

Malnutrition and Child Mortality:

PROGRAM IMPLICATIONS OF NEW EVIDENCE

Introduction

Nutrition interventions generally target severely malnourished children. The high costs for treatment and rehabilitation of these children leave few resources to address less severe malnutrition problems.

A recent analysis of 28 epidemiologic studies published by Dr. David Pelletier and colleagues¹ at Cornell University, however, indicates that mild and moderate malnutrition pose far greater risks to child mortality than previously documented. These findings strongly suggest that interventions to prevent malnutrition in children will increase the overall effectiveness of child survival programs.

Because malnutrition increases a child's risk of dying from many diseases—most prominently measles, pneumonia, and diarrhea—programs to prevent malnutrition can reduce mortality from several diseases simultaneously. Efforts to promote even modest nutritional improvements such as small changes in feeding behavior will have a beneficial impact on mortality rates over time.

Major research findings are summarized below, followed by a brief discussion of their implications for child survival programs. Based on several decades of experience in nutrition programming, recommendations are made for specific activities to promote optimum growth in infants and young children.

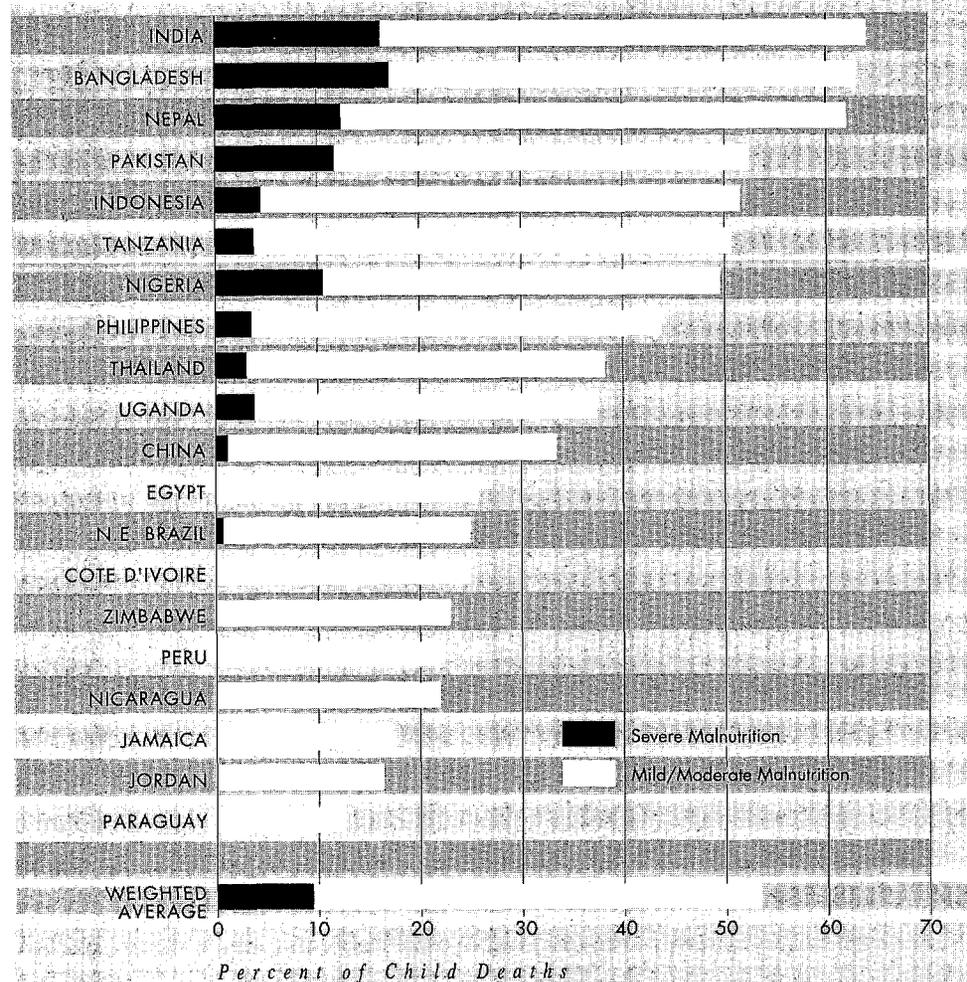
This research update is a collaboration among the Basic Support for Institutionalizing Child Survival (BASICS) Project, the Nutrition Communications Project (NCP), and the Health and Human Resources Analysis for Africa Project (HHRAA/SARA), with support from the U.S. Agency for International Development.





