The Nutritional Surveillance Project in Bangladesh in 1999

Towards the Goals of the 1990 World Summit for Children

HELEN KELLER INTERNATIONAL
AND
INSTITUTE OF PUBLIC HEALTH NUTRITION

IPHN

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Message from the Regional Director

The Nutritional Surveillance Project (NSP) was designed in 1989 by Sheryl Keller, who was with the Bangladesh Mission of the United States Agency for International Development (USAID) at the time and myself, as former Bangladesh Country Director for Helen Keller International (HKI). Looking back on it, I am very pleased to see the NSP's continued existence in Bangladesh.

Several key people have contributed to the NSP's development since it began. I am especially grateful to USAID for their courage in supporting this innovative activity. In particular, my heartfelt thanks go to Richard Brown, Richard Green, Margaret Neuse, and Herbie Smith, who have supported the NSP over the past 10 years. I would also like to acknowledge the contributions of my successors as Country Director in Bangladesh, who helped to establish the NSP as a widely-recognized surveillance system: Shawn Baker (1994-1996), Lynnda Kiess (1996-2000), and Andrew Hall (2000-present). Additionally, I would like to recognize the input of the current and past Directors of the Institute of Public Health and Nutrition.

The NSP represents one of HKI's finest achievements in bringing together scientific and technical expertise to capture the complex interaction of factors that affect nutritional status and health, and highlighting these important issues at both national and international levels to influence changes for the better. Through technically sound data collection, critical information from the NSP on nutrition, food and health has helped to advance our understanding of malnutrition.

This experience has served to expand HKI's nutrition surveillance program in the region, with the establishment of the Nutrition & Health Surveillance System (NSS) in Indonesia in 1995 – yet again with very strong support from USAID, particularly the Indonesia Mission. The technical expertise developed through these systems have extended HKI's ability to provide assistance to other governments and organizations in setting up nutritional and health surveys, and monitoring and evaluation of programs.

In over 10 years of operating in Bangladesh, the NSP has helped to bring attention to a country constantly at the mercy of the environment – with cyclones, droughts and excessive flooding that threaten the population with food insecurity and disease, and hamper development efforts. Through the NSP, HKI has gained invaluable experience in fine-tuning its system to monitor and assess the impact of crises on the most vulnerable children and women.

I am also very pleased that the NSP has proven to be a valuable system for monitoring improvements in child nutrition and health over the last 10 years, especially in light of the Goals of the 1990 World Summit for Children, as you will read about in this report.

Looking back over the years, I cannot express how valuable USAID's support has been to this important work – not just in financial terms. It is also manifested in their advocacy of our approach and their recognition that the findings generated by the NSP, which have shown how socioeconomic factors influence malnutrition, are crucial to combating malnutrition.

The NSP in Bangladesh and the NSS in Indonesia have proven useful in helping us to understand and capture the magnitude of malnutrition in the Asia-Pacific region. I strongly hope that, with the better understanding of malnutrition these systems provide us, they will ultimately contribute to the reduction of malnutrition and poverty.

Martin W. Bloem
Regional Director
HKI Asia-Pacific

Foreword

The NSP is a collaboration between the Institute of Public Health Nutrition (IPHN), sixteen non-governmental organizations (NGOs) and Helen Keller International. The surveys of the NSP take place six times a year and, in 1999, involved nearly 44,000 mothers and their children. First and foremost we are grateful to them for their participation.

The commitment of the staff of the NSP at all levels and in all collaborating agencies has earned it the distinction of providing the most important and reliable information on health and nutrition in Bangladesh for the last ten years, and has made it the longest running surveillance system in the world.

The fieldworkers from the NGOs and the IPHN, who have walked through villages in rain and shine to interview mothers and conduct anthropometric measurements, deserve special praise. Without their meticulous efforts and dedication there would not be a surveillance system.

The high quality of data has been ensured by the diligent work of the monitoring and quality control teams of HKI. Rapid data entry by the NGOs and its swift handling by the Data Management Unit of HKI has ensured that data are reported accurately and quickly.

Technical support from the Asia-Pacific Regional Office of HKI has been invaluable in producing this report.

All collaborators in the NSP are grateful to USAID for their continued financial support of the NSP. We would also like to express our gratitude to the Government of Bangladesh for their support to the NSP over the years.

We hope the information presented here will help to sharpen the focus of policy makers and programmers to the nutritional plight of children in this country and lead to long term improvements in child health and nutrition.

Prof. Mamunar Rashid
Director, Institute of Public Health Nutrition

Andrew Hall
Country Director
HKI Bangladesh

Abbreviations and Terms used in this document

ARI	Acute respiratory tract infection
Dal	Lentils
Decimal	Unit of area equivalent to 40 m^2
Division	Largest administrative sub-unit of Bangladesh
GLV	Green leafy vegetables
GOB	Government of Bangladesh
Height-for-age	Indicator of stunting that reflects chronic undernutrition
HKI	Helen Keller International
IPHN	Institute of Public Health Nutrition
NGO	Non-government organization
NID	National Immunization Day
NSP	Nutritional Surveillance Project
Mauza	Smallest administrative unit composed of several villages
PPS	Probability proportional to size
SD	Standard deviation
Thana	Administrative unit, equivalent to a sub-district, composed of 6-12 unions
UNICEF	United Nations Children's Fund
Union	Administrative unit composed of several *mauza*
USAID	United States Agency for International Development
VAC	Vitamin A capsule
Weight-for-age	Indicator of underweight that reflects chronic and/or acute undernutrition
Weight-for-height	Indicator of wasting that reflects acute undernutrition
WHO	World Health Organization
WSC	World Summit for Children

Executive Summary

Introduction

The Nutrition Surveillance Project (NSP), established by Helen Keller International in collaboration with the Government of Bangladesh, has been ongoing for more than 10 years. During this period, Bangladesh advanced its social and economic development agenda, including a significant reduction in childhood mortality, growth in the GDP and an increase in school enrollment. However, simultaneously Bangladesh experienced serious disasters, such as the cyclones in 1991-92 and 1994, floods in 1998, and periods of political uncertainty. Throughout this 10-year period, the NSP has been a source of high quality data for decision-makers, program managers, and donor organizations to advocate for policies and programs to improve nutrition and health. In 1990, when the NSP was just started, World Leaders convened to set goals and targets to improve child health and nutrition at the World Summit for Children (WSC). In this 1999 NSP annual report, data from the NSP is used to measure the 10-year progress in Bangladesh towards meeting the nutrition goals outlined at the WSC.

Key Findings

Childhood Stunting – The prevalence of childhood stunting (height-for-age <-2 SD) in Bangladesh declined in the past 10 years, from 72% in 1990 to 61% in 1999. This decline in the prevalence of stunting occurred during a period when rice production increased, rice prices declined on the international and national market, GDP increased, overall food availability improved and household consumption of non-grain foods increased. Yet, despite this progress, the rate of malnutrition among children in Bangladesh is still among the highest in the world. A combination of polices and programs to improve diet quality and quantity, including food policy, targeted food assistance, and health and nutrition interventions, should be promoted to ensure that stunting continues to decline in the future. Furthermore, malnutrition among women is also extremely high and programs are needed for women during pregnancy and for adolescent girls in order to prevent malnutrition throughout the life cycle and give children a better start in life.

Vitamin A Deficiency – Night blindness among preschool children in Bangladesh is now below the threshold of public health significance (below 1%). Both the vitamin A capsule program and home gardening have been shown to be associated with this decline and a lower risk of night blindness in rural Bangladesh. While this is a laudable achievement, the immediate causes of vitamin A deficiency, the low intake of foods rich in vitamin A and high rates of illness, have not been eliminated. Vitamin A deficiency among women is also very high, suggesting that maternal health and maternal and infant survival is threatened. Based on these findings, the GOB and its partners should continue VAC programs for preschool children and women during post-partum, continue to expand food-based programs, and explore the feasibility of providing vitamin A and micronutrient supplements to women during pregnancy and lactation.

Anemia – This assessment of the progress towards meeting the WSC goals also highlights the high rates of anemia among women and children in Bangladesh. Since the WSC goals were established in 1990, considerable evidence has been gathered documenting the serious consequences of anemia, such as lowered cognitive development and growth of children, increased risk of child and maternal morbidity and mortality and lowered work productivity. As a result, anemia has tremendous and long-lasting negative consequences on a country's immediate and future economic growth. While programs aimed at improving the intake of iron through the diet should be supported, the high rates of anemia among women and children in Bangladesh warrant an immediate intervention through

supplementation for children and for women during pregnancy and lactation. Internationally, there is growing consensus for programs to combat iron and other nutrient deficiencies simultaneously with multiple micronutrient supplementation.

Child Food Consumption Patterns – The NSP has collected information on food consumption patterns since its inception in 1990. Recent data from the NSP shows that the diets of children in rural Bangladesh are still not highly diversified and that only a small proportion of children between 6-23 months of age regularly consumes eggs, fruits and other good sources of micronutrients. The NSP also shows that exclusive breastfeeding stops too early for some children, the introduction of appropriate complementary foods is delayed, and the complementary foods provided to children are not always adequate in micronutrients. The decline in stunting between 1990 and 1999 parallels a decrease in rice price and an increase in household expenditure on non-grain foods such as eggs, fish, fruits and vegetables. However, childhood stunting is still very prevalent in Bangladesh and this largely reflects the poor diets of mothers and children. More detailed information on food consumption patterns is presented in Chapter 2.

Summary

This report demonstrates the importance of having technically sound data collection systems in place to monitor the nutrition and health status of women and children, which can be used to guide decisions for food, health and nutrition polices and programs. In addition to its contribution in Bangladesh, the NSP has also been a source of information on food and nutrition related issues for discussions of international technical committees. Comprehensive data systems such as the NSP have supported advancements in our understanding of many different issues, such as the interpretation of anthropometry and other indicators, the importance of the nutrition throughout the lifecycle, the co-existence of nutritional deficiencies and the linkages between health, poverty, nutrition and social development. Therefore, surveillance systems play an important role in advancing our understanding of food, nutrition and health and in monitoring the impact of policies and programs at the national, sub-national and international levels.

Chapter 1

Progress towards the nutrition goals of the 1990 World Summit for Children

At the World Summit for Children (WSC) in 1990, world leaders, governments and international agencies made commitments to improve the health and well-being of children globally. The WSC set 27 health, education and development goals for children to be met by the year 2000, including eight nutritional goals (See box, at right). Ten years have passed since the WSC, and countries are now reviewing their progress towards these goals.

The Nutritional Surveillance Project is able to provide timely and accurate data by which to assess progress in rural Bangladesh towards several of the nutritional goals. Since June 1990, the NSP has been collecting bimonthly information on nutritional indicators among children aged 6-59 months. Children under 6 months were included in the sample from February 2000. In 1997 data was collected during February, April and June only, as the 1997 National Vitamin A Survey replaced the NSP surveys in August, October and December.

