.2	9	0	6	0	2
Positive attitude towards child (child of desired sex)	0	0	8.3	66.7	25	12	1	6	0	3
Positive attitude (child born at desired time)	0	0	0	69.2	30.8	13	0	9	0	2
Less practice of favouritism or discrimination against female child	9.1	9.1	18.2	45.5	18.2	11	1	7	1	1

Maturity: 20 years old or more	0	7.7	15.4	38.5	38.5	13	0	8	1	4
Life-stage: not older than 35	14.3	14.3	14.3	35.7	21.4	14	1	7	2	3
Higher educational level	0	7.7	23.1	46.2	23.1	13	0	6	2	5
Higher natural intelligence	7.7	7.7	23.1	30.8	30.8	13	0	9	1	2
Greater contact with the world outside the home	0	0	28.6	57.1	14.3	14	0	10	2	3
<i>4. Preventive health care</i>										
Attention to hygiene and sanitary conditions of child's environment	0	7.1	0	35.7	57.1	14	1	4	2	9
Greater use of modern preventive health services (e.g. pre-natalcare, immunization)	0	7.1	0	35.7	57.1	14	1	5	1	9
Less use of traditional preventive measures (e.g. charms, amulets)	16.7	16.7	8.3	16.7	41.7	12	2	6	1	3
Less practice of dietary taboos	14.3	7.1	14.3	14.3	50	14	2	7	1	4
<i>5. Curative health care</i>										
Prompt visit to modern health services	7.1	0	21.4	7.1	64.3	14	1	8	0	4
Continuing to seek help until child recovered	0	7.1	7.1	35.7	50	14	0	8	1	3
Fewer visits to traditional healers	10	10	10	50	20	10	0	8	0	1
Continuing to give prescribed care and medication throughout the illness	0	7.7	7.7	30.8	53.8	13	0	8	1	3
Fewer home remedies	8.3	0	16.7	50	25	12	0	7	1	2
Fewer restrictions on diet during illness	8.3	0	16.7	25	50	12	0	7	1	2
Mother stays with sick child - does not leave with others when sick	0	7.7	15.4	30.8	46.2	13	1	9	1	1
<i>6. Characteristics of other caretakers</i>										
Mature, at least 15 years old	9.1	0	9.1	54.5	27.3	11	0	8	0	0
Experienced in child care	8.3	0	8.3	50	33.3	12	0	8	0	1
Better educated	16.7	0	16.7	50	16.7	12	1	9	0	0
Less burdened by other tasks	0	0	18.2	45.5	36.4	11	0	7	1	0
<i>7. Father's role</i>										

Living at home	7.7	15.4	15.4	38.5	23.1	13	0	9	2	2
One wife only	8.3	8.3	8.3	33.3	41.7	12	2	7	0	1
Providing financial support for child	0	7.1	7.1	35.7	50	14	0	9	1	2
Better educated	7.1	0	21.4	42.9	28.6	14	1	9	1	1
<i>8. Family size/structure</i>										
Children separated by birth interval of at least three years	0	0	7.7	61.5	30.8	13	0	9	1	4
Not more than four children	9.1	9.1	0	45.5	36.4	11	0	8	0	2
Higher ratio of adults to young children	0	36.4	9.1	54.5	0	11	2	8	1	1
Presence of siblings old enough to help mother	15.4	15.4	53.8	7.7	7.7	13	1	9	0	1
<i>9. Family attitudes</i>										
No preference for male and older family members in distribution of food	7.7	0	7.7	38.5	46.2	13	1	8	0	2
Recognition of special nutritional needs of young child	7.1	0	14.3	28.6	50	14	2	8	1	2
Ambitions for child to receive post-primary education	15.4	7.7	30.8	30.8	15.4	13	2	8	0	1
Ambition for child to succeed in modern occupation	15.4	0	38.5	30.8	15.4	13	2	8	0	1
<i>10. Household Resources</i>										
Significant hidden/intangible resources (given the low socio-economic status of the family)	11.1	0	11.1	55.6	22.2	9	1	7	0	0
Greater access to community services	0	7.7	7.7	46.2	38.5	13	1	8	1	2
Presence of informal social network whose support the mother can draw upon	0	20	10	30	40	10	0	7	2	2
Small amount of supplemental income earned by enterprising mother	10	0	30	40	20	10	1	8	0	0
<b>B. GENETIC AND PHYSIOLOGICAL FACTORS</b>										
<i>1. Maternal nutritional status</i>										
Height	25	0	8.3	33.3	33.3	12	0	7	1	5

Pre-pregnancy weight-for-height	9.1	0	9.1	36.4	45.5	11	0	5	1	7
Weight gain during pregnancy	9.1	0	18.2	18.2	54.5	11	0	4	1	7
Weight-for-height during lactation	9.1	9.1	9.1	45.5	27.3	11	0	5	1	5
Female obesity (contributing protective effect to infant nutrition in some societies)	27.3	27.3	18.2	18.2	9.1	11	0	5	2	3
Iron status	9.1	0	18.2	27.3	45.5	11	0	5	1	4
<i>2. Dietary intake during pregnancy</i>										
Calories	9.1	0	0	9.1	81.8	11	1	4	1	6
Protein	9.1	9.1	0	45.5	36.4	11	1	4	1	6
Iron	9.1	0	0	27.3	63.6	1	1	3	1	4
Folate	9.1	9.1	9.1	18.2	54.5	11	1	3	1	4
<i>3. Dietary intake during lactation</i>										
Calories	9.1	0	9.1	9.1	72.7	11	1	3	1	7
Protein	9.1	9.1	9.1	18.2	54.5	11	1	3	1	7
Iron	9.1	9.1	18.2	18.2	45.5	11	1	3	1	7
Folate	9.1	9.1	36.4	9.1	36.4	11	1	3	0	7
Fluids	9.1	0	18.2	27.3	45.5	11	1	4	0	7
<i>4. Child characteristics</i>										
Birth weight (large or average weight-for-date)	7.1	7.1	7.1	35.7	42.9	14	2	5	1	7
Normal gestational age (38-42 weeks)	7.1	7.1	7.1	35.7	42.9	14	1	5	0	8
Absence of complication/stress during pregnancy	7.7	0	7.7	61.5	23.1	13	1	6	0	6
Age supplementary food started	14.3	0	14.3	35.7	35.7	14	0	9	2	4
Age breast-feeding stopped	7.1	0	14.3	14.3	64.3	14	0	9	2	2
Age other milk stopped	15.4	15.4	15.4	38.5	15.4	13	0	9	2	2
Calories in supplementary food	7.7	0	7.7	30.8	53.8	13	0	8	2	3
Protein in supplementary food	7.7	7.7	15.4	30.8	38.5	13	0	8	2	3
Lower than average activity level	18.2	18.2	36.4	18.2	9.1	11	0	7	0	3
Greater than average stress tolerance	11.1	0	11.1	11.1	66.7	9	0	6	0	2

Lower than average caloric requirement	18.2	36.4	0	27.3	18.2	11	0	7	1	1
Lower than average protein requirement	22.2	44.4	22.2	11.1	0	9	0	5	0	2
<i>5. Child's resistance to infections</i>										
Diarrhoeal	7.7	0	0	7.7	84.6	13	1	6	2	5
Respiratory	7.7	0	0	23.1	69.2	13	1	6	2	5
Parasitic	7.7	7.7	23.1	7.7	53.8	13	1	5	3	5
Measles	8.3	8.3	8.3	25	50	12	1	5	2	4

a = anecdotal reports; b = personal observation; c = unpublished research; d = published research.

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**Table D. Survey of expert knowledge and opinion on positive deviance in nutrition of young children: overall**

	Per cent labelling					N		Absolute numbers			
	0	1	2	3	4			a	b	c	d
<b>A. BEHAVIOURAL, PSYCHOSOCIAL, AND CULTURAL FACTORS</b>											
<i>1. Mother-child interactions</i>											
Early bonding between mother and infant	0	1.7	10.2	25.4	62.7	59	3	40	5	17	
Positive "affect" or smiling happy mood between mother/ child	0	1.7	10.7	35.7	51.8	56	3	41	5	10	
Prompt response to child's hunger cues	0	1.7	11.7	33.3	53.3	60	4	46	4	4	
Mother's coaxing or stimulating child to eat	7.4	18.5	18.5	27.8	27.8	54	6	46	3	3	
Mother feeding older infant rather than letting infant feed self	17	21.3	23.4	17	21.3	47	4	40	1	5	
Frequent close physical contact	0	3.4	8.5	39	49.2	59	4	41	5	1	
Frequent physical care, cleaning, grooming	3.4	6.8	32.2	28.8	28.8	59	7	41	5	5	
Frequent psychosocial stimulation	5.1	5.1	13.6	23.7	52.5	59	4	39	4	17	
Lack of prolonged separation of child from mother	5.5	1.8	7.3	27.3	58.2	55	5	35	6	11	
Consistent reinforcement of child's developmental achievements	5.6	3.7	18.5	31.5	40.7	54	4	36	3	9	
<i>2. Behavioural characteristics of the child</i>											
Strong sucking reflex (in infants)	0	8.9	20	31.1	40	45	4	39	1	10	
High neo-natal assessment score	5.4	8.1	16.2	43.2	27	37	1	32	1	7	
Large appetite	7.8	3.9	17.6	31.4	39.2	51	3	42	2	4	
Willingness to eat new foods or variety of foods	5.6	3.7	24.1	31.5	35.2	54	5	44	1	1	
Well-defined hunger cues	6.3	4.2	16.7	43.8	29.2	48	6	35	1	1	
Aggressive approach to obtaining food	3.9	9.8	17.6	37.3	31.4	51	2	41	0	1	
Regular sleeping pattern	6.4	6.4	21.3	38.3	27.7	47	2	36	1	4	
Rapid adaption to new stimuli	0	4.8	16.7	47.6	31	42	3	35	0	5	
Enjoys interacting with people	0	8.3	14.6	43.8	33.3	48	3	37	1	3	
<i>3. Psychosocial characteristics of the mother</i>											
Satisfaction with her life in general	1.7	8.6	17.2	20.7	51.7	58	5	42	3	6	
Low levels of psychological stress	2	9.8	13.7	23.5	51	51	3	36	3	7	
Not overburdened by work	3.4	6.8	18.6	27.1	44.1	59	6	39	4	7	
Ability to put child's needs before her own needs or desires	0	1.9	18.9	26.4	52.8	53	3	38	2	6	
Good relationship with child's father	1.7	3.4	10.3	46.6	37.9	58	5	38	2	8	
Absence of psychiatric problems (anxiety, depression, etc. )	2	4	8	42	44	50	3	37	2	7	