FIGURE 1

Deaths due to the underlying effects of malnutrition on infectious diseases



Source: Pelletier DL. *Bulletin of the World Health Organization*, 1995; 73 (in press).

Research Findings

1. Malnutrition contributes to more than half of child deaths worldwide.

Fifty-six percent of deaths among pre-school children² in the developing world are due to the underlying effects of malnutrition on disease. Conventional methods of classifying deaths by cause have misleadingly attributed only about five percent of child deaths to malnutrition.

2. The risk of death rises increasingly among children who are mildly, moderately, and severely malnourished.

Previous research suggested that only severely malnourished children were at increased risk of dying, implying that interventions should be focused solely on reaching these children. The new analysis demonstrates that the relationship between malnutrition and mortality is ubiquitous. Even mildly and moderately malnourished children are at increased risk of death because of their poor nutritional status.

On average, a child who is severely underweight³ is 8.4 times more likely to die from infectious diseases than a well-nourished child. Children who are moderately underweight and mildly underweight are 4.6 and 2.5 times respectively more likely to die than well-nourished children.

3. Most malnutrition-related deaths occur in children who are mildly and moderately underweight.

Although the risk of death is greater for severely underweight children, these extreme



cases make up only a small fraction of the total number of children suffering from malnutrition and at increased risk of dying. In fact, the analysis estimates that the vast majority—83 percent—of all malnutrition-related deaths worldwide occur in children who are mildly and moderately underweight (*see Figure 1*). Programs directed only at treating severe malnutrition, therefore, will have only a minor impact on child mortality rates.

4. The synergistic contribution of malnutrition to child mortality is consistent across populations and can be estimated at the country level.

The analysis shows that the quantitative relationship between malnutrition and mortality is remarkably consistent across various populations representing diverse ecologic, disease, and cultural environments. The child deaths synergistically attributable to malnutrition can be estimated for countries with nationally representative weight-for-age data. In Figure 2, the number of child deaths attributable to malnutrition can be estimated by locating where the prevalence of all levels of malnutrition (below 80 percent of the NCHS median) crosses the line.

The percentage of all malnutrition-related deaths that occur in mildly and moderately malnourished children can also be estimated from weight-for-age prevalence data.⁴

Program Implications from the Research Data

These recent analyses quantify the effects of malnutrition on child mortality. Three compelling conclusions from this research are particularly important for improved child survival programming:

- Mild and moderate malnutrition are implicated in many more child deaths than previously recognized.
- The effectiveness of child survival programs will be increased by interventions that include the prevention of mild and moderate malnutrition.
- The largest reductions in child deaths are likely to be achieved by: (1) targeting populations with the highest rates of child mortality, and (2) simultaneously improving both health and nutritional status in children.

These program implications suggest that actions to promote positive behavior changes should be included in community prevention programs and at prenatal, well-child, and sick-child visits to health facilities.

Program Recommendations

The wealth of experience in nutrition programs over the last two decades offers a variety of lessons for developing integrated programs to reduce child mortality and improve early



childhood growth and development. These lessons and best practices are summarized below.

1. Promotion of appropriate infant and young child feeding practices from birth through the first two years of life

Programs to promote appropriate feeding practices of infants and young children stress what families themselves can do with their available resources to improve the nutritional well-being of their children, including optimal breastfeeding and improved complementary feeding practices.

Optimal breastfeeding begins with exclusive breastfeeding, starting at the time of birth and continuing for up to six months. Experience has demonstrated that the following strategies are effective for increasing the practice of exclusive breastfeeding. These include training, communications, and social marketing efforts to:

- Create hospital and birthing environments that are conducive to immediate and optimal breastfeeding practices.
- Encourage peer support groups for newly breastfeeding women.
- Focus on delaying the introduction of non-breast milk liquids into the diets of young infants.
- Enhance women's confidence in their breast milk production and its ability to satisfy their infants' hunger and nutritional needs.