World Summit Nutritional Goals

- Reduction in severe and moderate undernutrition among under 5 children by one half of 1990 levels
- Reduction of low birth weight to less than 10% of all births
- Reduction of iron deficiency anemia in women by one third of the 1990 levels
- Virtual elimination of iodine deficiency disorders
- Virtual elimination of vitamin A deficiency and its consequences, including blindness
- Empowerment of all women to exclusively breast-feed their children for four to six months and to continue breast-feeding with complementary food, well into the second year
- Growth promotion and its regular monitoring to be institutionalized in all countries by the end of the 1990s
- Dissemination of knowledge and supporting services to increase food production to ensure household food security

By examining the trends in nutritional indicators during the last decade the analysis presented in this section assesses how much progress has been made in rural Bangladesh towards the WSC nutritional goals. Where appropriate this analysis reflects recent advances in our understanding of child nutrition and appropriate indicators of undernutrition.

Child undernutrition

WSC goal: *Reduction of undernutrition among underfive children by one half of 1990 levels*

Undernutrition is a major cause of morbidity in children and contributes to more than a half of child deaths. Child undernutrition results directly from an inadequate intake of food and from diseases. As these factors are closely associated with household food security, health conditions and child care, children's nutritional status can be a useful indicator of economic and social development.

The prevalence of stunting, underweight and wasting in children aged 6-59 months between 1991 and 1999 is presented in Figure 1.1 (p4).

Between 1991 and 1999, the prevalence of stunting declined from 71.0% to 54.8% and the prevalence of underweight declined from 71.7% to 61.3%. The prevalence of wasting does not appear to have changed. The normalized distributions of the z-scores of height-for-age and weight-for-height in children aged 6-59 months in 1991 and 1999, and of the National Center for Health

Statistics reference population[1] are shown in Figure 1.2 (p5). The distribution curves show the general improvement in height-for-age and weight-for-age in rural Bangladeshi children between 1991 and 1999. Despite this improvement, the distribution of both height-for-age and weight-for-age in 1999 is still far to the left of a well-nourished international reference population.

Although there has been a consistent decline in stunting and underweight throughout the 1990s, the goal to reduce undernutrition by one half of 1990 levels by 2000 was not met in Bangladesh. On average, stunting declined by 2.0% per year, and underweight by 1.3% per year. Assuming that the prevalence of stunting and underweight fell by the same amount between 1990 and 1991 as they did between 1991 and 1999, the estimated prevalences of stunting and underweight in 1990 were 73.0% and 73.0% respectively. Thus the reduction in stunting among under-five children between 1990 and 1999 amounts to 24.9% of the 1990 level, while the reduction in underweight amounts to 16.0% of the 1990 level.

We can use the NSP data to make a rough estimate of when the goal would be met to reduce undernutrition by one half of 1991 levels based on the trends over the last 9 years. By correlating the annual mean z-scores of height-for-age over the last 9 years against the prevalence of stunting, we predict that a reduction in the prevalence of stunting observed in 1991 by one half (from 71.0% to 35.5%) will be achieved when the mean z-score of height-for-age increases to approximately -1.60 SD. On the basis of the yearly trends in z-scores of height-for-age, the WSC target will be reached in about 2008. The corresponding analysis for weight-for-age indicates that a reduction in the prevalence of underweight observed in 1991 by a half (from 71.1% to 36.7%), will be achieved in 2018, when the mean z-score of weight-for age increases to approximately -1.56 SD. This analysis is based on the trends in stunting and wasting between 1991 and 1999, and assumes these trends will not alter over the next one to two decades. While many assumptions are made in such extrapolations, this analysis is a good example of how NSP data can be used to make projections for long term planning, in this case to develop more realistic goals for the future. Using the same analytical procedures, we can predict that by the end of the next decade (2010) stunting will fall to 33% and underweight to 46%.

The magnitude of undernutrition, together with the associated adverse health and development consequences, demand that key stakeholders concerned with health, development and human rights give priority to confronting this problem. The challenge lies in addressing the multitude of interacting factors that contribute to undernutrition. Moreover it is now clear that we cannot ignore the nutritional status of adolescent girls and women of child-bearing

[1] *As recommended by WHO (1983), the NSP uses the international reference data provided by the United States National Center for Health Statistics (NCHS).*

Figure 1.1 *Prevalence of stunting (z-score height-for-age <-2 SD), underweight (z-score height-for-age <-2 SD) and wasting (z-score weight-for-height <-2 SD) in children aged 6-59 months in rural Bangladesh in 1991-1999.*

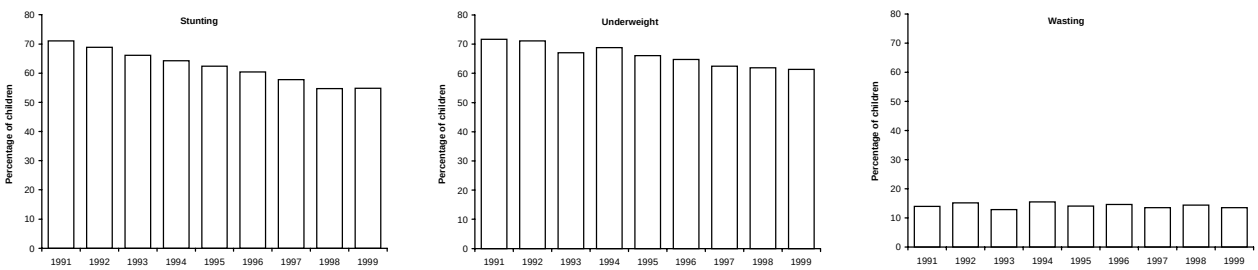
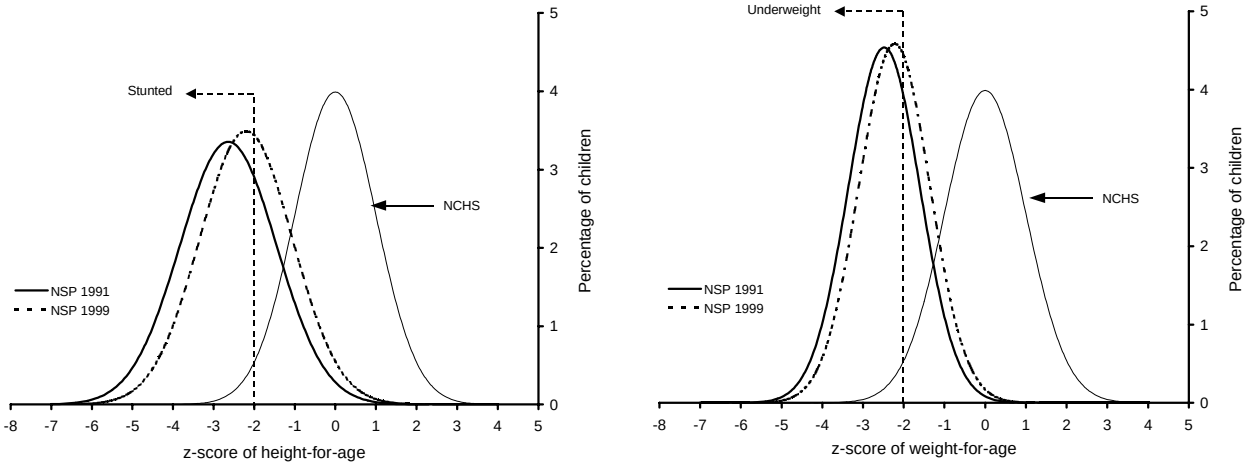


Figure 1.2 *Normalized distributions of the z-scores of height-for-age and weight-for-age in children aged 6-59 months in rural Bangladesh in 1991 and 1999 and in the NCHS reference population.*



age in our efforts to address undernutrition in infants and young children. The improvement in childhood nutrition in rural Bangladesh will accelerate more rapidly if nutrition programs consider the important determinants of undernutrition in all these key stages of the life-cycle.

Vitamin A deficiency

Goal: *Virtual elimination of vitamin A deficiency and its consequences, including blindness*

Following the 1990 WSC the National Plan of Action for Nutrition in Bangladesh set a country-specific goal to reduce the prevalence of clinical vitamin A deficiency among preschool children to less than 1% by the year 2000 and to eliminate vitamin A deficiency by 2010 (MOHFW, 1997).

Data collected by the NSP during the 1997 National Vitamin A Survey revealed that that the prevalence of night blindness in children aged 6-59 months had fallen from 3.6% to 0.6% between 1983 and 1997 (HKI/IPHN, 1985; HKI/IPHN, 1999a). Symptoms of vitamin A deficiency of greater severity than night blindness were exhibited by 0.33% of children. In 1999 0.3% of children aged 6-59 months were reported by their mothers to be showing signs of night blindness. These findings indicate that Bangladesh had met its nutritional goal to reduce vitamin A deficiency at least two years in advance of the target year.

The National Vitamin A survey also estimated the prevalence of subclinical vitamin A deficiency in children 6-59 months by measuring the concentration of serum retinol. One in four children were found to have serum retinol concentrations below the threshold associated with a clinical deficiency (<0.7 mmol/L). The prevalence was highest in children aged 12 to 23 months, which suggests that the youngest targets of the current national vitamin A capsule distribution campaigns are most at risk of deficiency. Poor breast-feeding and child feeding practices, higher illness rates and lower coverage with vitamin A capsules may contribute to the greater risk of vitamin A deficiency in this group. Clearly there is a need to reach younger children with effective interventions to reduce vitamin A deficiency.

At the time of the WSC public health nutritionists recognized the leading role of vitamin A deficiency in causing blindness, but many of the other health consequences of vitamin A deficiency were poorly understood. There is now extensive evidence from Bangladesh, Nepal and Indonesia that

vitamin A deficiency is linked with increased maternal and child morbidity and mortality. These findings have strengthened arguments for the control of vitamin A deficiency in young children and women.

One way to improve the vitamin A status of infants is to improve the vitamin A content of their diet. To do this infants should be exclusively breast-fed for the first six months of life, but lactating mothers who have a vitamin A deficiency do not produce breast-milk with an adequate vitamin A concentration. The 1997 National Vitamin A Survey found that 49.2% of all pregnant women and 45.9% of lactating women in rural Bangladesh were mildly deficient (serum retinol <1.05 mmol/L) (HKI/IPHN, 1999a). In order to prevent vitamin A deficiency in infants programs should address vitamin A deficiency among pregnant and lactating women. Supplementation of post-partum women with vitamin A can improve their vitamin A status and the vitamin A content of their breast-milk.