Enterprising, non-fatalistic attitude	7	4.7	2.3	41.9	44.2	43	3	32	3	4
Positive attitude towards child (child of desired sex)	0	5.5	7.3	36.4	50.9	55	5	37	2	9
Positive attitude (child born at desired time)	3.6	9.1	14.5	43.6	29.1	55	4	35	3	7
Less practice of favouritism or discrimination against female child	10.2	8.7	28.2	38.8	34.7	49	3	35	6	7
Maturity: 20 years old or more	3.8	7.5	22.6	30.2	35.8	53	3	35	5	9
Life-stage: not older than 35	15.1	17	20.8	30.2	17	53	2	35	6	9
Higher educational level	5.7	5.2	27.6	29.3	32.8	58	2	34	9	16
Higher natural intelligence	10	2	26	22	40	50	3	38	3	4
Greater contact with the world outside the home	7.1	10.7	23.2	35.7	23.2	56	5	43	5	9
<i>4. Preventive health care</i>										
Attention to hygiene and sanitary conditions of child's environment	3.7	1.6	3.2	29	62.9	62	4	34	6	28
Greater use of modern preventive health services (e.g. pre-natal care, immunization)	4.7	4.7	6.3	23.4	60.9	64	4	35	6	22
Less use of traditional preventive measures (e.g. charms, amulets)	17.1	13.5	17.3	21.2	30.8	52	2	40	3	9
Less practice of dietary taboos	15.5	10.3	15.5	17.2	41.4	58	6	37	7	15
<i>5. Curative health care</i>										
Prompt visit to modern health services	7.9	4.8	17.5	17.5	52.4	63	7	38	7	12
Continuing to seek help until child recovered	1.9	5.7	11.3	34	47.2	53	4	38	5	6
Fewer visits to traditional healers	21.2	11.5	17.3	28.8	21.2	52	7	36	3	4
Continuing to give prescribed care and medication throughout the illness	5.5	5.5	10.9	29.1	49.1	55	6	40	5	7
Fewer home remedies	14.3	16.3	26.5	20.4	22.4	49	6	36	3	4
Fewer restrictions on diet during illness	5.6	1.9	14.8	24.1	53.7	54	3	41	6	5
Mother stays with sick child - does not leave with others when sick	0	4	18	34	44	50	5	38	2	1
<i>6. Characteristics of other caretakers</i>										
Mature, at least 15 years old	6.3	0	10.4	41.7	41.7	48	2	37	2	5
Experienced in child care	8.9	1.8	14.3	30.4	44.6	56	1	41	6	5
Better educated	14	5.3	19.3	38.6	22.8	57	2	42	6	6
Less burdened by other tasks	5.8	5.8	23.1	26.9	38.5	52	2	38	5	4
<i>7. Father's role</i>										
Living at home	8.3	10	21.7	23.3	36.7	60	5	42	7	6
One wife only	8.7	6.5	21.7	23.9	39.1	46	8	37	3	3
Providing financial support for child	0	3.3	6.7	30	60	60	3	42	7	6
Better educated	6.8	6.8	20.3	35.6	30.5	59	5	42	6	8
<i>8. Family size/structure</i>										
Children separated by birth interval of at least three years	0	3.7	11.1	37	48.1	54	2	37	8	15
Not more than four children	4.1	2	8.2	38.8	46.9	49	2	34	8	11
Higher ratio of adults to young children	8.9	13.3	15.6	44.4	17.8	45	5	32	3	6

Presence of siblings old enough to help mother	12	16	24	30	18	50	3	37	0	4
<i>9. Family attitudes</i>										
No preference for male and older family members in distribution of food	8.6	10.3	5.2	36.2	39.7	58	9	38	4	9
Recognition of special nutritional needs of young child	6.9	1.7	8.6	24.1	58.6	58	6	39	4	9
Ambitions for child to receive post-primary education	9.4	5.7	22.6	32.1	30.2	53	4	39	0	2
Ambition for child to succeed in modern occupation	11.5	5.8	23.1	30.8	28.8	52	4	39	0	3
<i>10. Household resources</i>										
Significant hidden/intangible resources (given the low socio-economic status of the family)	8.5	6.4	10.6	31.9	42.6	47	6	31	4	4
Greater access to community services	3.6	3.6	7.1	37.5	48.2	56	5	39	7	5
Presence of informal social network whose support the mother can draw upon	3.7	7.4	9.3	35.2	44.4	54	4	38	8	4
Small amount of supplemental income earned by enterprising mother	4.3	2.2	23.9	30.4	39.1	56	4	33	2	5
<b>B. GENETIC AND PHYSIOLOGICAL FACTORS</b>										
<i>1. Maternal nutritional status</i>										
Height	13.5	5.8	21.2	28.8	30.8	52	0	28	8	16
Pre-pregnancy weight-for-height	4.3	6.5	17.4	30.4	41.3	46	0	27	5	19
Weight gain during pregnancy	4.3	8.5	14.9	27.7	44.7	41	1	28	5	17
Weight-for-height during lactation	6.5	6.5	15.2	39.1	32.6	46	0	27	4	15
Female obesity contributing protective effect to infant nutrition in some societies	25.6	17.9	20.5	20.5	15.4	39	1	26	4	10
Iron status	9.1	4.5	15.9	27.3	43.2	44	1	27	2	14
<i>2. Dietary intake during pregnancy</i>										
Calories	2.1	4.2	6.3	22.9	64.6	48	2	25	6	18
Protein	5.5	6.5	4.3	32.6	50	46	1	25	5	16
Iron	2.3	2.3	9.1	38.6	47.7	44	1	23	4	14
Folate	2.3	7	16.3	37.2	37.2	43	1	23	4	13
<i>3. Dietary intake during lactation</i>										
Calories	2.2	0	8.9	17.8	71.1	45	4	20	6	16
Protein	2.3	7	7	25.6	58.1	43	3	22	5	13
Iron	2.3	6.8	15.9	29.5	45.5	44	4	23	3	14
Folate	2.3	4.7	25.6	27.9	39.5	45	3	25	1	14
Fluids	2.3	4.7	20.9	25.6	46.5	45	3	24	1	15
<i>4. Child characteristics</i>										
Birth weight (large or average weight-for-date)	3.6	1.8	9.1	38.2	47.3	55	2	28	8	19
Normal gestational age (38-42 weeks)	1.9	1.9	5.6	40.7	50	54	4	31	5	20
Absence of complication/stress during pregnancy	2	0	4	52	42	50	5	33	3	13
Age supplementary food started	7.4	1.9	9.3	27.8	53.7	54	4	32	7	18

Age breast-feeding stopped	5.2	5.2	20.7	22.4	46.6	58	3	34	8	12
Age other milk stopped	12.5	14.6	27.1	25	20.8	48	0	31	5	9
Calories in supplementary food	1.9	1.9	9.4	24.5	62.3	53	1	31	6	14
Protein in supplementary food	5.8	7.7	9.6	36.5	40.4	52	2	31	5	12
Lower than average activity level	11.1	13.3	26.7	20	28.9	45	2	29	1	7
Greater than average stress tolerance	5.4	10.8	21.6	18.9	43.2	37	0	28	1	6
Lower than average caloric requirement	12.5	25	7.5	37.5	17.5	40	0	25	3	9
Lower than average protein requirement	11.4	31.4	22.9	22.9	11.4	35	0	22	1	6
<i>5 Child's resistance to infections</i>										
Diarrhoeal	1.7	0	1.7	13.6	83.1	59	5	32	4	24
Respiratory	1.9	0	1.9	15.4	80.8	52	3	30	4	17
Parasitic	1.9	7.5	9.4	26.4	54.7	53	4	29	7	18
Measles	4.1	4.1	2	22.4	67.3	49	7	30	5	15

a = anecdotal reports; b = personal observation; c = unpublished research; d = published research.

**Table E. Survey of expert knowledge and opinion on positive deviance in nutrition of young children: opinion scores by setting mean (SD)**

	Rural	Urban	Total	N
<b>A. BEHAVIOURAL, PSYCHOSOCIAL. AND CULTURAL FEATURES</b>				
<i>1. Mother-child interactions</i>				
Early bonding between mother and infant	3.28 (0.83)	3.62 (0.65)	3.42 (0.76)	59
Positive "effect" or smiling happy mood between mother/child	3.29 (0.92)	3.15 (0.80)	3.23 (0.86)	56
Prompt response to child's hunger cues	3.33 (0.69)	3.46 (0.78)	3.39 (0.72)	60
Mother's coaxing or stimulating child to eat	2.47(1.28)	2.00 (1.34)	2.29 (1.30)	54
Mother feeding older infant rather than letting infant feed self	1.93 (1.28)	1.30 (1.42)	1.68 (1.35)	47
Frequent close physical contact	3.29 (0.85)	3.08 (0.76)	3.20 (0.81)	59
Frequent physical care. cleaning. grooming	2.33 (1.14)	2.54 (0.97)	2.42 (1.06)	59
Frequent psychosocial stimulation	3.05 (1.31)	2.92 (1.26)	3.00 (1.27)	59
Lack of prolonged separation of child from mother	3.25 (1.18)	2.80 (1.23)	3.08 (1.19)	55
Consistent reinforcement of child's developmental achievements	2.71 (1.391)	2.42 (1.31)	2.58(1.21)	54
<i>2. Behavioural characteristics of the child</i>				
Strong sucking reflex (in infants)	2.82 ( 1.17)	2.67 (0.89)	2.74 ( 1.00)	45
High neo-natal assessment score	2.8 (1.41)	2.50 ( 1.09)	2.33 ( 1.19)	37
Large appetite	2.93 ( 1.16)	2.75 (1.29)	2.85 (1.20)	51
Willingness to eat new foods or variety of foods	2.87 (1.19)	2.50 (1.09)	2.69 (1.13)	54
Well-defined hunger cues	3.00 (1.04)	2.46 (1.13)	2.72 (1.10)	48
Aggressive approach to obtaining food	3.00 (1.10)	2.60 (1.08)	2.83 (1.09)	51
Regular sleeping pattern	2.42 (1.31)	2.82 (0.75)	2.61 (1.08)	47
Rapid adaption to new stimuli	2.89 (0.60)	2.70 (0.48)	2.79 (0.53)	42
Enjoys interacting with people	3.07 (0.80)	2.50 (1.18)	2.84 (0.99)	48
<i>3. Psychosocial characteristics of the mother</i>				
Satisfaction with her life in general	2.67(1.33)	3.58 (0.51)	3.03 (1.16)	58
Low levels of psychological stress	2.92(1.19)	3.23 (0.83)	3.08 (1.01)	51