Improved complementary feeding practices should begin at six months of age when mothers move from exclusive breastfeeding to introducing locally available solid foods. Experience has shown that training, communications, and social marketing efforts are successful in promoting the following actions:

- Increase the nutrient density and quality of traditional weaning foods by adding oil, sugar, groundnuts, and/or appropriate animal products and vitamin-rich fruits and vegetables at six months.
- Increase the variety of foods and snacks offered to infants after nine months.
- Increase the frequency of feeding solid foods and snacks to four or five times daily by 12 months.
- Encourage mothers and caretakers to take an active role in feeding by providing them with strategies for feeding children with poor appetites and monitoring the quantity of food they consume.
- Encourage appropriate hygiene-related practices. These practices include hand washing and serving all foods immediately after preparation to reduce the possibility of contamination.
- Continue breastfeeding through at least 24 months of age.

Although the selection of specific behaviors and strategies to emphasize will vary in different settings, experiences from many countries suggest that mothers—even under the most difficult conditions—are willing to introduce or continue these positive feeding practices if they perceive benefits for themselves and their children. These benefits need to be actively communicated by all programs.

2. Proper nutritional management of childhood illnesses and increased feeding during recuperation from acute infections

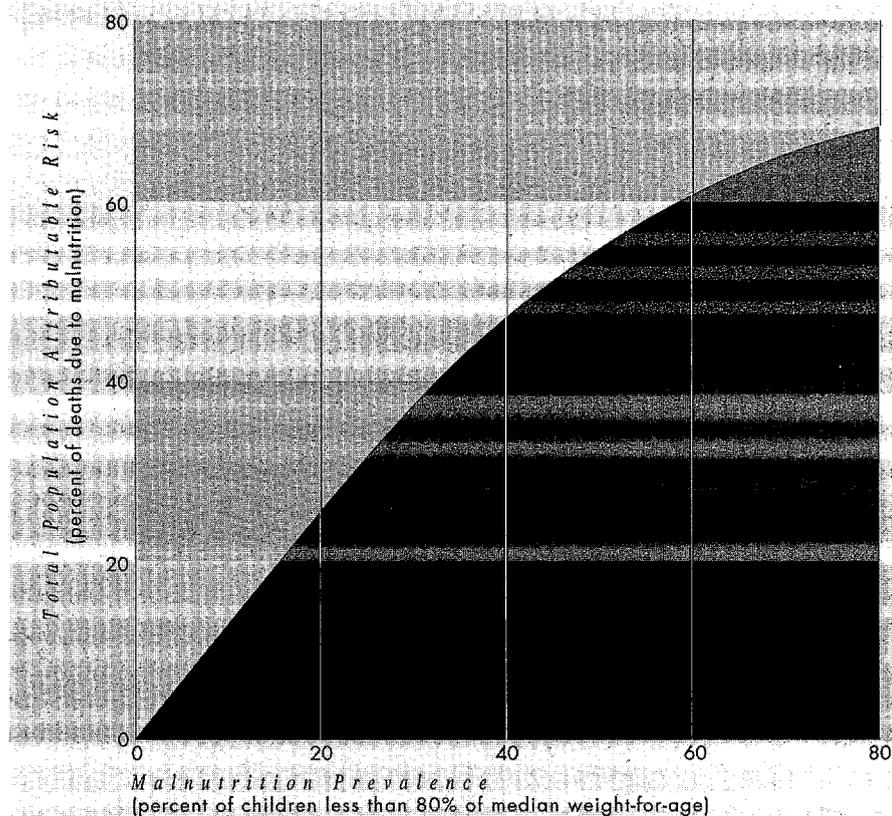
Past experience has demonstrated the feasibility of implementing these feeding behaviors to reduce the nutritional consequences of infection:

- Continue breastfeeding during all illnesses.
- When possible, continue feeding solid foods and actively encourage children to eat.
- Increase feeding during recuperation periods as soon as children are willing and able to eat and continue increased feeding for as long as possible.