From the age of 6 months infants require complementary food in addition to breast-milk, which should continue to be given into the second year of life. Delayed and inappropriate complementary feeding at this age may lead to vitamin A deficiency. While improvements in infant feeding practices will lead to a sustainable reduction in vitamin A deficiency in infants, this is a far-off goal for the many households in Bangladesh that live in abject poverty. In the short term vitamin A status can be improved by giving infants 100,000 units of retinol (half the child dose) when they receive their measles vaccination at 9 months of age and during the national vitamin A capsule distribution program.

The major cause of the decline in vitamin A deficiency in rural Bangladesh is the high coverage achieved by the national vitamin A capsule program (HKI/IPHN, 1999a). All children aged 12-59 months in Bangladesh are eligible to receive a vitamin A capsule twice a year at six-monthly intervals. Since 1990 the NSP has provided a mechanism to estimate divisional and national coverage of the vitamin A capsule programs and to identify the characteristics of non-recipients. This information has contributed to the design of improved strategies for increasing the coverage of the vitamin A capsule distribution.

Figure 1.3 *Percentage of children aged 12-59 months reported to have received a vitamin A capsule within the previous 6 months in rural Bangladesh in 1991-1999. ND = no data.*

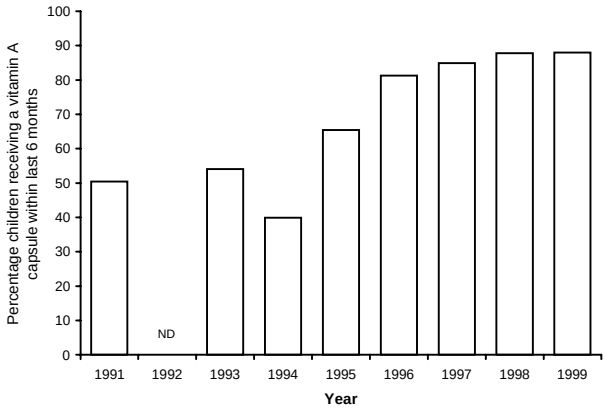


Figure 1.3 shows that the percentage of children who were reported to have received a vitamin A capsule within the previous 6 months during the twice-yearly national program has been sustained above 80% since 1996. By 1999 the coverage of the program was estimated to be 85.0% during the National Vitamin A Week and 89.6% when vitamin A was given during the Polio National Immunization Days.

The excellent coverage achieved by the national vitamin A capsule campaigns needs to be sustained while continuing to promote alternative sources of dietary vitamin A such as homestead gardening and food fortification. Homestead gardening, now included in the development programs of many NGOs in Bangladesh, has been shown to lower the risk of both clinical and sub-clinical vitamin A deficiency in preschool children in rural Bangladesh (HKI/IPHN, 1999a).

Chapter 1

Iron deficiency anemia

WSC goal: *Reduction of iron deficiency anemia in women by one third of the 1990 levels*

Iron deficiency is the most common micronutrient deficiency in the world and the predominant cause of anemia in areas where malaria is not endemic. Iron deficiency anemia represents the latter stages of iron deficiency, when the depletion of body iron stores leads to a reduction in the production of hemoglobin. The WHO estimated in 1992 that about half of all pre-school children and pregnant women in developing countries are anemic (WHO, 1992). Iron-deficiency anemia increases the risk of dying among women and children, and is associated with lower birth weight and impaired growth, immunity, learning ability, work capacity and productivity (ACC/SCN, 2000). Not only are these effects cumulative and constitute a major public health problem, but they also constrain social and economic development (Ross and Horton, 1998).

There is no reliable and nationally representative data on the prevalence of anemia in Bangladesh from the time the World Summit goals were set in 1990. As a part of the National Vitamin A survey in 1997, the hemoglobin concentration of randomly selected pre-school children and their mothers[2] was estimated using a portable hemoglobinometer (Hemocue, Sweden). The prevalence of anemia among the children and their mothers is shown in Table 1.1 (HKI/IPHN, 1999b). As expected the prevalence of anemia was highest in pre-school children, followed by pregnant women, lactating women and non-lactating women.

Table 1.1 *Prevalence of anemia in children aged 6-59 months and their mothers (HKI/IPHN, 1999b).*

	n	% Anemic
Preschool children*	1199	52.7
Pregnant mothers*	120	49.2
Lactating mothers**	694	48.7
Non-lactating mothers**	388	38.9

**Anemia defined as a hemoglobin concentration <110 g/L (ACC/SCN, 2000)*
***Anemia defined as a hemoglobin concentration <120 g/L (ACC/SCN, 2000)*

Because of the lack of data from 1990, or of data collected in periodic surveys over the last 10 years, it is not possible to determine the extent to which the prevalence of anemia has declined since the WSC. Nonetheless the data collected in 1997 indicate that anemia is of severe public health significance (prevalence >40%), (ACC/SCN, 1997) in preschool children and their mothers. It is important that we now have accurate baseline prevalence data with which to compare the results of future surveys.

Since malaria is only endemic in the Hill Tracts of Bangladesh, iron deficiency is likely to be the major cause of anemia in the country. Other possible causes of anemia include folate deficiency, hookworm infection and AIDS. As anemia usually has several causes, multiple and complementary strategies may be required for its prevention and control, including iron-folate supplements, dietary modification, food fortification and hookworm control. As iron and folate deficiencies rarely occur in isolation of other micronutrient deficiencies, there is ongoing research in Asia and Africa to examine the comparative effectiveness of multimicronutrient supplements and iron-folate supplements for the control of maternal anemia and the reduction of maternal mortality.

Supplementation is likely to be the key strategy for the prevention and control of iron deficiency and anemia. While supplements are cheap and efficacious when taken under controlled conditions, problems of unreliable service delivery and low intake of supplements by target groups often constrain their effectiveness. Optimal service delivery and adherence to treatment is

[2] As the NSP samples households with at least one child less than five years of age, only mothers who have a child less than five year of age are included.

difficult to achieve because, unlike vitamin A supplements, iron-folate (and multimicronutrient) supplements have to be taken daily.

Breast-feeding

Goal: *Empowerment of all women to breast-feed their children exclusively for four to six months and to continue breast-feeding, with complementary food, well into the second year*

Early termination of breast-feeding and early or late introduction of complementary foods increases the risk of undernutrition and illness in infants (WHO, 1998). In assessing breast-feeding and infants' feeding practices, three aspects should be examined: exclusive breast-feeding, timely complementary feeding and continued breast-feeding.

Exclusive breast-feeding

Breast-feeding is considered to be exclusive if the child is only given breast-milk and no other liquids or foods, not even water. Breast-milk provides all the nutrients and water needed during the first six months of life. As breast-milk is sterile, it effectively protects the infant from diarrheal diseases and other infections that are transmitted in contaminated water or foods. Diarrhea is one of the major causes of growth faltering and deaths in infants and young children. Exclusive breast-feeding also helps to space births by preventing the mother from becoming pregnant again. At the time of the WSC, the WHO recommended that infants be exclusively breast-fed for the first four to six months of life. In the light of recent studies in developing countries, which have shown that infants grow adequately when exclusively breast-fed for six months, it is now recommended by the WHO that infants be exclusively breast-fed for about six months.

Figure 1.4 *Percentage of children in rural Bangladesh who were exclusively breast-fed and partially breast-fed by age in February 2000.*

Since February 2000 the NSP has collected data on children aged less than 6 months. Data collected in February 2000 were analyzed to examine progress towards achieving the WSC goal for exclusive breast-feeding. The prevalence of exclusive breast-feeding and partial breast-feeding in infants aged less than 10 months is shown in Figure 1.4. For the purposes of the analysis, an infant is considered to be exclusively breast-fed if he or she is breast-fed and is not consuming family food, gruel, fresh or powered animal milk, water, rice water, fruit juice or sugar water. It is possible that some infants consumed liquids or foods that are not included in this list and were incorrectly categorized as exclusively breast-fed. In addition, the practice of giving honey or sugar-water to newborn infants has been ignored. For these reasons, the data are likely to overestimate the prevalence of exclusive breast-feeding.

All infants less than 6 months old were breast-fed, but a substantial percentage were not exclusively breast-fed. The prevalence of exclusive breast-feeding fell from 84.3% in children aged less than 1 month to 35.0% in children aged 5 months. The average prevalence of exclusive breast-feeding was 62.3% among children less than 4 months, 59.3% among children less than 5 months and 55.2% among children less than 6 months. According to the revised WHO recommendation of exclusive breast-feeding for about 6 months, exclusive breast-feeding was stopped too early in 44.8% of children.

Figure 1.5 *Percentage of breast-fed infants aged 6-9 months given family food, gruel, animal milk, other liquids (water, rice water, fruit juice, sugar water) or nothing in rural Bangladesh in 1999.*

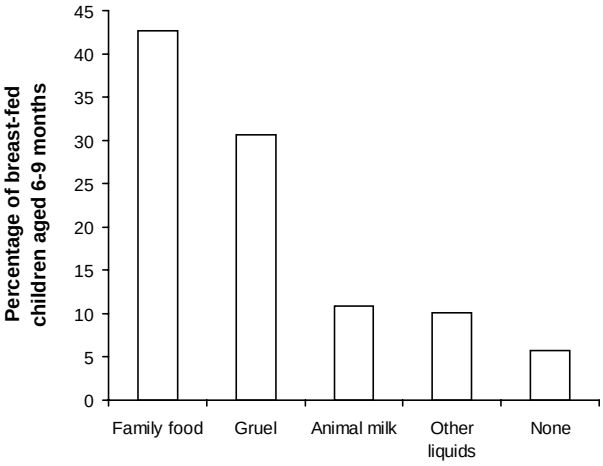
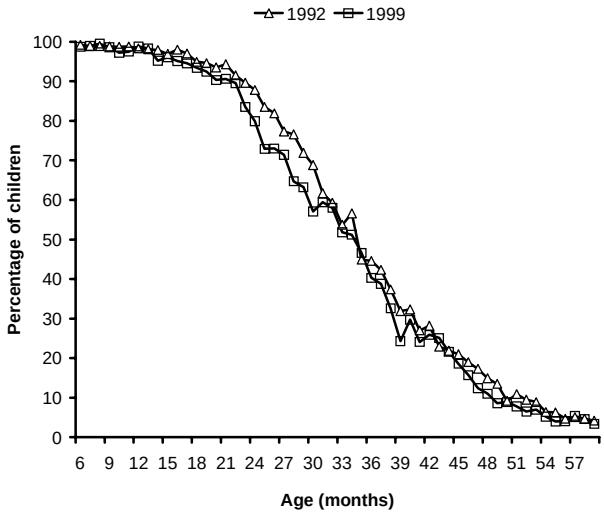


Figure 1.6 *Percentage of breast-fed children by age in rural Bangladesh in 1991 and 1999.*

Note: For the purposes of clarity, a line is drawn to join the points, but it should be noted that the data is based on cross-sectional surveys, not a longitudinal cohort.