Not overburdened with work	2.89 (1.32)	3.00 (0.74)	2.93 (1.11)	59
Ability to put child's needs before her own needs or desires	3.21 (0.89)	3.33 (0.78)	3.27 (0.83)	53
Good relationship with child's father	3.00 (0.87)	3.31 (0.48)	3.13 (0.73)	58
Absence of psychiatric problems (anxiety, depression, etc.)	3.20 (0.79)	3.46 (0.88)	3.35 (0.83)	50
Enterprising, non-fatalistic attitude	2.85(1.21)	2.67(1.32)	2.77(1.23)	43
Positive attitude towards child (child of desired sex)	3.63 (0.62)	3.17 (0.58) <sup>b</sup>	3.43 (0.63)	55
Positive attitude (child born at desired time)	2.60 (1.30)	3.30 (0.48) <sup>b</sup>	2.93 (1.05)	55
Less practice of favouritism or discrimination against female child	2.93 (1.33)	2.55 (1.21)	2.77 (1.27)	49
Maturity: 20 years old or more	3.06 (1.24)	3.07 (0.95)	3.07 (1.10)	53
Life-stage: not older than 35	2.38 (1.31)	2.36 (1.39)	2.37 (1.33)	53
Higher educational level	2.37 (1.02)	2.85 (0.90)	2.59 (0.98)	58
Higher natural intelligence	2.58 (1.16)	2.69 (1.25)	2.64 (1.19)	50
Greater contact with the world outside the home	2.33 (1.14)	2.86 (0.66) <sup>c</sup>	2.56 (0.98)	56
<i>4. Preventive health care</i>				
Attention to hygiene and sanitary conditions of child's environment	3.35 (1.06)	3.43 (0.85)	3.39 (0.95)	62
Greater use of modern preventive health services (e.g. pre-natal care, immunization)	3.06 (1.34)	3.43 (0.85)	3.23 (1.15)	64
Less use of traditional preventive measures (e.g. charms, amulets)	1.69 (1.44)	2.50 (1.62)	2.08 (1.55)	52
Less practice of dietary taboos	2.00 (1.57)	2.79 (1.52)	2.34 (1.58)	56
<i>5. Curative health care</i>				
Prompt visit to modern health services	2.88 (1.17)	3.21(1.25)	3.03(1.20)	63
Continuing to seek help until child recovered	2.94 (0.10)	3.29 (0.91)	3.10(0.96)	53
Fewer visits to traditional healers	1.50 (1.41)	2.60 (1.26) <sup>b</sup>	1.92(1.44)	52
Continuing to give prescribed care and medication throughout the illness	2.93 (1.14)	3.31 (0.95)	3.11(1.05)	55
Fewer home remedies	1.79 (1.25)	2.83 (1.11) <sup>b</sup>	2.27(1.28)	49
Fewer restrictions on diet during illness	3.29 (1.14)	3.08 (1.24)	3.19(1.17)	54
Mother stays with sick child - does not leave with others when sick	3.00 (0.76)	3.15(0.99)	3.07(0.99)	50
<i>6. Characteristics of other caretakers</i>				
Mature, at least 15 years old	2.71(1.27)	2.91(1.14)	2.80(1.19)	48
Experienced in child care	2.21(1.48)	3.00(1.13) <sup>c</sup>	2.57(1.36)	56
Better educated	1.67(1.35)	2.50(1.31) <sup>a</sup>	2.04(1.37)	57
Less burdened by other tasks	2.08(1.32)	3.18(0.76) <sup>a</sup>	2.58(1.21)	52
<i>7. Father's role</i>				
Living at home	2.56(1.29)	2.54(1.27)	2.55(1.26)	46
One wife only	2.50(1.45)	2.92(1.31)	2.69(1.38)	60
Providing financial support for child	3.44(0.81)	3.29(0.91)	3.67(0.85)	60
Better educated	2.94(1.31)	2.86(1.10)	2.55(1.23)	59
<i>8. Family size /structure</i>				
Children separated by birth interval of at least three years	3.27(0.80)	3.23(0.60)	3.25(0.70)	54
Not more than four children	3.36 (0.50)	2.90(1.30)	3.16(0.94)	49

Higher ratio of adults to young children	1.92(1.24)	2.18(0.98)	2.04(1.12)	45
Presence of siblings old enough to help mother	2.81(1.10)	1.77(1.09) <sup>a</sup>	2.34(1.20)	50
<i>9. Family attitudes</i>				
No preference for male and older family members in distribution of food	2.88(0.93)	3.15(1.14)	3.00(1.01)	58
Recognition of special nutritional needs of young child	3.07(1.14)	3.14(1.17)	3.10(1.13)	58
Ambitions for child to receive post primary education	2.79 (1.05)	2.23 (1.30)	2.52 (1.19)	53
Ambition for child to succeed in modern occupation	2.46(1.05)	2.31 (1.25)	2.38(1.13)	52
<i>10. Household resources</i>				
Significant hidden/intangible resources(given the low socio-economic status of the family)	2.92 (1.32)	2.78 (1.20)	2.86 (1.25)	47
Greater access to community services	3.21 (1.05)	3.15 (0.91))	3.19 (0.96)	56
Presence of informal social network whose support	3.33 (1.05)	2.90 (1.20)	3.16 (1.10)	54
Small amount of supplemental income earned by enterprising mother				
<b>B. GENETIC AND PHYSIOLOGICAL FACTORS</b>				
<i>1. Maternal nutritional status</i>				
Height	2.77 (1.36)	2.50 (1.62)	2.64 (1.47)	52
Pre-pregnancy weight-for-height	3.09 (1.04)	3.09 (1.22)	3.09 (1.10)	46
Weight gain during pregnancy	3.00 (1.41)	3.09 (1.30)	3.05 (1.33)	47
Weight-for-height during lactation	2.64 (1.08)	2.73 (1.28)	2.70 (1.14)	46
Female obesity (contributing protective effect to infant nutrition in some societies)	1.67(1.80)	1.54(1.37)	1.60(1.54)	39
Iron status	2.67(1.00)	3.00(1.27)	2.85(1.14)	44
<i>2. Dietary intake during pregnancy</i>				
Calories	3.42 (1.08)	3.55 (1.21)	3.48 (1.08)	48
Protein	3.09 (1.37)	2.90 (1.30)	3.00 (1.31)	46
Iron	3.18 (0.98)	3.36 (1.21)	3.27 (1.08)	44
Folate	2.82 (0.87)	3.00 (1.41)	2.41 (1.15)	43
<i>3. Dietary intake during lactation</i>				
Calories	3 44(0.88)	3.36(1.29)	3.40(1.10)	45
Protein	2.78(1.20)	3.00(1.41)	2.90(1.29)	43
Iron	2.80(1.23)	2.81 (1.40)	2.80(1.29)	44
Folate	2.78(0.97)	2.55(1.37)	2.65(1.18)	43
Fluids	2.89 (1.17)	3.00 (1.27)	2.95 (1.19)	43
<i>4. Child characteristics</i>				
Birth weight (large or average weight for-date)	3.50 (0.67)	3.00(1.24)	3.23(1.03)	55
Normal gestational age (38-42 weeks)	3.67 (0.49)	3.00 (1.24)	3.31 (1.01)	54
Absence of complication/stress during pregnancy	3.58 (0.51)	2.92(1.04) <sup>b</sup>	3.24(0.88)	50
Age supplementary food started	3.75 (0.45)	2.79 (1 37) <sup>b</sup>	3.30 (1.09)	54
Age breast-feeding stopped	3 17 (1.10)	3.29(1.20) <sup>b</sup>	3.22(1.13)	58
Age other milk stopped	1.93 (1.33)	2.23 (1.36)	2.07 (1.33)	48
Calories in supplementary food	3.65(0.61)	3.23(1.17)	3.47(0.90)	53
Protein in supplementary food	2.77(1.39)	2.85(1.28)	2.80(1.31)	52

Lower than average activity level	2.(18(1.35)	2.30(1.44)	1.81 (1.25)	45
Greater than average stress tolerance	2.38(1.30)	3.22(1.39)	2.82(1.38)	37
Lower than average caloric requirement	1 70(1.34)	1.91 (1.51)	1.81 (1.40)	40
Lower than average protein requirement	1.80(1.23)	1.22(0.97)	1.53(1.12)	35
<i>5. Child's resistance to infections</i>				
Diarrhoeal	3.81 (0.54)	3.62 (1.12)	3.72 (0.54)	59
Respiratory	3 67 (0.62)	3.46 (1.13)	3.57 (0.88)	52
Parasitic	2.42 (1.38)	3.08 (0.95)	3.00 (1.16)	53
Measles	3.42 (0.85)	3.00 (1.35)	3.23 (1.11)	49

a=p<0.05; b=p<0.1 c=p<0.15.

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**Table F. Survey of expert knowledge and opinion on positive deviance in nutrition of young children: opinion scores by region, mean (SD)**

	Sub-Saharan Africa	Middle South Asia	S.E. Asia, E. Asia	Latin America	Other developing	Industrial	Total	N
	(N = 8)	(N = 5)	(N = 5)	(N = 7)	(N = 6)	(N = 6)	(N = 68)	68
<b>A. BEHAVIOURAL, PSYCHOSOCIAL, AND CULTURAL FACTORS</b>								
<i>1. Mother-child interactions</i>								
Early bonding between mother and infant	3.49 (0.15)	3.38 (0.77)	4.00 (0.00)	3.64 (0.63)	3.20 (1.03)	3.42 (0.79)	3.49 (0.75)	59
Positive "affect" or smiling happy mood between mother/child	3.67 (1.51)	3.31 (0.75)	3.57 (0.53)	3.15 (0.90)	3.30 (0.95)	3.57 (0.53)	3.38 (0.75)	56
Prompt response to child's hunger cues	3.38 (0.52)	3.38 (0.77)	2.75 (0.89)	3.43 (0.85)	3.80 (0.42)	3.43 (0.79)	3.38 (0.76)	60
Mother's coaxing or stimulating child to eat	2.29 (0.25)	2.92 (1.16)	2.57 (1.13)	2.09 (1.38)	2.60 (1.51)	2.43 (1.40)	2.50 (1.28)	54
Mother feeding older infant rather than letting infant feed self	1.38 (0.30)	2.50 (1.20)	2.29 (1.50)	1.64 (1.20)	2.11 (1.45)	3.00 (2.00)	2.04 (1.40)	47
Frequent close physical contact	3.29 (1.11)	3.31 (0.75)	3.38 (1.06)	3.50 (0.65)	3.50 (0.53)	2.86 (0.69)	3.34 (0.78)	59
Frequent physical care, cleaning, grooming	2.29 (1.25)	2.62 (1.19)	2.78 (1.09)	2.79 (1.12)	2.89 (0.93)	3.00 (0.82)	2.73 (1.06)	59
Frequent psychosocial stimulation	2.51 (1.51)	3.08 (1.32)	3.13 (1.01)	3.36 (1.01)	3.50 (0.71)	2.86 (0.90)	3.14 (1.15)	59
Lack of prolonged separation of child from mother	3.11 (1.05)	3.58 (0.51)	2.71 (1.89)	3.27 (1.27)	3.60 (0.70)	3.33 (0.82)	3.31 (0.07)	55