Appropriate nutritional management of childhood illness is addressed in the WHO/UNICEF approach to the integrated case management of the sick child. This protocol includes assessment, treatment, counseling, and follow-up of several conditions affecting nutrition and child growth. The protocol recommends these actions:

FIGURE 2

Percent of deaths in children less than 5 that are attributable to malnutrition



Formula: Total Population Attributable Risk (PAR) = $0.87 + 1.42X - 0.0075X^2$
 where X is Malnutrition Prevalence (percent under 80% of median weight-for-age)

Source: Pelletier, D. et al. *Bulletin of the World Health Organization*, 1995; 73 (in press)

- Give vitamin A supplements to children with measles.
- Provide iron tablets to children with signs of anemia.
- Weigh sick children and assess their nutritional status and feeding routines.
- Provide feeding advice tailored to local conditions to mothers with malnourished children or children who are experiencing feeding difficulties.
- Delay first pregnancies and increase intervals between births.
- Provide adequate care during pregnancy, including appropriate treatment for malaria, sexually transmitted diseases and other infections that affect fetal growth and development.
- Increase protein and energy consumption and improve the quality of women's diets during pregnancy and lactation.

3. Promotion of appropriate dietary practices and micronutrient supplements among women of reproductive age

Malnutrition is an intergenerational phenomenon. The growth and development of young children are affected by their mothers' past nutritional history and their well-being during pregnancy. Weight-for-age in infancy is highly correlated with birth weight, which itself is affected by maternal health and nutrition. In light of these relationships and the relationship between weight-for-age and child mortality, programs should include interventions to improve the nutrition of women as a means of preventing childhood malnutrition and early death.

Although program experience in this area is more limited, the following strategies are recommended:

- Increase the micronutrient stores of girls and women before pregnancy, especially iron, iodine, and vitamin A.

- Introduce labor- and time-saving technologies to reduce energy expenditure during pregnancy.
- Provide iron supplements during pregnancy and vitamin A supplements to mothers within the first month after birth in areas where vitamin A deficiency is common.

Conclusion

These research findings indicate that child survival programs must directly address the increased risks created by malnutrition—even mild and moderate malnutrition—in the populations they serve. Although disease-centered treatment and prevention programs can positively affect nutritional status, preventing malnutrition in children is essential to reduce significantly child mortality.

By emphasizing what families can do for themselves—especially through optimal breastfeeding and complementary feeding practices—international assistance programs can take a leadership role in reducing child

mortality caused in part by malnutrition. While the specific strategies for reducing malnutrition will vary in different settings, the commitment to address nutritional problems must not.

Endnotes

¹ This research is published in: (1) Pelletier D.L., Frongillo E.A. Jr, Schroeder D.G., Habicht J-P. The effects of malnutrition on child mortality in developing countries. *Bulletin of the World Health Organization*, **73** (in press), 1995. (2) Pelletier D.L. The relationship between child anthropometry and mortality in developing countries: implications for policy, programs and future research. *The Journal of Nutrition*, Supplement, **124** (10S):2047S-2018S, 1994. (3) Pelletier D.L., Frongillo E.A. Jr, Schroeder D.G., Habicht J-P. A methodology for estimating the contribution of malnutrition to child mortality in developing countries. *The Journal of Nutrition*, Supplement, **124**(10S):2106S-2122S, 1994. (4) Pelletier D.L., Frongillo E.A. Jr., and Habicht J-P. Epidemiological evidence for a potentiating effect of malnutrition on child mortality. *American Journal of Public Health*, **83**:1130-1133, 1993.

² Pelletier's results are based on studies of children of different age ranges up to five years, but only one of the studies includes children under six months. Thus, the results are most secure in children aged 6-59 months, and they are least applicable to the neonatal period.

³ The definitions of mild, moderate and severe malnutrition used by Pelletier *et.al.* are based on percent of median weight-for-age.

Approximate relationships between percent of National Center for Health Statistics (NCHS) median weight-for-age and Z-scores are shown below:

Underweight category	Percent of NCHS median weight-for-age	Z-score range
mild	70 - 79%	-2.0 to -3.0
moderate	60 - 69%	-3.0 to -4.0
severe	less than 60%	less than -4.0

More exact formulas to convert Z-score data to percent of NCHS median weight-for-age can be found in Pelletier D.L., *et.al.*, *J. Nutrition*, **124**(10S):2106S-2122S, 1994.

⁴ The percentage of all malnutrition-related deaths that occur in mildly and moderately malnourished children (percent MMM) can be estimated for a country using the following formula: percent MMM = 99.2 - 9.02X + 0.8058X² where X is the percent of children below 60 percent of the NCHS median weight-for-age (severely malnourished).