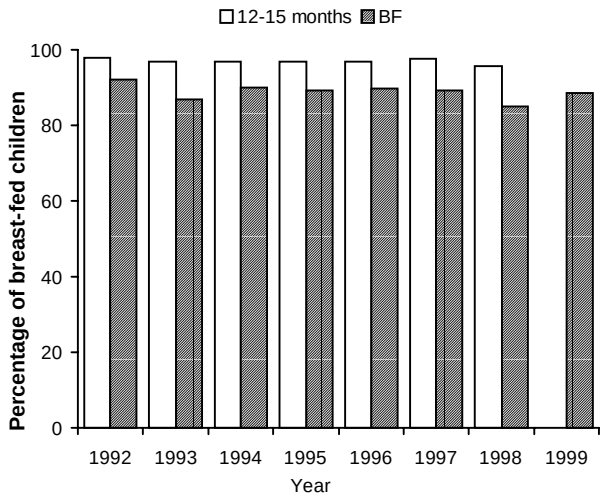
There are no nationally representative data on breast-feeding practices for children aged 4-6 months from the early 1990's with which to compare these findings. Nonetheless it is clear that, as of February 2000, a substantial proportion of mothers exclusively breast-fed their infants for an inadequate length of time. There is a need to better identify and address the barriers to exclusive breast-feeding and to improve messages about its benefits.

Complementary feeding

From the age of six months highly nutritious complementary foods should be introduced gradually into an infant's diet. Since February 1998, the NSP has collected information on the main type of food or drink given to breast-fed children. In descending order of quality these foods and drinks are categorized as family food, gruel, animal milk and other liquids (water, rice water, fruit juice, or sugar water). If a mother reported giving her child food or drinks in several of these categories, the food of highest quality is recorded by the NSP.

Timely complementary feeding is assessed in terms of the percentage of children aged 6-9 months who are receiving breast-milk and complementary food. Figure 1.5 shows the percentage of children in 1999 who received breast-milk plus food or drink in each of the categories. Over one in twenty (5.8%) infants aged 6-9 months were not receiving any food or drink in these categories, suggesting that they were still being exclusively breast-fed. A further 20.9% received only animal milk or liquids. It is unlikely that the diet of these infants is sufficient to meet their nutritional needs. The remainder of infants (73.3%) received either family food or gruel in addition to breast-milk, and are considered to

Figure 1.7 *Percentage of breast-fed children aged 12-15 months and 20-23 months in rural Bangladesh in 1992-1999.*



be given complementary food at a timely age, although the quality of this complementary food is not known.

The low prevalence of exclusive breast-feeding and timely complementary feeding may partially account for the high levels of undernutrition in preschool children in rural Bangladesh. Clearly, there is need to add improved messages for mothers on adequate and timely complementary feeding to those on exclusive breast-feeding.

Continued breast-feeding

Breast-feeding should continue into the second year of life and beyond, if possible. The NSP has collected data on breast-feeding since August 1991 so annual aggregated data are available from 1992 onwards. Figure 1.6 (p9) shows the percentage of breast-fed children by age in 1992 and 1999. The percentage of breast-fed children in 1992 slightly exceed the values in 1999 for most age categories.

Two age groups are used by UNICEF to gauge the extent of continued breast-feeding: the proportions of children aged 12-15 months or 20-23 months who are receiving breast-milk. Figure 1.7 (p9) shows that between 1992 and 1999, the percentage of breast-fed children aged 12-15 months declined from 97.8% to 97.1% ($p<0.05$) and the percentage of breast-fed children aged 20-23 months declined from 92.2% to 88.5% ($p<0.001$).

Although most mothers in rural Bangladesh in 1999 still breast-fed their children well into the second year of life, the decline over the last 7 years in the percentage of breast-fed children aged 12-15 months and 20-23 months adds to concerns over the lack of exclusive breast-feeding and timely complementary feeding. Continued surveillance is needed to determine whether or not the downward trend continues. At the same time, the importance of continued breast-feeding well into the second year of life should be reinforced and encouraged.

Conclusions

During the last decade the government and humanitarian agencies have worked to improve the nutritional status of young children in rural Bangladesh. Data collected by the NSP over the last ten years provides information on progress towards the goals set by the WSC at the beginning of the decade. Significant achievements have been made in the reduction of vitamin A deficiency and its consequences. There has also been some progress towards the reduction of stunting and underweight, but these reductions fall short of the WSC goals. A large proportion of Bangladeshi children remain stunted, underweight, wasted and anemic. Many are exclusively breast-fed for too short a period and are not given complementary foods at the right age. These children are consequently deprived of their right to achieve their full potential for growth, cognitive development and productivity. The fact that these children will be the work force and parents of the future has considerable social and economic implications for Bangladesh.

There is a need to redouble efforts in Bangladesh to further tackle undernutrition, anemia and poor breast-feeding and child feeding practices. At the same time programs to address vitamin A deficiency must not be abandoned or else the gains of the last decade may be lost. By examining the achievements of the last decade realistic goals can be set for the next decade and beyond. As demonstrated in this report, information provided by the NSP can be used to set these goals, as well as to monitor progress towards achieving them. Future goals should reflect expanding knowledge of the causes and consequences of undernutrition, such as the important role of maternal nutritional status in determining the nutritional status of infants and young children.

Chapter 2

Food consumption

Children need a varied and balanced diet that provides an adequate intake of nutrients for their growth and well-being. According to the WHO infants should be exclusively breast-fed until they are about 6 months old. Although breast-feeding should be continued until at least the second year of life, infants require complementary food from 6 months of age to meet their nutritional requirements (WHO, 1998). Complementary feeding is considered to be delayed if it is not provided at this age. *Timely complementary feeding* is assessed by the percentage of children aged 6-9 months who receive breast-milk and complementary food, and *continued breast-feeding* by the percentage of children aged 12-15 months and 20-23 months who are breast-fed.

Mothers in the surveys were asked to describe their breast-feeding and child feeding practices for each child under five years. The percentage of children receiving breast-milk, gruel and family food by the age of the child is shown in Figure 2.1. Almost all children under 12 months old and over 90% of children under 24 months, were breast-fed. The percentage of breast-fed children fell gradually with age in children older than 24 months. Over 45% of children aged 6 months received gruel. This percentage fell rapidly with age, and none of the children aged 24 months received any gruel. The intake of family food increased rapidly with age, from approximately 30% among children aged 6 months to almost 100% in children aged 24 months and older.

Overall, 73.3% children aged 6-9 months received gruel or family food in addition to breast-milk, indicating that 26.7% of children in this age group had not been introduced to complementary food at the correct age and/or were not receiving breast-milk. While we cannot rule out that the latter children received adequate complementary foods other than gruel or family food, this finding indicates that that the nutrition and well-being of these infants may be jeopardized by a failure to introduce complementary foods at the appropriate age. Timely complementary feeding will not necessarily protect against undernutrition if these foods are deficient in micronutrients and are provided in inadequate amounts. Information on the quality and quantity of complementary foods and the frequency of feeding is not collected by the NSP.

In 1999 97.1% of children aged 12-15 months and 88.5% of children aged 20-23 months were breast-fed, indicating that most

Figure 2.1 *Percentage of children aged 6-59 months who were given breast-milk, gruel or family food by age in rural Bangladesh in 1999.*

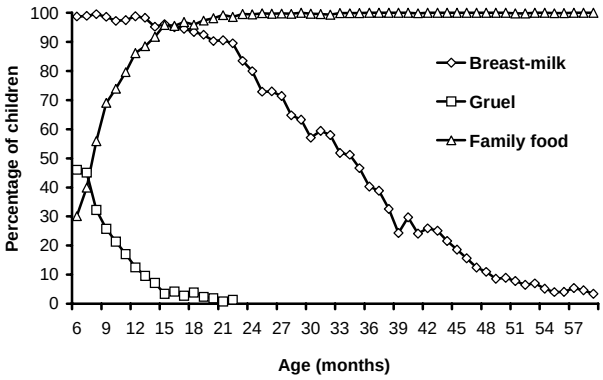
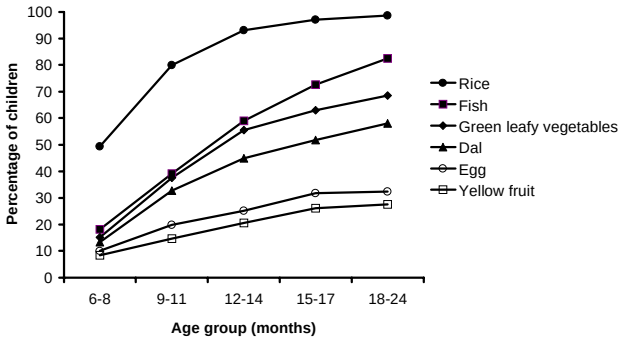


Figure 2.2 *Percentage of children who were given any of six key foods, by age, in rural Bangladesh in 1999.*



Note (to Figures 2.1 and 2.2): For the purposes of clarity, a line is drawn to join the points, but it should be noted that the data are based on cross-sectional surveys, not a longitudinal cohort.

mothers in rural Bangladesh breast-feed their children well into the second year of life. In fact continued breast-feeding into the third, or even fourth, year of life was not rare. Figure 2.1 shows that 40.3% of children aged 36 months and 11.0% of children aged 48 months were still receiving breast-milk.

The percentage of children who received various key foods during the three days prior to the survey are presented by age group in Figure 2.2 (p11). Note that the percentage values indicate the relative frequency of intake of each key food and not the relative quantity of intake. For each key food the percentage values were positively associated with age group (p<0.001), suggesting that the diet of older children was more varied compared with younger children. Fish and *dal* were the most frequent sources of protein, and green leafy vegetables the most frequent source of vitamin A. For children aged 24-59 months there was a strong correlation between the number of days per week that specific foods were eaten by children and eaten by their mothers and other household members (rank correlation coefficients of 0.84 – 0.98, p<0.001). This finding suggests that the diet of these children is closely linked with the diet of their mothers and other family members.