Consistent reinforcement of child's developmental achievements	2.57 (1.39)	3.18 (1.08)	2.63(1.19)	3.00 (0.96)	3.57 (0.79)	2.86 (1.46)	2.98 (1.12)	54
<i>2. Behavioural characteristics of the child</i>								
Strong sucking reflex (in infants)	2.86 (1.46)	3.11 (0.60)	3.00 (1.22)	2.60 (0.97)	3.43 (0.98)	3.29 (0.76)	3.02 (0.99)	45
High neo-natal assessment score	2.25 (0.96)	2.71 (1.11)	3.67 (0.58)	2.50 (1.08)	2.71 (1.60)	3.33 (0.52)	2.78 (1.11)	37
Large appetite	3.00 (1.41)	2.90 (1.30)	3.13 (1.46)	2.30 (0.82)	3.33 (0.71)	2.83 (1.60)	2.90 (1.20)	51
Willingness to eat new foods or variety of foods	2.00 (1.63)	3.08 (1.19)	3.00 (1.15)	2.64 (0.92)	3.44 (0.73)	2.86 (0.69)	2.87 (1.12)	54
Well-defined hunger cues	2.25 (1.50)	3.09 (1.22)	2.75 (1.04)	2.91 (1.16)	3.17 (0.75)	2.57 (0.98)	2.85 (1.09)	48
Aggressive approach to obtaining food	3.43 (1.13)	3.08 (0.76)	2.43 (1.62)	2.50 (1.08)	2.67 (1.11)	2.80 (1.11)	2.80 (1.11)	51
Regular sleeping pattern	1.50 (1.73)	2.67 (1.15)	3.12 (1.13)	2.60 (1.08)	3.00 (0.82)	3.17 (0.75)	2.74 (1.13)	47
Rapid adaption to new stimuli	2.33 (1.15)	3.10 (0.88)	3.57 (0.79)	3.13 (0.64)	2.75 (0.89)	3.00 (0.63)	3.05 (0.83)	42
Enjoys interacting with people	3.00 (0.63)	2.81 (0.87)	3.33 (1.00)	3.00 (1.22)	3.00 (1.00)	3.00 (0.63)	3.02 (0.91)	48
<i>3. Psychosocial characteristics of the mother</i>								
Satisfaction with her life in general	2.78 (1.48)	3.23 (1.09)	3.22 (0.83)	3.33 (0.98)	2.87 (1.36)	3.14 (0.90)	3.12 (1.09)	58
Low levels of psychological stress	2.50 (1.29)	3.20 (1.32)	3.56 (0.73)	3.15 (1.14)	3.13 (1.36)	2.71 (0.76)	3.12 (1.11)	51
Not overburdened with work	2.86 (1.55)	3.08 (1.08)	3.44 (0.88)	2.92 (1.19)	2.92 (1.19)	2.90 (1.20)	3.02 (1.10)	59
Ability to put child's needs before her own needs or desires	3.60 (0.89)	3.38 (0.96)	3.42 (0.79)	2.79 (0.80)	3.63 (0.74)	3.50 (0.55)	3.30 (0.85)	53
Good relationship with child's father	3.14 (0.69)	3.15 (0.99)	3.38 (0.74)	2.93 (1.21)	3.44 (0.53)	3.00 (0.58)	3.16 (0.87)	58
Absence of psychiatric problems (anxiety, depression, etc.)	3.00 (0.82)	3.18 (0.87)	3.33 (1.21)	3.07 (1.07)	3.38 (0.74)	3.43 (0.79)	3.22 (0.91)	50
Enterprising, non-fatalistic attitude	3.33 (1.21)	3.43 (0.79)	2.80 (1.64)	3.50 (0.52)	2.33 (1.58)	3.25 (0.50)	3.12 (1.14)	43
Positive attitude towards child (child of desired sex)	3.75 (0.46)	3.42 (0.67)	3.67 (0.52)	3.07 (0.92)	3.11 (1.27)	3.17 (0.75)	3.33 (0.84)	55
Positive attitude (child born at desired time)	3.13 (0.64)	2.73 (1.35)	1.57 (1.13)	3.23 (0.83)	3.11 (0.93)	3.00(0.58)	2.85 (1.06)	55
Less practice of favouritism or discrimination against Female child	2.75 (0.50)	3.75 (0.45)	1.75 (1.67)	2.64 (1.21)	2.56 (1.59)	3.00 (0.71)	2.80 (1.29)	49
Maturity: 20 years old or more	3.20 (1.30)	2.82 (1.25)	2.63 (1.06)	3.08 (0.10)	2.70 (1.42)	2.85 (0.69)	2.88 (1.11)	53

Life-stage: not older than 35	1.29 (1.11)	2.40 (1.26)	2.50 (1.20)	1.67 (1.44)	2.33 (1.58)	3.00 (0.58)	2.17 (1.33)	53
Higher educational level	2.78 (1.30)	2.77 (1.09)	2.75 (1.28)	3.00 (1.04)	2.80 (1.40)	2.50 (0.55)	2.79 (1.12)	58
Higher natural intelligence	2.71 (1.50)	3.36 (0.80)	2.50 (1.52)	2.54 (1.39)	2.28 (1.50)	3.33 (0.82)	2.80 (1.28)	50
Greater contact with the world outside the home	2.43 (1.13)	2.69 (1.25)	2.17 (1.33)	2.77 (0.73)	2.10 (1.60)	3.14 (0.90)	2.57 (1.17)	56
<i>4. Preventive health care</i>								
Attention to hygiene and sanitary conditions of child's environment	3.33 (1.00)	3.50 (1.17)	3.78 (0.44)	3.53 (0.64)	3.30 (1.34)	3.29 (0.49)	3.47 (0.90)	62
Greater use of modern preventive health services (e.g. pre-natal care, immunization)	3.30 (1.06)	3.46 (1.13)	3.40 (1.08)	3.43 (0.94)	3.00 (1.63)	3.14 (0.69)	3.31 (1.10)	64
Less use of traditional preventive measures (e.g. charms, amulets)	2.29 (1.38)	2.36 (1.50)	2.50 (1.51)	2.43 (1.74)	1.86 (1.57)	2.60 (1.14)	2.35 (1.48)	52
Less practice of dietary taboos	1.70 (1.49)	2.81 (1.53)	2.88 (1.55)	2.92 (1.56)	2.50 (1.71)	2.71 (0.76)	2.59 (1.50)	58
<i>5. Curative health care</i>								
Prompt visit to modern health services	3.00 (1.34)	2.69 (1.44)	3.63 (1.06)	3.14 (1.29)	2.70 (1.42)	3.14 (0.90)	3.02 (1.28)	63
Continuing to seek help until child recovered	3.00 (1.07)	2.87 (1.36)	3.71 (0.49)	3.46 (0.66)	3.00 (1.25)	3.00 (0.82)	3.19 (0.98)	53
Fewer visits to traditional healers	2.00 (1.41)	2.10(1.60)	2.08 (1.93)	2.54 (1.45)	1.90 (1.37)	2.50 (0.58)	2.17 (1.45)	52
Continuing to give prescribed care and medication throughout the illness	3.00 (1.22)	3.25 (1.22)	3.25 (1.39)	3.15 (1.07)	2.90 (1.37)	3.00 (0.82)	3.11 (1.15)	55
Fewer home remedies	1.67 (0.82)	1.63 (1.30)	3.00 (1.41)	2.38 (1.56)	2.11 (1.45)	2.20 (0.84)	2.20 (1.35)	49
Fewer restrictions on diet during illness	3.11 (1.27)	3.25 (1.22)	3.50 (0.76)	2.75 (1.36)	3.50 (0.93)	3.20 (0.83)	3.19 (1.12)	54
Mother stays with sick child - does not leave with others when sick	3.29 (0.76)	2.88 (0.64)	3.71 (0.75)	3.08 (0.97)	3.00 (1.05)	3.33 (0.82)	3.18 (0.87)	50
<i>6. Characteristics of other caretakers</i>								
Mature, at least 15 years old	2.17 (1.72)	3.38 (0.74)	3.38 (0.91)	3.17 (0.58)	3.33 (1.32)	3.00 (0.71)	3.13 (1.04)	48
Experienced in child care	2.00 (1.73)	3.17 (0.19)	3.38 (0.91)	2.92 (1.19)	3.20 (1.23)	3.17 (0.75)	3.00 (1.22)	56
Better educated	1.71 (1.60)	2.77 (1.24)	2.38 (1.41)	2.93 (1.14)	2.22 (1.20)	2.50 (1.38)	2.51 (1.30)	57

Less burdened by other tasks	3.17 (1.33)	2.83 (1.33)	3.00 (0.89)	2.91 (1.00)	2.50 (1.51)	3.00 (0.90)	2.86 (1.17)	52
<i>7. Father's role</i>								
Living at home	2.13 (1.73)	3.22 (1.09)	2.83 (0.98)	3.56 (0.53)	1.75 (1.39)	3.17 (0.75)	2.78 (1.28)	46
One wife only	3.33 (1.00)	3.62 (0.51)	3.38 (1.06)	3.69 (0.48)	3.20 (0.92)	3.43 (0.79)	3.47 (0.77)	60
Providing financial support for child	3.47 (0.77)	3.33 (1.00)	3.61 (0.51)	3.37 (1.06)	3.69 (0.48)	3.20 (0.92)	3.43 (0.79)	60
Better educated	2.89(1.45)	2.77(1.09)	2.63(1.51)	3.08(0.95)	2.11(1.17)	3.00(0.82)	2.76(1.17)	59
<i>8. Family size/structure</i>								
Children separated by birth interval of at least three years	3.50 (0.53)	3.50 (0.67)	3.00 (1.41)	3.00 (0.91)	3.40 (0.84)	3.29 (0.76)	3.30 (0.82)	54
Not more than four children	2.33 (1.86)	3.63 (0.50)	3.25 (0.96)	3.18 (0.98)	3.27 (0.79)	3.33 (0.52)	3.22 (0.98)	49
Higher ratio of adults to young children	2.57 (1.62)	2.20 (1.03)	2.80 (1.64)	2.60 (0.97)	2.57 (1.40)	2.33 (1.03)	2.49 (1.20)	45
Presence of siblings old enough to help mother	2.71 (1.60)	2.30(1.49)	1.83 (1.47)	2.17(0.94)	2.44 (1.24)	2.00 (1.27)	2.26 (1.27)	50
<i>9. Family attitudes</i>								
No preference for male and older family members in distribution of food	2.60 (1.35)	2.83 (1.40)	2.83 (1.83)	2.77 (1.36)	3.09 (1.13)	3.33 (0.52)	2.89 (1.29)	58
Recognition of special nutritional needs of young child	3.20 (1.23)	3.08 (1.50)	4.00 (0.00)	3.14 (1.10)	3.38 (1.19)	3.14 (0.90)	3.26 (1.15)	58
Ambitions for child to receive post primary education	2.57 (1.62)	2.69 (1.38)	2.25 (1.71)	3.08 (0.10)	2.30 (1.25)	2.85 (0.69)	2.68 (1.26)	53
Ambition for child to succeed in modern occupation	2.63 (1.77)	2.64 (1.29)	2.50 (1.73)	2.67 (0.98)	2.20 (1.48)	3.00 (0.82)	2.60 (1.29)	52
<i>10. Household resources</i>								
Significant hidden/intangible resources (given the low socio-economic status of the family)	3.29 (1.50)	3.08 (1.12)	3.67 (0.58)	2.56 (1.13)	2.33 (1.73)	3.33 (0.52)	2.94 (1.26)	47
Greater access to community services	3.56 (1.01)	3.33 (0.65)	3.00 (1.55)	3.62 (0.51)	2.78 (1.30)	2.71 (0.95)	3.23 (0.99)	56
Presence of informal social network whose support the mother can draw upon	3.44 (1.01)	3.15 (1.14)	1.80 (1.30)	3.40 (0.70)	2.90 (1.19)	3.29 (0.76)	3.09 (1.09)	54