Figure 2.3 *Percentage of children in two age groups (6-23 months and 24-59 months) who were reported to have consumed a non-grain food on at least four days in the previous week in rural Bangladesh in 1999.*

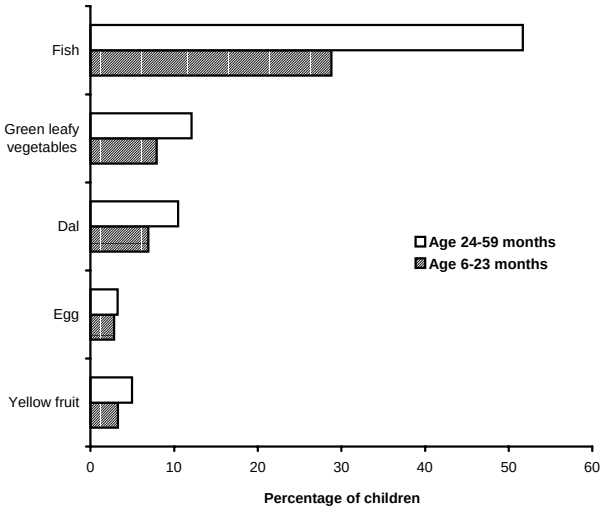


Table 2.1 *Percentage of children aged 6-59 months who were reported to have eaten non-grain foods regularly during the previous week by division, sex of the child, household vulnerability and mother's education in rural Bangladesh in 1999. Regular intake is defined as consumption on four or more days in the previous week*

			Percentage of children who consumed each food item regularly during the previous week				
		n	**Fish**	**Egg**	**GLV[a]**	***Dal***	**Yellow Fruit**
Division	Dhaka	15872	44.4***	2.8***	9.9***	9.1***	4.9***
	Chittagong	9556	54.8	3.6	13.6	14.1	3.7
	Rajshahi	11896	29.4	2.1	11.4	5.5	4.5
	Khulna	5620	44.1	4.7	7.3	5.9	4.1
	Barisal	3523	43.1	4.5	10.6	13.9	2.6
	Sylhet	2989	54.3	2.0	6.1	9.0	6.2
Sex	Male	25925	43.4	3.3**	10.7	9.4	4.3***
	Female	23533	43.1	2.8	10.3	8.9	3.7
Household Vulnerability[b]	Least	17890	48.8***	4.7***	10.2**	10.4***	5.9***
	Moderate	16511	43.0	2.9	10.2	9.6	4.3
	Most	15044	36.9	1.3	11.2	7.2	2.7
Mother's Education	None	29282	41.2***	1.2***	10.0***	7.0***	3.4***
	Primary	11756	44.4	3.3	10.6	9.7	4.5
	Secondary	8385	48.6	9.0	12.0	15.6	7.4

[a] *GLV= green leafy vegetables*

[b] *See box on 'Household vulnerability' (p15)*

*** p<0.01, *** p<0.001, Chi-square test for significant differences between categories.*

Chapter 2

Foods that are consumed on four or more days per week by children are considered to be eaten 'regularly'. The percentage of children aged 6-23 months and 24-59 months who ate key foods regularly in 1999 is shown in Figure 2.3 (p12). The figure conceals the fact that children who ate one food regularly tended also to eat other foods regularly. A closer examination of the data reveals that only 39.3% of children aged 6-59 months had a regular protein intake provided by fish, egg or *dal*, and only 11.9% had regularly consumed green leafy vegetables or yellow fruit, the two most common sources of vitamin A.

The percentages of children who regularly consumed key foods during the previous week by the division of Bangladesh, the sex of the child, an index of household vulnerability and mother's education are shown in Table 2.1 (p12). There were regional variations in the regular intake of fish, eggs, green leafy vegetables, *dal* and yellow fruit by children ($p<0.001$). For example, fish was less regularly eaten in Rajshahi division than in Chittagong and Sylhet divisions. Boys were more regularly given eggs ($p<0.01$) and yellow fruit ($p<0.001$) than girls, but the overall percentages were very low. A regular intake of all the non-grain foods was positively associated with an index of household vulnerability ($p<0.001$), with the exception of green leafy vegetables, and negatively associated with mother's education ($p<0.001$). Fish, egg and yellow fruits were rarely eaten by children in the most vulnerable households. As these foods are the main dietary sources of vitamin A and are good sources of iron and other micronutrients, this finding suggests that children in extremely vulnerable households may be at risk of vitamin A deficiency, iron deficiency and other micronutrient deficiencies.

Chapter 3

Summary of NSP findings in 1999

The following pages describe some of the key findings from the NSP in 1999. These include information on socio-demographics, child nutrition, child health and breast-feeding practices.

Socio-demographic characteristics

The NSP collected information in 1999 on the socio-demographic characteristics of all sampled households with a child aged 6-59 months. The socio-demographic status of a household determines the extent to which the household unit can adequately feed and care for all members, provide a healthy environment and have access to health services. Socio-demographic factors are therefore important determinants of the health and nutritional status of household members. The socio-demographic characteristics of rural households in all six divisions of Bangladesh in 1999 are summarized in Table 3.1 (p15).

The overall mean family size in 1999 was 5.7 persons. Women headed 3.5% of households. Because the NSP samples only households with children less than five years old, the proportion of households with female heads is less than the estimate of 9.3% obtained by the Bangladesh Demographic and Health Survey (BDHS, 1997). Almost one quarter (23.8%) of households had two or more children aged less than five years. One in eight households (7.9%) had five or more members per 100 square feet[3] and were highly crowded.

Only 41.4% of all mothers and 46.6% of all fathers had received at least one year of formal education. Most household earners were farmers (20.8%), followed by unskilled laborers (12.8%), salaried workers (11.2%) and agricultural day laborers (10.1%). Unemployment affected 5.7% of household main earners in the week prior to the surveys. The main earners of 38.9% of households reported earning money from casual or short-term sources.

Household vulnerability

The HKI index of household vulnerability is a composite of the stability of income and land ownership.

- Least vulnerable households have land and the main earner is either self employed or has a permanent source of income.
- Moderately vulnerable households have land and the main earner is a casual laborer, or have no land but the main earner has permanent income.
- Most vulnerable households do not have land and the main earner is a casual laborer.

Over a half of households (54.4%) were landless and 67.9% were functionally landless, which refers to a cultivable land of <50 decimals[4], insufficient to support a household economically. However, a large proportion of households (83.6%) had home gardens. Approximately 12.3% of households with home gardens were practicing improved or developed gardening.[5]

Almost all households (98.3%) had access to clean drinking water, but less than one third (31.3%) had closed latrines. Food aid was received by 5.1% of households in the month prior to the surveys. Over 60% of households had carried out activities to reduce expenditure in the week prior to the surveys, such as crop gleaning or gathering fuel.

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[3] 100 square feet is equivalent to 9.3 square meters

[4] 50 decimals is equivalent to 0.3 hectares

[5] Developed gardens have fixed land and produce vegetables year-round using improved technology. Improved gardens have fixed land and grow some seasonal vegetables in addition to traditional types, but not throughout the year.

Chapter 3

Table 3.1 *Socio-demographic characteristics of the survey population by division in rural Bangladesh in 1999.*

Socio-demographic characteristic	Dhaka *n=7199*	Chittagong *n=7200*	Rajshahi *n=7200*	Khulna *n=7200*	Barisal *n=7200*	Sylhet *n=7200*	Overall[a] *n=43199*
Family size (mean)	6.4	6.8	5.3	5.2	5.7	6.6	5.7
Number of children under 5 years (%)							
1	75.2	63.0	84.7	85.4	76.2	68.2	76.2
≥2	24.8	37.0	15.3	14.6	23.8	31.9	23.8
Household with a female head (%)	3.5	8.4	1.1	1.9	2.6	2.5	3.5
Household crowding (persons per 100 sq ft[b]) (%)							
1-2	58.1	61.3	55.0	42.3	58.3	44.3	55.2
3-4	35.8	33.1	37.3	43.2	32.2	44.5	36.8
≥5	6.1	5.6	7.6	14.5	9.6	11.1	7.9
Parent's eduation[c] (%)							
Mother	34.4	46.0	37.8	54.9	58.5	31.8	41.4
Father	37.5	54.4	45.3	53.7	60.2	45.1	46.6
Occupation of main household earner (%)							
Farmer	22.5	12.6	27.0	24.7	16.8	21.1	20.8
Unskilled laborer	11.7	13.9	7.2	11.6	15.0	17.1	12.8
Salaried worker	10.1	23.3	4.9	5.0	12.4	11.4	11.2
Agriculture day laborer	12.5	4.5	16.6	13.4	6.1	7.7	10.1
Other	43.2	45.7	44.3	45.3	49.7	42.7	45.1
Main earner currently unemployed[d] (%)	4.4	2.7	9.9	5.9	5.7	3.0	5.7
Main earner has casual or short term job (%)	37.0	37.5	43.5	35.1	41.6	37.9	38.9
Land ownership (%)							
Landless	55.3	59.3	51.2	52.5	50.8	57.4	54.4
Functionally landless (<50 decimals)	69.9	71.7	65.0	65.7	66.8	63.7	67.9
Homestead gardening type[e] (%)							
None	15.4	12.8	21.6	14.7	12.4	19.6	16.4
Traditional	73.4	76.7	73.7	71.8	72.6	64.3	73.3
Improved	10.1	10.3	4.5	13.2	14.5	14.8	9.7
Developed	1.1	0.2	0.2	0.3	0.5	1.3	0.6
Clean drinking water[f] (%)	99.6	99.6	99.5	98.8	86.4	95.3	98.3
Use of closed latrine (%)	23.6	52.7	15.1	50.2	33.5	34.6	31.3
Food aid received from any source (%)	5.6	5.3	3.9	4.4	7.1	6.0	5.1
Performed expenditure saving activities[g] (%)	71.7	43.9	57.6	62.8	65.8	63.1	61.1

[a] *Weighted using 1991 population census to obtain national estimates.*

[b] *100 sq ft is equivalent to 9.3 sq m.*

[c] *Attainment of at least one year of formal education.*

[d] *A household's main earner is considered unemployed if he/she has not worked at all for income in the past week for reasons other than sickness.*

[e] *Traditional, scattered land small scale production; Improved, fixed land seasonal production; Developed, fixed land all-year production.*

[f] *Drinking water obtained from hand pump, deep tube well, tap and/or water purified by tablet.*

[g] *Activities such as crop gleaning, gathering of fuel, house materials or fish in the previous week.*

Chapter 3

Child nutrition

Undernutrition can affect all sectors of the community, but infants and young children are at greatest risk because their proportionately higher nutritional requirements for growth and development are often not met due to an inadequate dietary intake or diseases. The consequences of undernutrition tend to be most severe in this group, as nutritional deprivation in early life can have long lasting effects on growth, educational attainment and productivity. For these reasons, undernutrition in children aged 6-59 months is used to gauge the extent of the public health problem in a population.

Anthropometric indices of weight-for-age, height-for-age and weight-for-age are used to assess the degree of undernutrition. These indices are expressed as z-scores, which are a measure of a child's weight or height in comparison with the distribution of the weight or height of a reference population of well-nourished children of the same age and sex[6]. Z-scores of weight-for-age, height-for-age and weight-for-height capture the degree to which a child is underweight, stunted or wasted, respectively. Children who have z-scores less than -2 standard deviations below the reference median are classified as undernourished. Wasting reflects current nutritional status or acute undernutrition. As stunting takes some time to develop, it reflects past nutritional status or chronic undernutrition. Underweight does not distinguish between chronic and acute undernutrition because child may be underweight due to stunting and/or wasting.