Small amounts of supplemental income earned by enterprising mother	0	0	0	0	0	0	0	0	0	0
<b>B. GENETIC AND PHYSIOLOGICAL FACTORS</b>										
<i>1. Maternal nutritional status</i>										
Height	2.63 (1.30)	2.90 (1.45)	2.20 (1.30)	2.85 (1.46)	2.00 (1.49)	2.67 (0.82)	2.58 (1.35)	52		
Pre-pregnancy weight-for-height	2.20 (1.64)	3.18 (0.87)	3.00 (1.41)	2.90 (1.22)	3.14 (0.90)	3.20 (0.89)	2.98 (1.13)	46		
Weight gain during pregnancy	2.80 (1.64)	3.18 (1.33)	3.17 (1.17)	3.17 (1.03)	2.63 (0.92)	2.80 (1.30)	3.00 (1.16)	47		
Weight-for-height during lactation	2.60 (1.67)	2.50 (1.43)	2.67 (1.37)	2.80 (0.92)	3.22 (0.83)	3.33 (0.82)	2.85 (1.15)	46		
Female obesity (contributing protective effect to infant nutrition in some societies)	0.75 (1.50)	1.33 (1.51)	2.75 (1.26)	2.00 (1.35)	1.88 (1.25)	2.00 (1.87)	1.82 (1.43)	39		
Iron status	1.83 (2.04)	3.11 (0.93)	3.14 (1.22)	2.78 (1.39)	3.14 (1.07)	3.33 (0.52)	2.92 (1.27)	44		
<i>2. Dietary intake during pregnancy</i>										
Calories	3.14 (1.46)	3.63 (0.75)	3.25 (1.17)	3.55 (0.93)	3.38 (0.74)	3.67 (0.51)	3.44 (0.94)	48		
Protein	2.20 (0.64)	3.00 (1.31)	4.00 (0.00)	3.00 (1.09)	2.75 (1.39)	3.67 (0.52)	3.13 (1.19)	46		
Iron	2.80 (1.64)	3.25 (0.70)	3.43 (1.13)	3.36 (0.67)	3.14 (0.90)	3.50 (0.55)	3.27 (0.90)	44		
Folate	2.40 (1.52)	3.00 (0.76)	2.71 (1.25)	3	3.50 (0.84)	3.33 (0.82)	3.00 (1.02)	43		
<i>3. Dietary intake during lactation</i>										
Calories	3.50 (1.41)	3.57 (0.79)	3.17 (0.98)	3.60 (0.70)	3.75 (0.46)	3.67 (0.52)	3.56 (0.84)	45		
Protein	2.67 (1.75)	3.25 (1.04)	3.67 (0.82)	3.10 (1.10)	3.71 (0.49)	3.50 (0.55)	3.30 (1.04)	43		
Iron	2.57 (1.62)	3.25 (0.89)	3.17 (1.17)	2.80 (1.03)	3.57 (0.79)	3.33 (0.52)	3.09 (1.05)	44		
Folate	2.86 (1.46)	3.00 (0.82)	3.00 (1.10)	2.60 (1.07)	3.57 (0.79)	3.00 (0.89)	2.98 (1.08)	43		
Fluids	2.67 (1.75)	3.00 (1.10)	3.43 (0.79)	3.30 (0.95)	3.25 (0.89)	2.67 (0.82)	3.09 (1.04)	43		
<i>4. Child characteristics</i>										
Birth weight (large or average weight for-date)	3.13 (1.36)	3.40 (0.84)	3.38 (0.74)	2.92 (1.19)	3.67 (0.50)	3.00 (0.82)	3.24 (0.96)	55		
Normal gestational age (38-42 weeks)	3.12 (1.36)	3.50 (0.71)	3.22 (0.67)	3.25 (0.87)	3.63 (0.52)	3.43 (0.79)	3.35 (0.83)	54		
Absence of complication/stress during pregnancy	3.00 (1.41)	3.56 (0.53)	3.71 (0.49)	3.08 (0.52)	3.33 (0.71)	3.33 (0.52)	3.32 (0.74)	50		

Age supplementary food started	3.60 (1.27)	3.50 (0.76)	2.88 (1.36)	2.75 (1.42)	3.60 (0.52)	2.67 (1.21)	3.19 (1.17)	54
Age breast-feeding stopped	3.20 (1.23)	2.89 (1.36)	2.78 (1.09)	3.38 (0.87)	2.50 (1.51)	3.14 (0.90)	3.00 (1.17)	58
Age other milk stopped	2.20 (1.48)	2.25 (1.39)	2.50 (1.20)	2.70 (1.06)	1.20 (1.32)	3.00 (0.82)	2.27 (1.30)	48
Calories in supplementary food	3.50 (1.27)	3.56 (0.53)	3.43 (0.79)	3.72 (0.65)	3.20 (1.05)	3.00 (0.90)	3.43 (0.89)	53
Protein in supplementary food	2.25 (1.67)	3.00 (1.22)	3.22 (1.09)	3.45 (0.93)	3.00 (0.93)	2.71 (0.90)	2.98 (1.16)	52
Lower than average activity level	2.00 (1.58)	2.14 (1.36)	2.67 (1.22)	2.67 (1.22)	1.89 (1.62)	3.17 (0.98)	2.42 (1.32)	45
Greater than average stress tolerance	1.75 (1.71)	2.86 (1.22)	2.40 (1.14)	3.38 (1.19)	2.86 (1.46)	3.17 (0.75)	2.83 (1.26)	37
Lower than average caloric requirement	2.00 (1.15)	2.29 (1.11)	1.80 (1.64)	2.20 (1.40)	2.71 (1.60)	2.14 (1.45)	2.25 (1.35)	40
Lower than average protein requirement	2.00 (1.00)	2.00 (0.71)	1.50 (1.73)	1.78 (1.20)	2.50 (1.64)	1.67 (1.21)	1.49 (1.22)	35
<i>5. Child's resistance to infections</i>								
Diarrhoeal	4.00 (0.00)	3.55 (0.69)	3.88 (0.35)	3.86 (0.36)	3.33 (1.32)	4.00 (0.00)	3.76 (0.65)	59
Respiratory	3.71 (0.49)	3.70 (0.67)	3.86 (0.38)	3.75 (0.45)	3.56 (1.33)	2.85 (0.38)	3.73 (0.69)	52
Parasitic	3.78 (0.67)	3.09 (0.94)	3.20 (0.45)	3.23 (1.01)	2.50 (1.60)	3.71 (0.76)	3.25 (1.03)	53
Measles	3.78 (0.44)	3.50 (0.97)	3.50 (0.58)	3.18 (0.98)	3.00 (1.85)	3.86 (0.38)	3.45 (1.02)	49

**Table G. Summary of observations, suggestions, and comments from the questionnaire**

		Country/culture	Setting
<i>Factors to be included in the study of positive deviance</i>			
1. Mother-child interactions	Excessive crying by the child	N. India	Rural and urban
	Unusually dull child		
	Normal power of extremities of the child	Taiwan	Urban
	Normal growth of teeth of the child which will affect feeding interactions		
	<i>Observations and comments</i>		
	Koran says mothers should breast-feed their children up to two years and should be with their babies for a prolonged period	Kenya (Bantus)	Rural

	Negative practice of abrupt separation of child from mother in another village at time of weaning needs to be changed	Lesotho	Rural
	Wealthier families do not necessarily have healthier children. Food with love and support is most important	Nepal (Brahmin)	Rural
	<i>Factors to be included in the study of positive deviance</i>		
	Mother's perception of etiology of illness in relation to nutrition	Mexico (Mitla, Zapotec)	Town
	Supplies child with all available ttrbits		
	Mother's awareness of issues concerning child nutrition	Turkey	Urban
	Extent of protectiveness of mothers toward children	S. India	Rural
	Working mother	N. India	
	Stepmother		
	Mother's extent of contact outside house; non-professional women with greater contacts outside home may neglect their children	Turkey	
	Self-sacrificing attitude of the mother important	Taiwan	Moderately developed
	<i>Observations and comments</i>		
2. Maternal psychosocial characteristics	P.D. mothers have no food taboos for themselves or their children	Nepal (Tamang. Newar)	Rural
	Mothers who practiced the custom of massaging the child with oil and then exposing them to sunlight tended to have healthier children	Bangladesh	Rural
	Mother sacrifices everything she can afford for her child	Papua New Guinea (Kewabi)	Rural
	Breast-feeding can continue for three years		
	Mother commonly obeys food taboos on many protein foods and avoids sexual intercourse while lactating	Papua New Guinea (Saniyo, Hiyowe)	Rural
	<i>Factors to be included in the study of positive deviance</i>		
	Absence of chronic illness in fathers	Papua New Guinea (Saniyo, Hiyowe)	Rural

Relationship of father to child			
Influence of grandparents in child feeding and rearing	Mexico		Mixed
Parents ambition for the child to have higher status than themselves in the society	Greece		Urban
Influence of grandparents	US/Mexican American		Urban
Role of grandparents	Argentina (Criolla)		
Type of family: extended v. nuclear			
Geographic stability of the parents			
Early biography of mother and father			
Former traumatic experiences of the parents			
Father's health - absence of prolonged illnesses	N. India		
Non-discrimination against child's sex			
Less belief in old customs by parents			
Caretaker's status in home			
Personal gains of caretaker			
Father's interest and knowledge of proper infant feeding methods	Philippines		Urban
Caretaker's interest/knowledge of proper infant feeding methods			
<i>Observation</i>			
Fathers of North Chinese Province, regardless of the wife's origin (mainlander or Taiwanese), had babies with greater appetite that grew well	Taiwan		Moderately developed
<i>Factors to be included in the study of positive deviance</i>			
Children spaced at least two years apart	Papua New Guinea (Motu)		Rural
Number of children in a family. Fourth and following children are at a disadvantage. First child is also at a disadvantage due to young age of the mother. Second and third child has a positive advantage	Turkey		

### 3. Parental and caretaker characteristics

4. Family size, household structure, socio-economic status	Adequate living space in the house per family member	Taiwan	Urban
	Socio-economic factors at the macro-and micro-level are the most important determinants, especially family's access to means of production if rural and employment if urban	Cameroon	Rural
	Adequate financial resources	N. India	
	Careful distribution of household resources and setting of priorities concerning children are important	St. Kitts Nevis	Rural
	Nuclear v. extended family	S. India (S. Kanenese)	Rural
	<i>Observations and comments</i>		
	One family, one child policy of Chinese government will affect child-care issues in China and increase parents receptiveness to health programmes	People's Republic of China	Rural
	According to their research, mothers of positive deviants had mean parity of 4-8 while mothers of malnourished had 6-8	Haiti	Rural
	<i>Factors to be included in the study of positive deviance</i>		
	5. Community health social services	Improved water supply	Kenya (Bantus)
Clean reliable source of water		S. India	Rural
<i>Observations and comments</i>			
Mothering is perceived as woman's most important role and new mothers are supported and exempted from performing normal chores		St. Kitts Nevis	Rural
<i>Factors to be included in the study of positive deviance</i>			
Intake of calcium during pregnancy		Taiwan	Urban
Avoidance of sleeping drugs			
6. Maternal physical and nutritional characteristics	Mother's hygiene	Mexico (Mitla. Zapotec)	Town

	Negative effect of using drugs, especially anticonvulsants and antibiotics taken by the mother during pregnancy	Turkey	
	Breast-feeding	Papua New Guinea (Motu)	Rural
	Introduction of solids at 4-6 months		
	Regular three meals and snacks		
	Breast-feeding for longer than nine months important because of scarcity of milk	Zambia	Rural
	Good supplemental feeding/weaning patterns	Philippines (Cebu)	
7. Child's physical and nutritional characteristics	Eating wholesome local diet rather than less nutritious new and modern foods	Nepal (Newer. Brahmin)	Rural
	Child is at disadvantage if (1) primarily breast-fed for longer than 7 months; (2) never breast-fed.		
	Advantageous to begin proper supplementary foods at four months		
	<i>Observation</i>		
	Female children under three years are superior in weight-for-age and weight-for-height than male children	Peru (Andean)	Rural

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## **Names and Addresses of Positive-deviance Mail-survey Respondents**

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### **Appendix 2. Names and Addresses of Positive-deviance Mail-survey Respondents**

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## **Other UNU Titles of Interest**

### **Intra-household Resource Allocation: Issues and Methods for Development Policy and Planning** *Edited by Beatrice Lorge Rogers and Nina P. Schlossman*

Emphasizing the importance of understanding how resources are distributed within the household in order to design successful and effective development programmes, the authors of this 3-part study first consider various conceptual approaches to the subject, then examine different methods for collecting the information needed for analysing household resource allocation, and, finally, focus on such key variables as how members allocate time, individual food consumption, and household flexibility in adapting to external economic and social changes. Of special note is the sample approach to incorporating household issues into the design and evaluation of development programmes presented in the Appendix.