[6] *As recommended by the WHO (1983), the NSP uses the international reference data provided by the United States National Center for Health Statistics (NCHS).*

Table 3.2 *Prevalence of underweight, stunting and wasting in children aged 6-59 months in rural Bangladesh at each bimonthly survey in 1999. The data are weighted using the 1991 population census to obtain national estimates.*

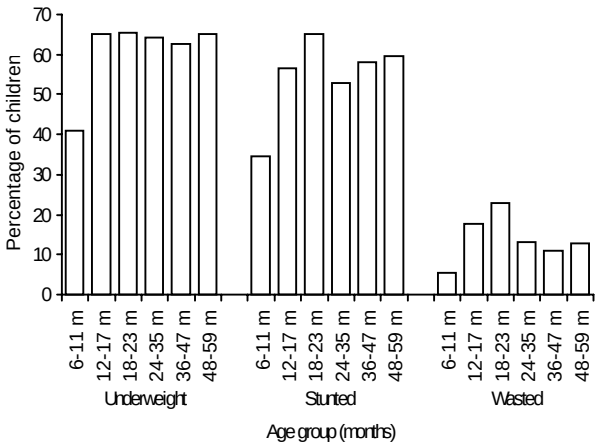
	Dhaka %	Chittagong %	Rajshahi %	Khulna %	Barisal %	Sylhet %	Overall %	*n*
Underweight [a]								
February	60.6	59.9	60.5	50.9	67.3	70.4	60.4	8280
April	63.6	63.0	63.4	55.2	72.2	70.4	63.5	8231
June	63.7	60.4	63.4	57.7	69.7	71.7	63.2	8238
August	65.5	58.1	62.6	57.1	65.7	72.9	62.9	8190
November	57.7	61.3	60.1	51.6	64.9	68.5	59.5	8242
December	58.6	58.8	56.8	49.6	66.2	71.4	58.5	8187
Overall	61.6	60.3	61.1	53.7	67.7	70.9	61.3	49367
Stunting [b]								
February	57.4	61.5	54.4	45.9	65.5	66.5	57.3	8237
April	54.0	57.4	53.7	39.4	60.2	64.9	54.0	8189
June	51.8	55.0	50.7	38.5	62.1	67.9	52.3	8205
August	54.5	62.5	51.0	43.2	57.5	63.6	54.6	8148
November	52.4	58.7	55.2	45.9	58.0	60.4	54.4	8208
December	56.5	60.8	52.6	46.3	62.3	66.3	56.2	8143
Overall	54.4	59.3	52.9	43.2	61.0	64.9	54.8	49130
Wasting [c]								
February	10.0	9.9	13.4	11.2	12.8	11.5	11.2	8253
April	15.5	13.1	14.8	14.9	20.7	15.5	15.2	8219
June	17.1	13.9	22.2	16.0	19.1	14.3	17.5	8218
August	13.6	10.4	18.8	18.4	17.0	18.9	15.4	8198
November	10.0	10.5	12.4	10.3	13.2	16.5	11.4	8229
December	9.8	7.1	11.7	8.0	12.6	14.7	10.0	8173
Overall	12.7	10.8	15.6	13.1	15.9	15.3	13.5	49290

[a] *Z-score weight-for-age <-2 SD,* [b] *Z-score height-for-age <-2 SD,* [c] *Z-score weight-for-height <-2 SD.*

The prevalence of underweight, stunting, and wasting in children aged 6-59 months in all six divisions for each of the six cross-sectional surveys in 1999 is given in Table 3.2[7] (p16). Overall, 61.3% of children were underweight, 54.8% were stunted and 13.5% were wasted. The prevalence of underweight and stunting exceeded the WHO threshold value for 'very high' prevalence levels[8]. The prevalence of undernutrition varied by division (p<0.001). The overall prevalence of underweight ranged from 53.7% in Khulna to 70.9% in Sylhet. Khulna also had the lowest prevalence of stunting (43.2%) and Sylhet the highest prevalence of stunting (64.9%). The overall prevalence of wasting ranged from 10.8% in Chittagong to 15.9% in Barisal. As previously documented (HKI/IPHN, 1999c), wasting is highly seasonal: in all six divisions, the prevalence of wasting peaked in June-August and was lowest in December-February.

The age distribution of undernutrition in rural Bangladesh in 1999 is shown in Figure 3.1. The prevalence of underweight, stunting and wasting varied significantly with age (p<0.001) and was greatest among children aged 18-23 months. Although inferences regarding growth cannot be made from cross-sectional surveys, the data are consistent with findings elsewhere that children aged 6-23 months are most vulnerable to undernutrition (Calloway *et al*., 1992). The greater risk of undernutrition in this age group is attributed to an inadequate

Figure 3.1 *Percentage of underweight, stunted and wasted children by age group in rural Bangladesh in 1999.*



[7] *Information on the prevalence of undernutrition (underweight, stunting, and wasting) and mean z-scores by age group, sex and division are provided to the Global Database on Child Growth and Malnutrition of the WHO (www.who.int.nutgrowthdb).*

[8] *A population with prevalence of underweight >30% and prevalence of stunting >40% is considered as having very high prevalence levels (WHO, 1995).*

Table 3.3 *Prevalence of stunting and wasting in children aged 6-59 months according to a household vulnerability index, mother's education and experience of a crisis during the previous two months in rural Bangladesh in 1999.*

		n	Stunted[a] (%)	Wasted[b] (%)
Household vulnerability[c]	Least	17783	51.3	12.6
	Moderate	16403	56.5	13.9
	Most	14932	61.5***	15.3***
Mother's education	None	28296	60.9***	15.4***
	Primary	11672	54.5	12.8
	Secondary	8328	42.2	10.8
Experienced a crisis[d]	No	36663	56.2	13.5***
	Yes	12866	56.1	14.8

[a] *Z-score height-for-age <-2 SD.*

[b] *Z-score weight-for-height <-2 SD.*

[c] *See box on 'Household vulnerability' (p14)*

[d] *Crises include natural disaster, loss of employment, land or livestock, illness, poor agricultural production, loan or credit payment, high food prices, and wedding, funeral or other ceremony.*

*** *p<0.001, Chi-square test for significant differences between categories.*

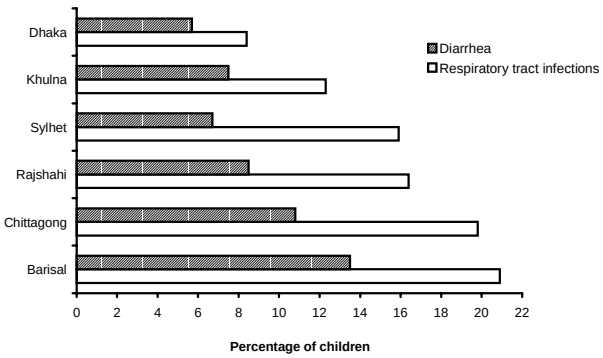
dietary intake and exposure to diseases during the period in life when nutritional requirements are proportionately high due to rapid growth.

Table 3.3 (p17) shows the prevalence of stunting and wasting in children aged 6-59 months in households classified according to selected socio-economic characteristics. The prevalence of both stunting and wasting was positively associated with an index of household vulnerability ($p<0.001$) (see box 'Household vulnerability, p14) and negatively associated with mother's education ($p<0.001$). The prevalence of wasting was significantly higher among children in households that had experienced a crisis during the two months prior to the surveys, such as a natural disaster; loss of employment, land or livestock; illness; or poor agricultural production ($p<0.001$).

Child health

Child nutrition and child health are closely linked. Many diseases are associated with poor nutritional status in children, while undernutrition is known to impair immune function. Acute respiratory tract infections (ARI) and diarrhea are the leading causes of mortality in preschool children in Bangladesh. The association between diarrhea and undernutrition is well documented. During the surveys, mothers are asked a series of questions to determine whether any child

Figure 3.2 *Percentage of children aged 6-59 months who had diarrhea or an acute respiratory tract infection by division in rural Bangladesh in 1999.*



under five years had symptoms of diarrhea and ARI within the previous 24 hours. Diarrhea is defined as three or more loose, watery or mucoid stools. ARI is indicated by a cough and/or difficult breathing (WHO, 1990).

Overall, 8.2% of children aged 6-59 months had diarrhea and 14.3% had symptoms of ARI within the previous 24 hours. Figure 3.2 shows the prevalence of diarrhea and ARI in each division in rural Bangladesh in 1999. In terms of both the prevalence of diarrhea and ARI, the ranking of the top three divisions is the same: Barisal, Chittagong and Rajshahi.

The mean prevalence of diarrhea and ARI by age group in 1999 is shown in Figures 3.3 and 3.4 (p19) respectively. Children in younger age groups appear to be more affected by both diarrhea and ARI than older children. Younger children are probably more vulnerable to these diseases because their immune system is still developing and the introduction of

complementary foods combined with increasing mobility increases their exposure to infection.

The prevalence of diarrhea and ARI by selected characteristics of the household is given in Table 3.4. There was a positive association between the prevalence of ARI and household population density (p<0.001). A similar association was observed between the prevalence of both diarrhea and ARI and the number of children aged less than 5 years in the household (p<0.05). These findings are consistent with the widely held notion that the spread of infectious diseases, such as diarrhea and ARI, is more likely to occur when people live in close proximity. However, it should be noted that household crowding is also associated with other indicators of socio-economic status, and therefore a causal link between crowding and infection cannot be inferred from this analysis alone.

The prevalence of diarrhea (p<0.01) and ARI (p<0.001) was positively associated with the index of household vulnerability. Children in the most vulnerable households had significantly higher prevalence of these infections than children in moderate and least vulnerable households.