*WHTR- 1 3/UNUP-733 ISBN 92-808-0733-1*  
*16.4 x 23.9 cm, paper-bound, US\$35*

### **Identification of Food Components for INFOODS Data Interchange** *by John C Klensin, Diane Feskanich, Victor Lin, A. Stewart Truswell, and David A.T. Southgate*

Makes available for the first time a comprehensive standardization of nomenclature for international

nutrient data exchange. The reader is provided with a straight forward set of rules for identifying food components precisely and constructing data bases suitable for transfer between computers. This unique compilation will be of great value both for international data exchange and for the assemblage of national food composition tables.

*WHTR- 1 4/UNUP-734 ISBN 92-808-0734-x 112 pages, 16.4 x 23.9 cm, paper-bound, US\$20*

### **Food Composition Data: A User's Perspective**

*Edited by William M. Rand, Carol T. Windham, Bonita W. Wyse, and Vernon R. Young*

Knowledge of the composition of the foods we eat is of critical importance, and yet, the available data are extremely inadequate. Food composition data play a key part in research and policy relating to public health, dietetics, nutrition, and epidemiology and are crucial to all phases of food production and manufacturing. In this volume, prominent workers in the field pin-point the problems and offer concrete steps to remedying the situation.

*WHTR- 1 0/UNUP-633 ISBN 92-808-0633-5 240 pages, 16.4 x 23.9 cm, paper-bound, US\$20*

### **Research Methods in Nutritional Anthropology**

*Edited by Gretel H. Pelto, Pertti I. Pelto, and Ellen Messer*

A comprehensive manual of anthropological methodologies applicable to field studies in nutrition, this volume describes strategies of field research in nutritional anthropology, determinants and cultural components of food intake, methods for collecting and analysing data on energy expenditures, and statistical methods for nutritional anthropology.

*WHTR-9/UNUP-632 ISBN 92-808-0632-7 218 pages, 16.4 x 23.9 cm, paper bound, US\$20*


Positive deviance refers to children who grow and develop well in impoverished environments where most children are victims of malnutrition and chronic illness. These exceptional children are important as examples of successful child care behaviour and community support systems that can be applied when designing policies and programmes aimed at the malnourished. The first half of this volume discusses the relationships between child growth and care-giver-child interactions, mother-child characteristics, and the social support systems in which the interactions arise and are sustained. Part 1 closes with conclusions and policy and programme recommendations. The second half offers a guide to future research, including goals, solutions to methodological problems, and a pilot project model.