Figure 3.3 *Percentage of children who had diarrhea by age group in rural Bangladesh in 1999.*

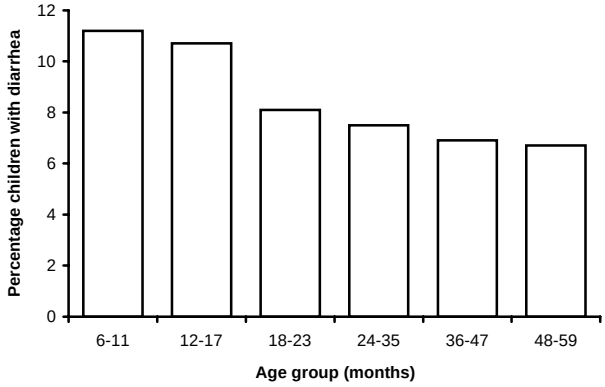


Figure 3.4 *Percentage of children who had an acute respiratory tract infection (ARI) by age group in rural Bangladesh in 1999.*

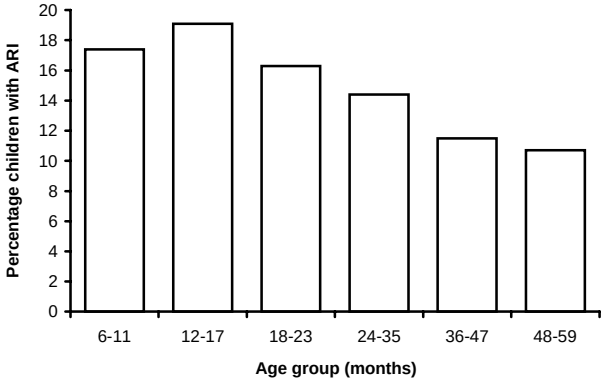


Table 3.4 *Prevalence of diarrhea and acute respiratory tract infections (ARI) in children aged 6-59 months by selected socio-economic variables in rural Bangladesh in 1999.*

		n	Diarrhea (%)	ARI (%)
Household crowding (persons per 100 sq ft[a])	1	7187	6.8	11.4***
	2	18927	7.8	12.0
	3	12559	8.6	16.3
	4	6042	9.5	17.4
	> 5	4084	8.8	19.0
Number of children under 5 years	1	33136	7.3*	13.3*
	2	15218	9.8	16.0
	> 3	1104	9.7	19.8
Household vulnerability[b]	Least	17891	6.8**	11.7***
	Moderate	16511	8.1	15.0
	Most	15044	9.8	16.7

[a] *100 sq ft is equivalent to 9.3 sq m*

[b] *See box on 'Household vulnerability' (p14)*

** p<0.05, ** p<0.01, *** p<0.001, Chi-square test for significant differences between categories*

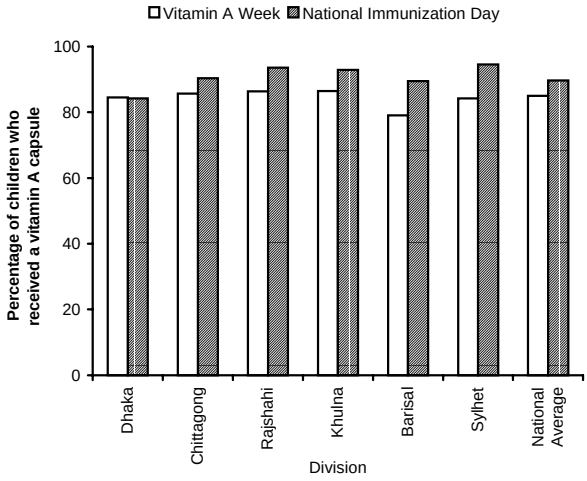
Night blindness and vitamin A capsule supplementation

Night blindness is a manifestation of vitamin A deficiency and is considered to be a public health problem in areas where the prevalence in preschool children exceeds 1% (WHO, 1996). The estimated prevalence of night blindness in children aged 12-59 months in Bangladesh declined from 3.6% to 0.6% between 1983 and 1997 (HKI/B, 1997; HKI/PHN, 1999). In 1999, approximately 0.3% of children aged 6-59 months were reported by their mothers to have symptoms of night blindness, indicating that the prevalence has been sustained below the level associated with a public health problem.

The decline in night blindness in Bangladesh is largely due to the efforts of the national campaigns to distribute high potency vitamin A capsules (IPHN/HKI, 1999a). The Government of Bangladesh currently aims to give every child in the country aged 12-59 months a capsule of high potency vitamin A twice a year. In June a National Vitamin A Week was conducted with the specific aim of targeting these children with vitamin A capsules. Six months later, in December, vitamin A capsules were distributed to children during the second of the two National Immunization Days to vaccinate children against polio.

The NSP assesses the coverage of each campaign to distribute vitamin A capsules during the survey immediately following the campaign. Mothers are asked whether each of their children aged 12-59 months received a capsule during the campaign. The coverage for all divisions in Bangladesh during the two campaigns in 1999 are shown in Figure 3.5. Overall coverage during the Vitamin A week was 85.0% and coverage during the National Immunization Days was 89.6%. Coverage during the Vitamin A weeks improved considerably from 1998 to 1999, particularly in Chittagong Division, where coverage

Figure 3.5 *Percentage of children aged 12-59 months who were reported to have received a vitamin A capsule during the Vitamin A Week in June and during the National Immunization Day in December in rural Bangladesh in 1999*



increased from 64.4% to 87.2%. The lowest recorded coverage in 1999 was during the Vitamin A Week in Barisal (79.0%). However, this division achieved considerably better coverage during the National Immunization Day (89.5%), which suggests that, with increased efforts, coverage could be improved during future Vitamin A Weeks.

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- Martin W. Bloem, M.D., Ph.D. (Regional Director)
  Established the NSP in 1989 as Country Director for HKI/Bangladesh

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- Lynnda Kiess, M.P.H. (Regional Advisor)
- Saskia de Pee, Ph.D. (Regional Nutrition Research Advisor)

Appendix 1: Profile of the NSP

Severe flooding in Bangladesh in 1987 and 1988 revealed a critical lack of information to guide relief efforts to the neediest geographical areas and people. Helen Keller International (HKI) responded to this information lack by establishing the Nutritional Surveillance Project (NSP) in 1990. Ten years later the NSP has become one of the longest running nutritional surveillance projects in a developing country and has been used as a model for nutritional surveillance systems in other countries, most recently in Indonesia.

The NSP recognizes that child undernutrition is the consequence of multiple interacting determinants. It links information on manifestations of child undernutrition with information on the direct determinants of undernutrition (dietary intake and diseases) as well as the underlying determinants (household food security, maternal and child care, health environment and health services). Many of these determinants are associated closely with poverty and with the social and economic development of the country.

In collaboration with the Institute of Public Health Nutrition (IPHN) and partner non-government organizations (NGOs), the NSP conducts bi-monthly surveys at urban and rural sites throughout Bangladesh. The sampling procedure in rural Bangladesh was revised in 1998 to provide nationally representative information. Data are routinely collected on indicators of child nutrition and health status, receipt of vitamin A capsules, breast-feeding and child feeding practices, food consumption patterns, food prices, agricultural (food) production, household socio-demography, employment status of household earners, parental education and natural disasters. Additional indicators are sometimes added to answer questions on specific issues. Details of the survey methods are provided in Appendix 2.

The information generated by the NSP surveys is disseminated to relevant ministries in the Government of Bangladesh, international agencies and national and international NGOs. The NSP provides policy makers and program managers in many development sectors with accurate and timely information on the magnitude and determinants of nutrition and health problems. It provides a mechanism to plan, monitor and evaluate policies and programs in nutrition, poverty relief and food security. In a country that is repeatedly affected by natural disasters, NSP data can also be used to assess the effects of these disasters and to monitor the coverage and impact of relief and rehabilitation efforts. The analysis of NSP data generates powerful advocacy material to promote policy decisions and program responses to improve the nutrition and health of vulnerable groups, including children and women.

The year 1999 marks the end of the decade that began with ambitious goals to improve the health and well-being of children throughout the world. These goals were set by representatives from 153 countries and various UN agencies attending the World Summit for Children (WSC) in 1990. Amongst the 27 goals set by the WSC to be achieved by the year 2000 were eight that specifically addressed nutritional issues. The NSP has been conducting regular surveys since the beginning of the decade, and collects data on nutritional indicators that are included in several of these goals. Following an overview of the data collected during the six bi-monthly surveys in 1999, this report uses data from the NSP to assess the progress of rural Bangladesh towards achieving the WSC goals for nutrition.

Appendix 2: Survey methods

Sampling

Since February 1998 the NSP has done surveys every two months in 24 *thana* to provide data that are representative of each of the six divisions of Bangaldesh and of the country. The multistage sampling design used by the NSP is shown diagrammatically in Figure A1. Four *thana* were randomly selected from each of the six divisions in Bangladesh when the new sampling design was started in 1998 and these 24 *thana* remain the same from survey to survey. A probability proportionate to size (PPS) sampling technique is used to select 10 clusters (*mauza*) from each of the 24 *thana* in each survey. Within each cluster, 30 households are systematically sampled from one randomly selected village. A household is eligible for inclusion only if it contains at least one physically able child aged 6-59 months and if his or her mother is present.

In 1999 this selection process provided approximately 1,200 households per survey in each division of Bangladesh, 7,200 households per survey in the country as a whole, and 54,000 households during all 6 surveys. The prevalence of wasting among pre-school children was the basis for the sample size calculation (Box 3).

Sample Size Calculation for the NSP

The sample size needed to provide data representative of each division at each survey was calculated to estimate the prevalence of wasting using the following formula:

$n = z^2_{1-\alpha/2} P(1-P)/d^2$

n = sample size
$z^2_{1-\alpha/2}$ = two-sided normal variate (1.96)
P = prevalence of wasting
d = precision

By applying an average prevalence of wasting of 15%, and assuming an absolute precision of 3% and a 95% confidence interval, a minimum of 544 households are required per division. As the NSP uses multistage cluster sampling, a larger sample size is needed to account for the "design effect". Assuming a design effect of 2, the required sample size is 1,088 households per division. This sample size is increased by 10% to allow for some refusals (non-sampling error) and rounded up to 1,200 households per division. As there are six divisions in Bangladesh the total sample size per survey is 1,200 x 6 = 7,200 households.

Survey Teams and Training.

In each of the 24 randomly selected *thana,* HKI works with a well-established local NGO, most of which provide micro-credit or health services to the community. The NGO employs two people, one male and one female, who are responsible for selecting and interviewing members of households in each *mauza*.

HKI provides two weeks of initial basic training to new survey teams and data entry operators, and refresher training for 2-3 days before each survey. The refresher training allows the NGO staff to interact with HKI/B staff, share their experiences, and discuss problems encountered in the field. During these sessions any problems with data quality are shared with enumerators and, where necessary, the sources of problems are identified and resolved. Special training is given when new questions are added or the questionnaire is modified. Through this interactive training process, HKI helps to develop the teams' understanding of the surveillance system. Qualitative 'debriefing' sessions are also occasionally held to gather feed-back about conditions in a *thana* and to assist with the interpretation of the data.

Frequency and Timing of Data Collection

Since its inception, the NSP has conducted bimonthly surveys ('rounds') starting in February, April, June, August, October and December, which coincide with the six seasons in Bangladesh. Data collection in each survey takes approximately 6 weeks to complete. There was one major break in data collection in 1997 when the NSP conducted a National Vitamin A Survey in rural Bangladesh. This national survey replaced the surveys starting in August, October and December 1997.

Appendix 2: Survey methods

Data Collection Instruments

A structured coded questionnaire is administered to each household. The questionnaire is composed of sections on child health and nutrition, household demographic data, socio-economic data, household distress and food availability. A village price form is also filled out to obtain village-level information on the price of staple foods and other essential commodities. An example of a questionnaire administered in 1999 is provided in Appendix 3.