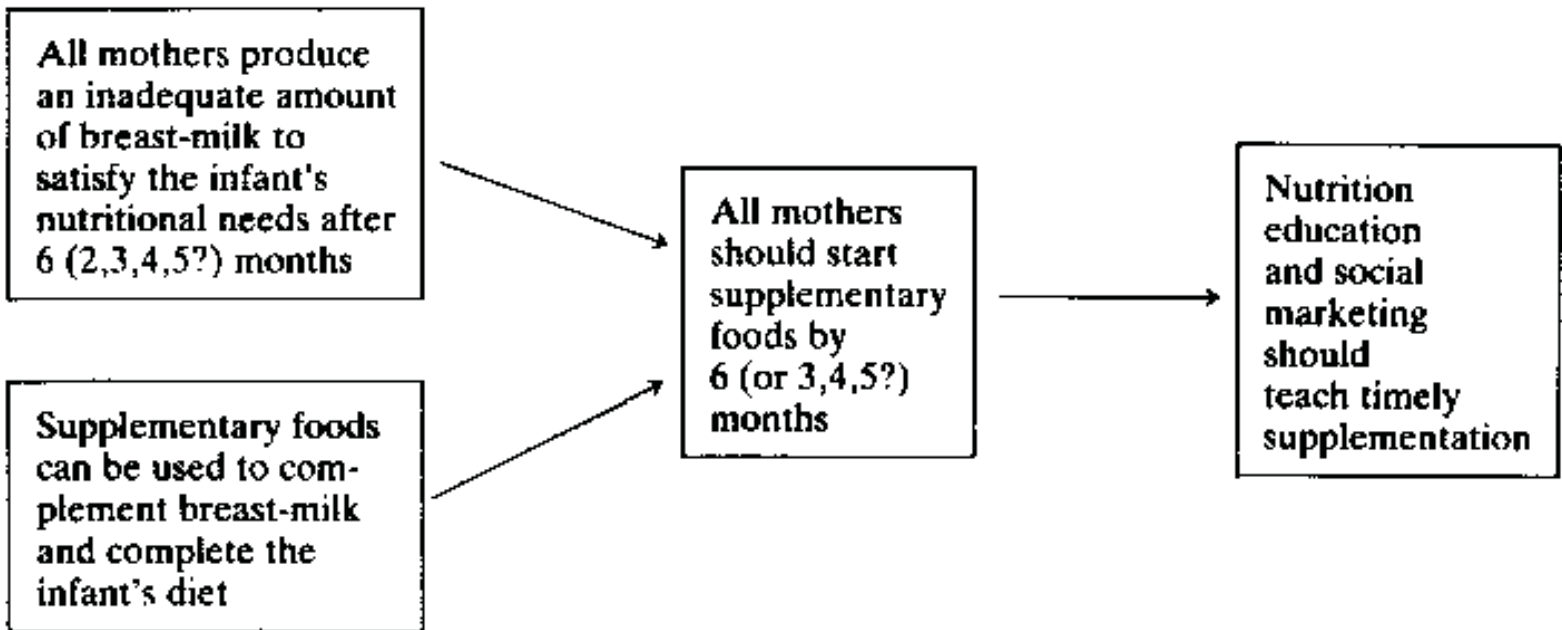
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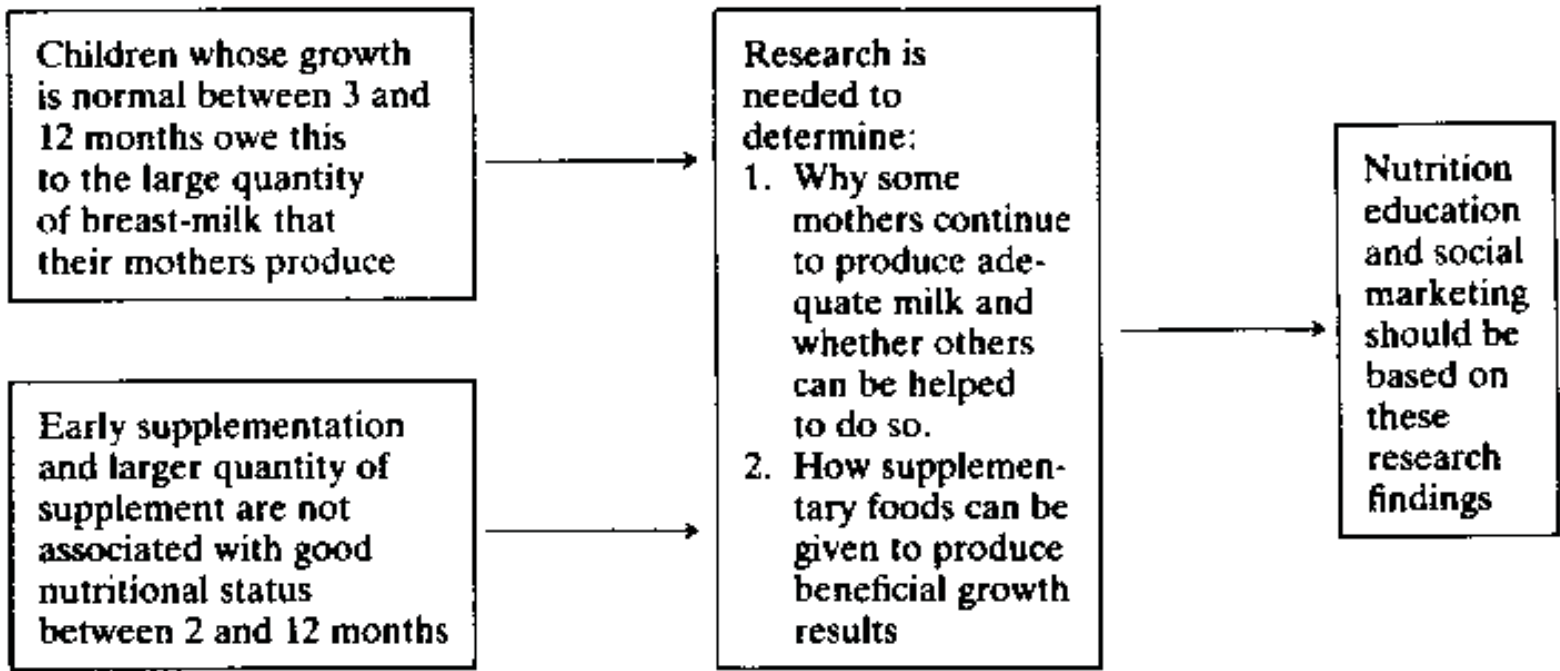
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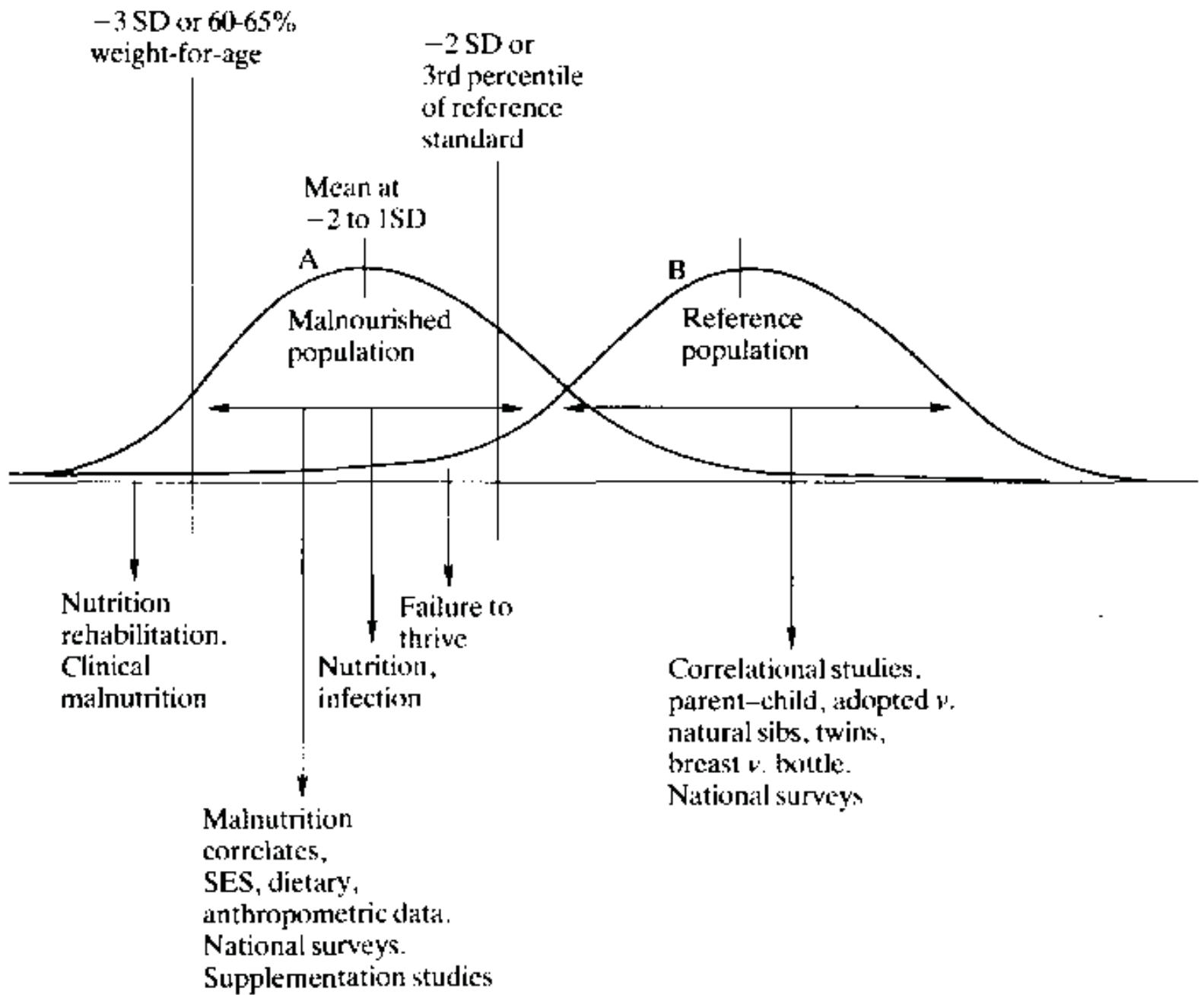
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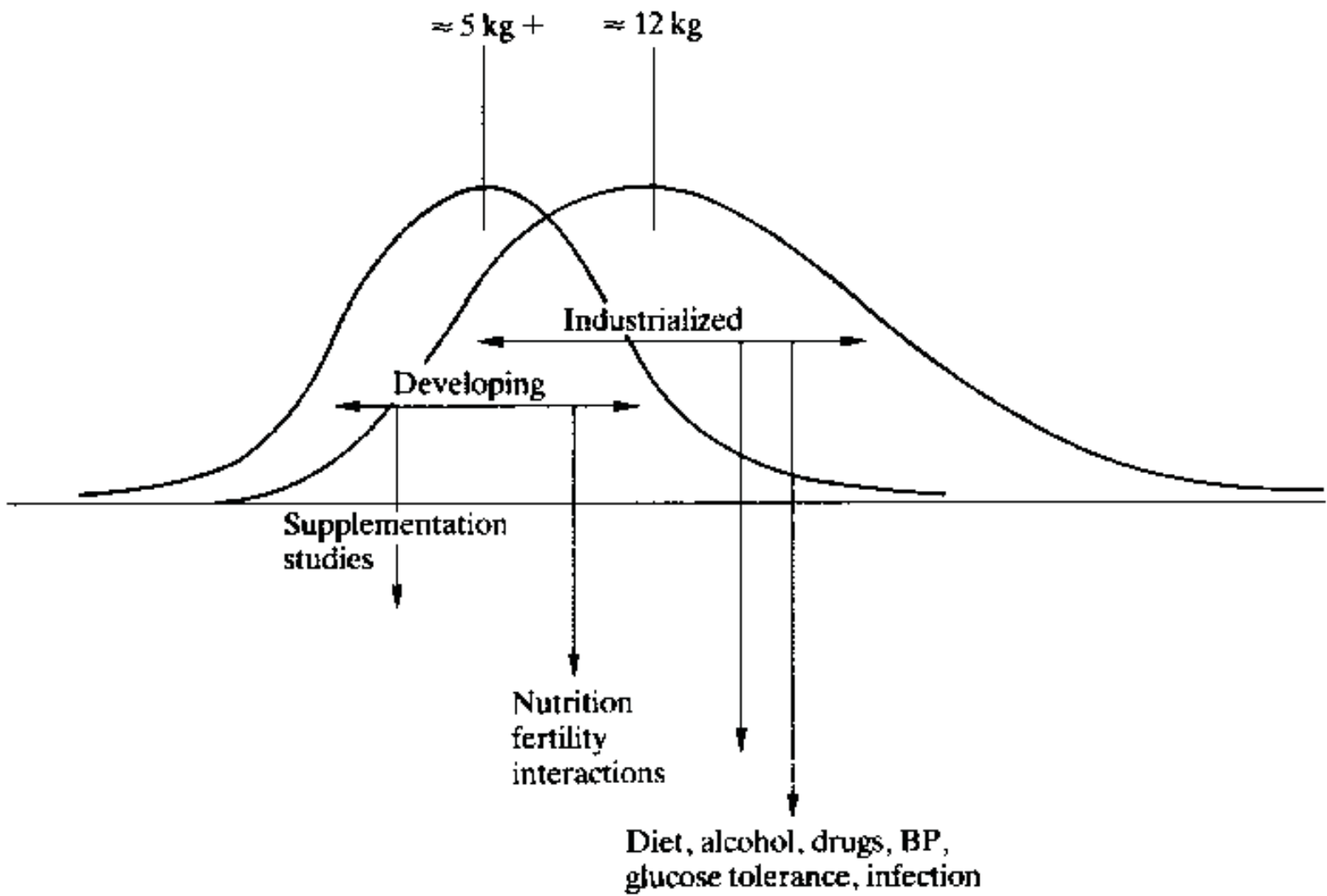
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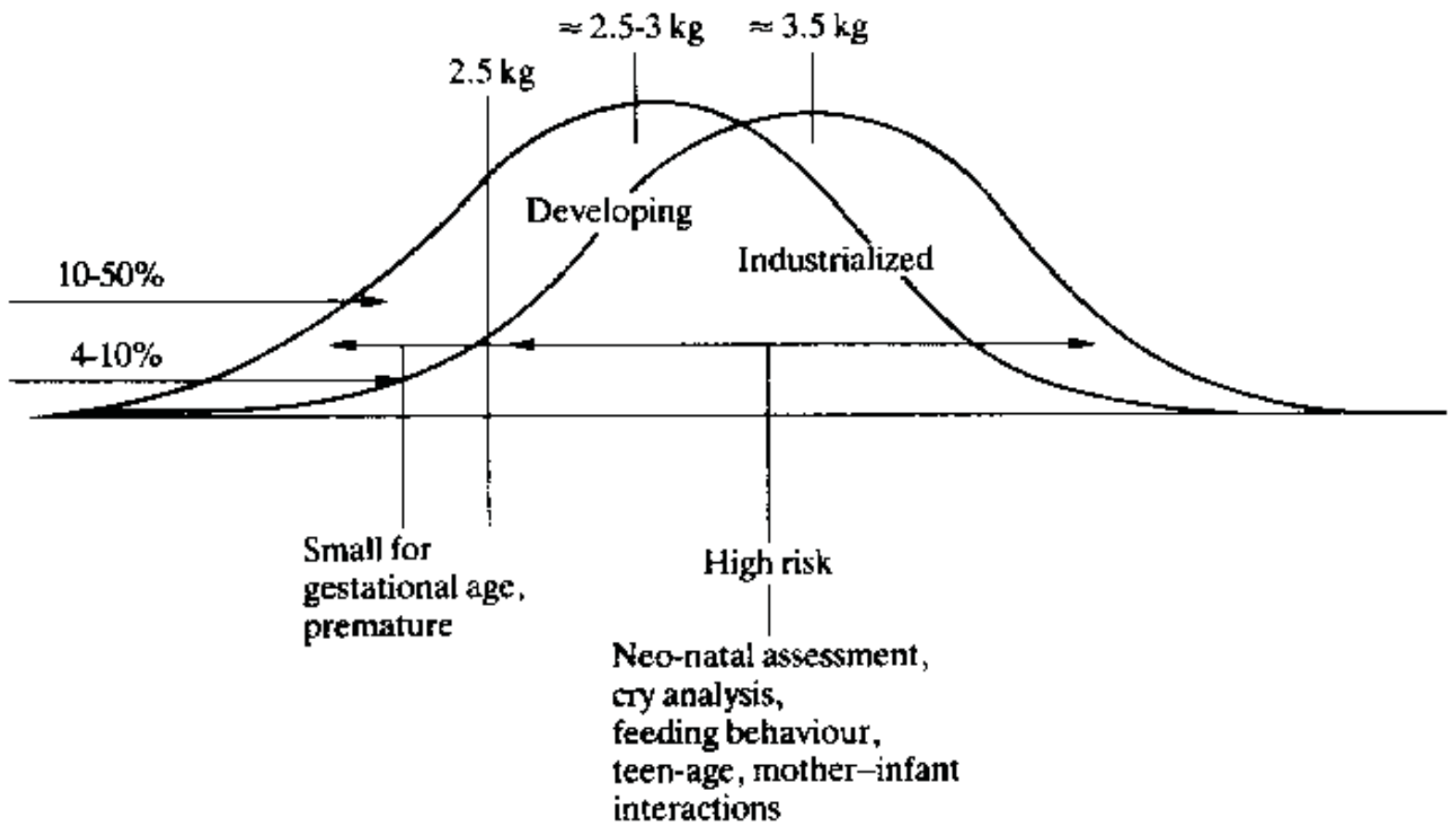
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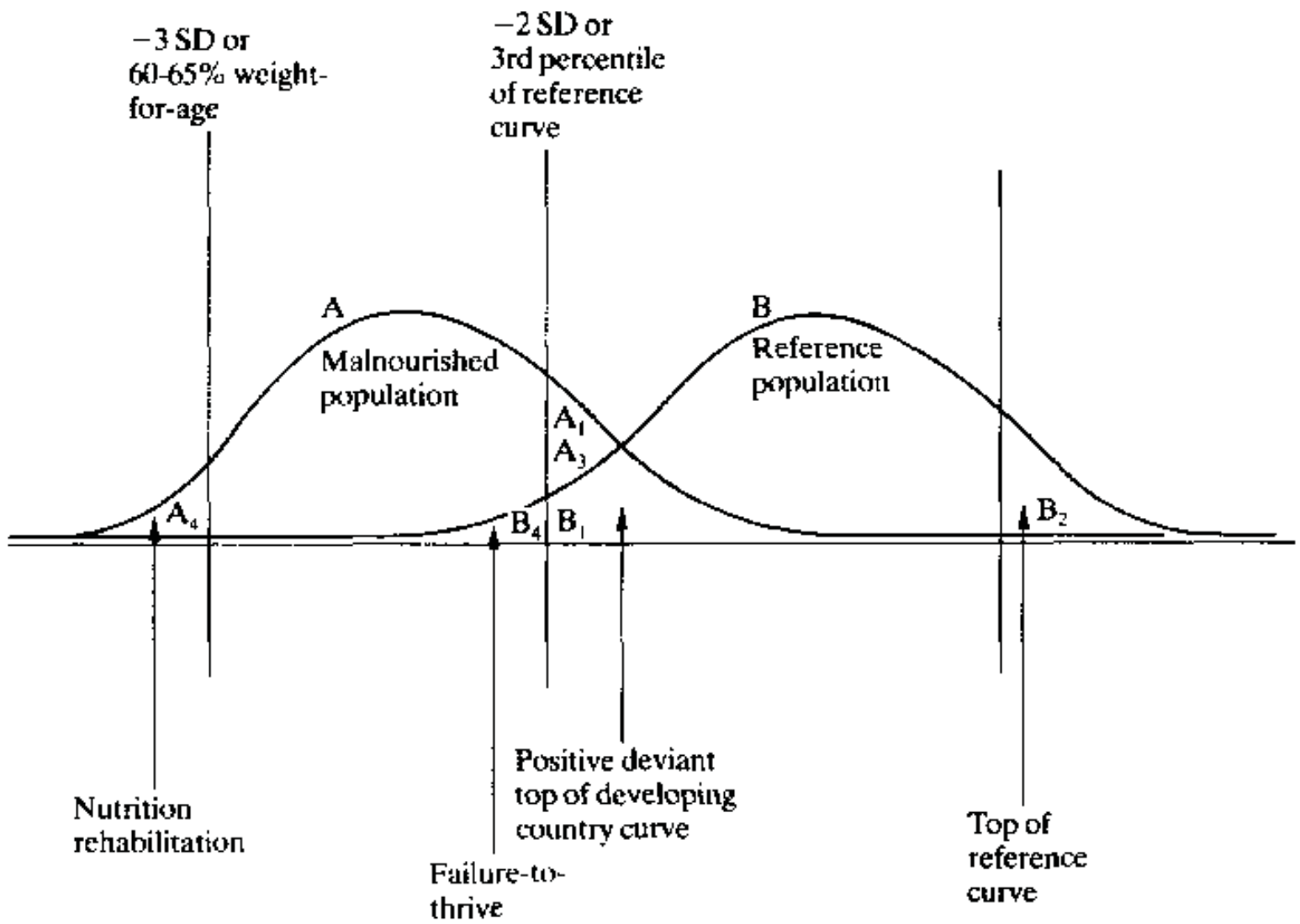