Anthropometry

Naked or lightly clothed children aged 6-59 months are weighed on an electronic scale to the nearest 0.1 kg. If the child is too young to stand on the scale, the mother is weighed alone and with the child in her arms. To obtain the weight of the child, the mother's weight is subtracted from the combined weight of the mother and child. The scales are regularly calibrated against standard weights.

Supine length or standing height are measured to the nearest 1 mm using a locally constructed length board. Mid-upper arm circumference (MUAC) is measured to the nearest 2 mm by using a TALC® insertion tape.

The exact date of birth of a child is often difficult to ascertain but is estimated to the nearest day by using the Bangla yearly calendar and a list of notable events.

Quality Control

To ensure the high quality of data the NSP has monitoring and quality control teams to supervise and monitor data collection by partner NGOs. The monitoring personnel provide on-the-spot training of NGO staff, check equipment, supervise data collection and anthropometric measurements, and assist in the event of problems. The quality control teams re-visit the survey sites without warning during each round of data collection and re-collect data from households surveyed by the NGO teams in the last 24 hours. The teams repeat anthropometric measurements on 5-7% of children and collect information on selected indicators. Data collected by the quality control teams are later compared with the data collected by the NGO teams to provide an assessment of the accuracy of the data.

Data Management

Each partner NGO enters the raw data from the survey forms using a standard data entry program and sends the data files to the NSP Statistical and Data Management Department in Dhaka. There the data files from the 24 sites are merged and a Microsoft FoxPro® program is run to edit and clean the data. The data are checked for consistency and validity using standard procedures.

Data Analysis

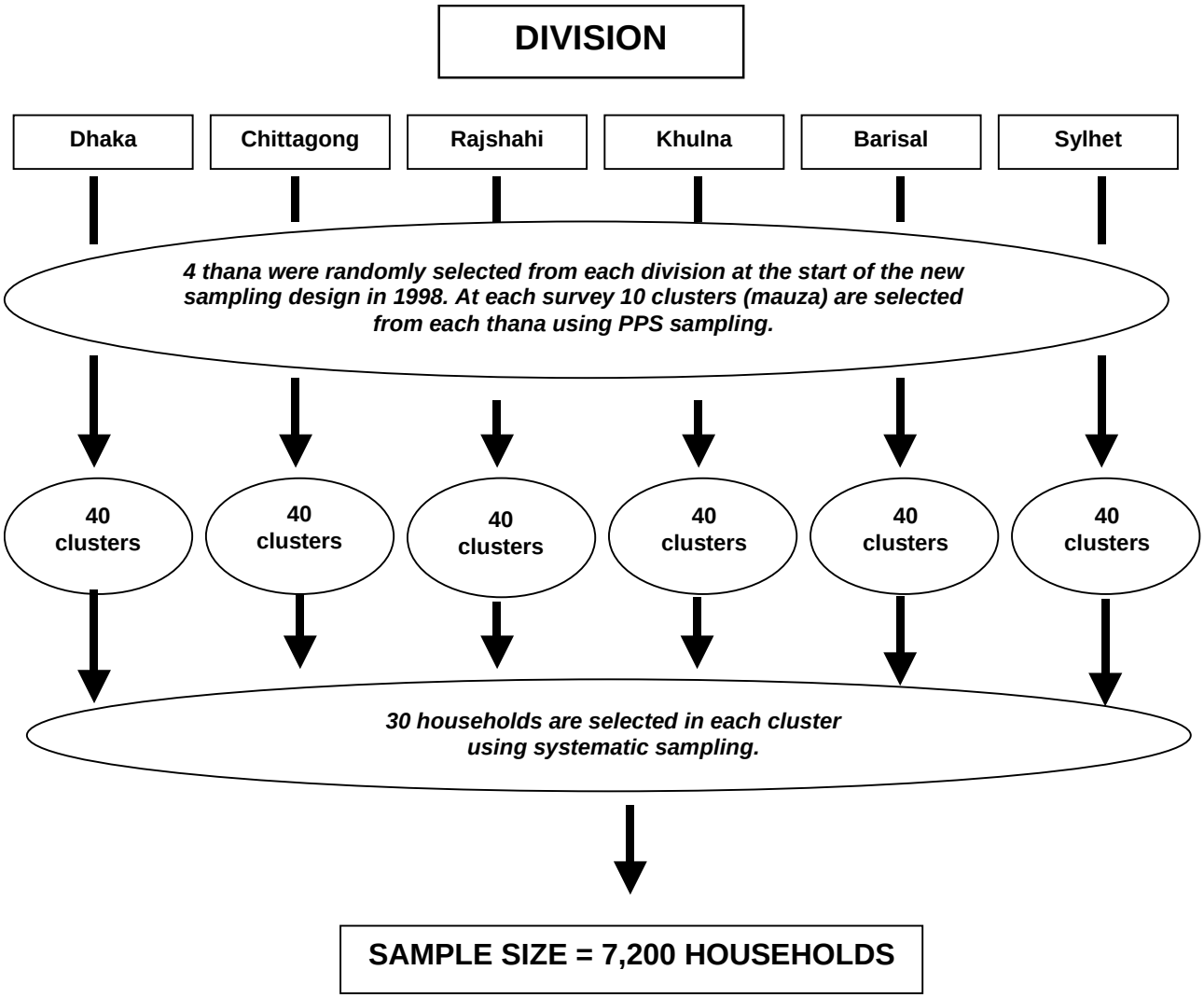
Anthropometric indices are calculated using Anthro software (Sullivan & Gorstein, 1990). This software uses the reference population of the US National Center for Health Statistics to calculate the nutritional indices height-for-age, weight-for-height and weight-for-age.

All data analysis is done using SPSS for Windows statistical software. A routine output for all collected and computed indicators by division is generated for each survey and for annual aggregated data. An appropriate weighting factor (estimated from the divisional proportion of the national population size from the 1991 census) is applied to the data to produce national estimates. Comparisons of proportions and means between divisions, sub-groups or other categories is done using appropriate statistical tests, including Chi-square, t-tests and ANOVA.

Round reports and special topic reports are produced and distributed regularly to provide up-to-date information to local and international agencies.

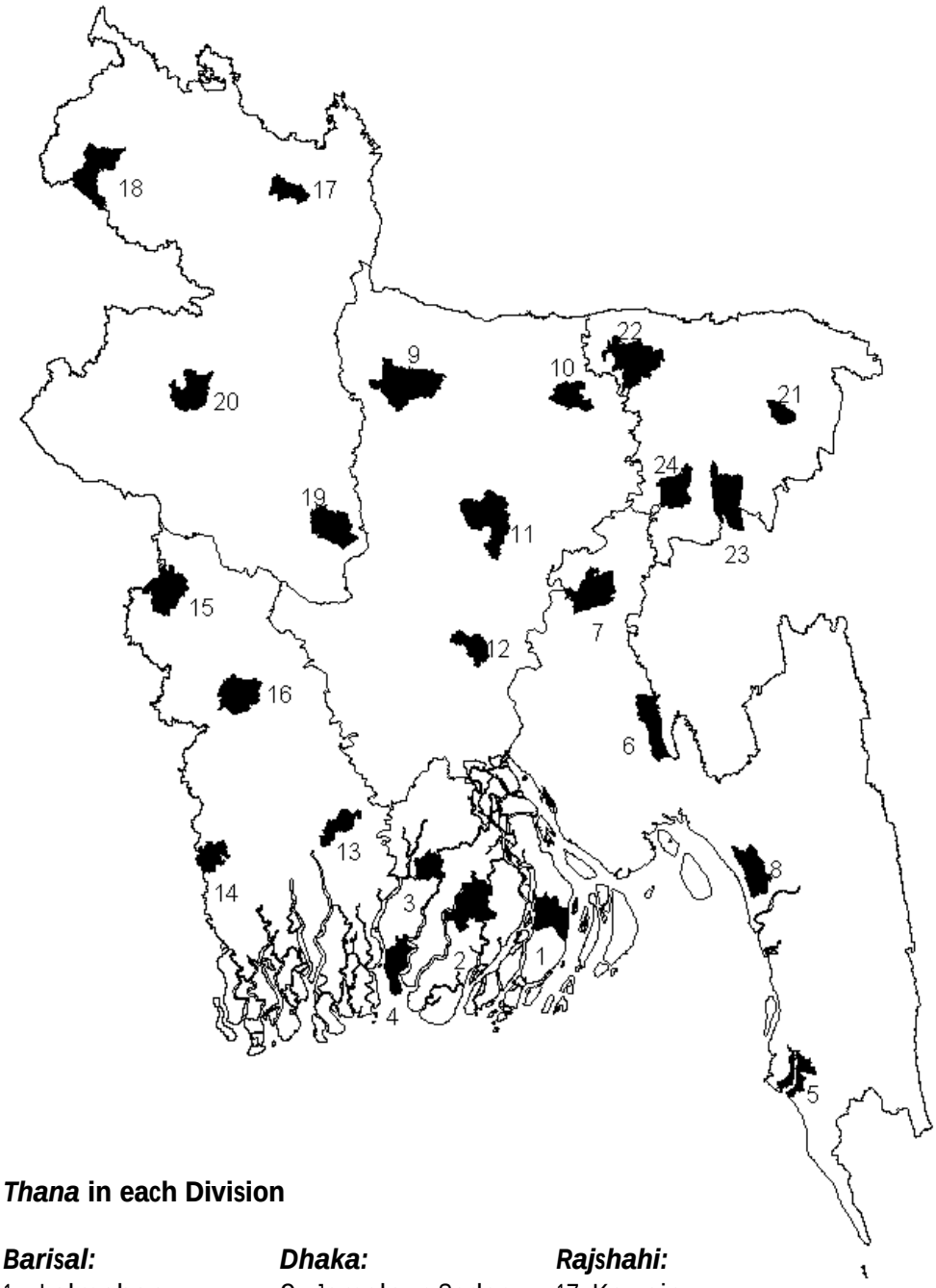
Appendix 2: Survey methods

NSP Sampling Procedure (as from February 1998)



Appendix 2: Survey methods

NSP *Thana* in Rural Bangladesh



***Thana* in each Division**

Barisal:	***Dhaka:***	***Rajshahi:***
1 Lalmohan	9 Jamalpur Sadar	17 Kaunia
2 Patuakhali Sadar	10 Atpara	18 Pirganj
3 Rajapur	11 Sreepur	19 Shahjadpur
4 Patharghata	12 Serajdikhan	20 Naogaon Sadar
Chittagong:	***Khulna:***	***Sylhet:***
5 Cox's Bazar	13 Fakirhat	21 Fenchuganj
6 Chauddagram	14 Debhata	22 Jamalganj
7 Nabinagar	15 Gangni	23 Sreemangal
8 Hathazari	16 Kaliganj	24 Habiganj

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