*Major risk factors (at birth)*

- Chronic poverty
- Mother with little education
- Moderate-severe perinatal complications
- Developmental delays or irregularities
- Genetic abnormalities
- Parental psychopathology

VULNERABILITY

*Major sources of support*

*Care-giving environment*

- Four or fewer children spaced more than two years apart
- Much attention paid to infant during first year
- Positive parent-child relationship in early childhood
- Additional caretakers besides mother
- Care by siblings and grandparents
- Mother has some steady employment outside of household
- Availability of kin and neighbours for emotional support
- Structure and rules in household
- Shared values-a sense of coherence
- Close peer friends
- Availability of counsel by teachers and/or ministers

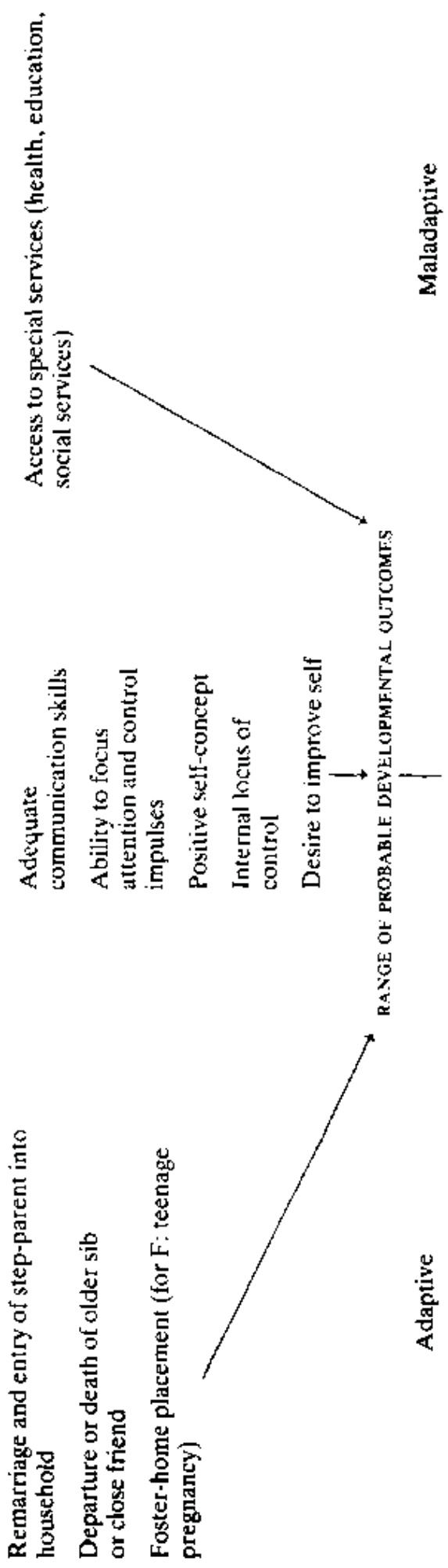
*Protective factors within the child*

- Birth order (first; CNS integrity)
- High activity level
- Good-natured; affectionate disposition
- Responsive to people
- Free of distressing habits
- Positive social orientation
- Autonomy
- Advanced self-help skills
- Age-appropriate sensorimotor and perceptual skills

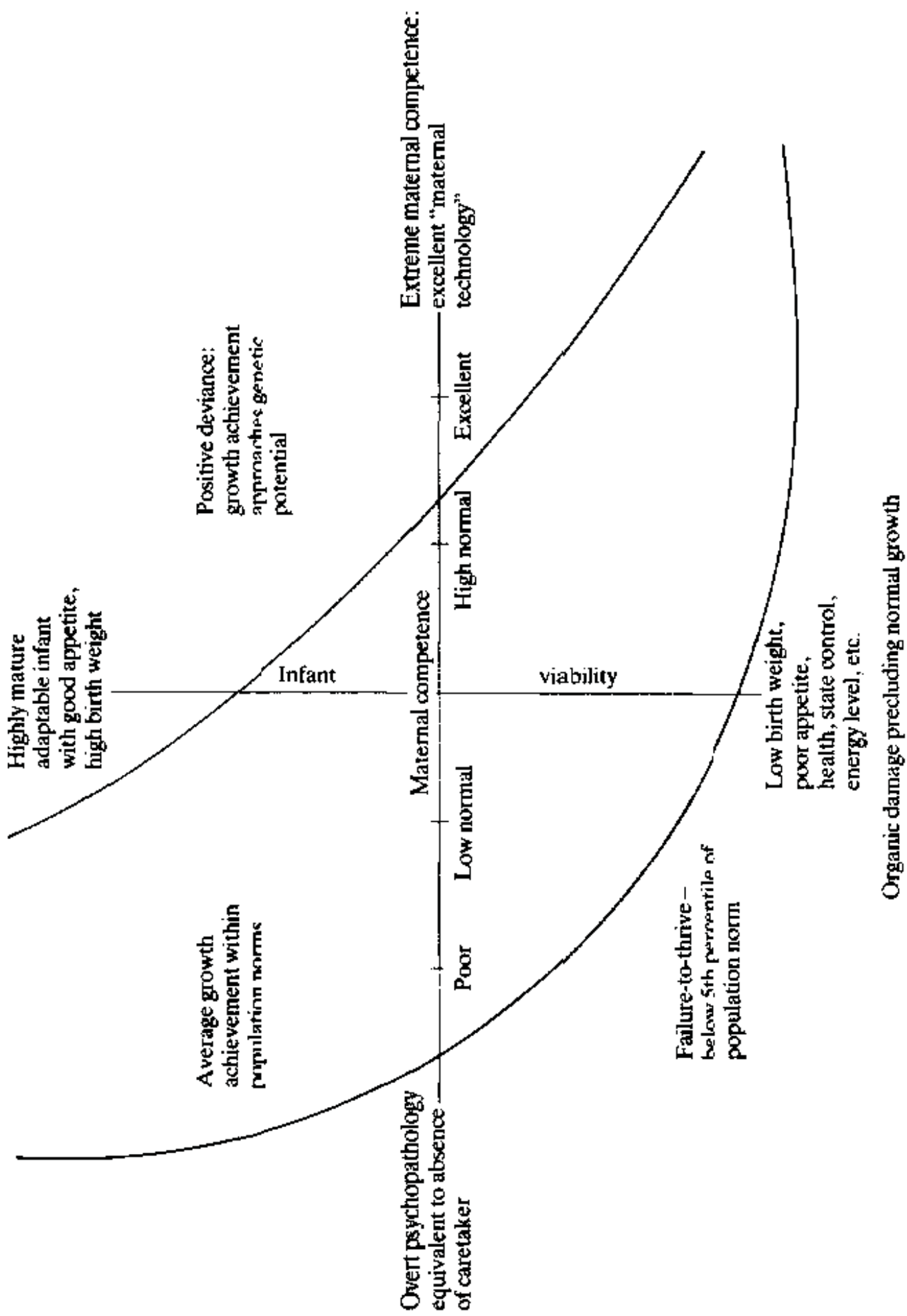
*Major sources of stress*

*In childhood and adolescence*

- Prolonged separation from primary caretaker during first year of life
- Birth of younger sib within two years after child's
- Serious or repeated childhood illnesses
- Parental illness
- Paternal mental illness
- Sib with handicap or learning or behaviour problem
- Chronic family discord
- Father absent
- Loss of job or sporadic employment of parent(s)
- Change of residence
- Change of schools
- Divorce of parents



Adaptive		Maladaptive	
<b>Fewer</b>	<b>Risk factors</b> Stressful events	<b>More</b>	<b>Risk-taking</b> Stressful events
<b>More</b>	<b>Protective factors</b> -in child -in care-giving environment	<b>Fewer</b>	<b>Protective factors</b> -in child -in care-giving environment



**Positive-deviant  
growth outcome**

**Potential  
interventions**

