Demography India Vol. 29. No. 2 (2000), pp. 179-200

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Determinants of Nutritional Status of Young Children in India: An Analysis of 1992-93 NFHS Data

Introduction

MALNUTRITION, specifically undernutrition, is one of the prime causes of morbidity and mortality among young children. Under-nutrition predisposes children to infection, and impairs body's defence mechanism. Severely undernourished children are at a greater risk of dying than are healthy children. A United Nations Panel report states that in the developing world malnutrition is an important cause of infant and young child mortality, stunted physical growth, low work output, premature ageing and reduced life span (United Nations Panel, 1971). Malnutrition refers to the physical effects of dietary intake in human body wherein the intake is inadequate either in quality or quantity, or both. Such a state not only retards physical growth but also affects mental and intellectual development. Malnutrition also lowers resistance to infection, and, in turn, infection accelerates nutritional deficiency, and many deaths among young children are due to this synergic action.

In India the overall nutritional status of young children is far from satisfactory. A survey conducted during 1988-90 by the National Nutrition Monitoring Bureau (NNMB) revealed that between 43 percent of the children in Kerala and 70 percent in Orissa are undernourished (Gopalan, 1995). The National Family Health Survey (NFHS) of 1992-93 showed that over 50 percent of the children of age 0-47 months are undernourished, and 25 percent are severely undernourished (International Institute for Population Sciences, 1995). According to Ali (1992), the most glaring nutritional disorders in India are protein energy malnutrition, and iron, iodine, vitamin A and vitamin B deficiencies. A review of studies conducted during the 1960s and 1970s revealed that the prevalence of nutritional disorders among young children is almost the same in various parts of India. The review also showed that there had been very little change in the nutritional status of children of low-income groups in the country over the review period (Swaminathan, 1979). Thus, malnutrition in general and undernutrition in particular remains a major health problem in India even today. In this paper we attempt to

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identify some of the determinants of severe undemutrition among young children in India using the NFHS data of 1992-93.

Theoretical Background

Malnutrition is not only a cause but also a sensitive indicator of infant and child mortality. Based on a review of six nutrition intervention projects conducted in four countries including two in India, Kielmann *et al. (*1982) conclude that while nutrition intervention seems to have its clear and most important effect on child mortality, the prevalence of malnutrition as a precursor to child mortality is similarly affected. Mosley and Chen (1984) state that since growth faltering indicates the current health status of a population, a health status index based on grade of malnutrition can serve as a measure of the relative risk of various subgroups of the population to mortality in the future. They also identified 14 proximate determinants (or, intermediate variables) of growth faltering (the risk of infant and child mortality) and grouped them into five factors. They are maternal factors (age, parity and birth interval), environmental contamination (air; food/water/fingers; skin/soil/inanimate objects, and insect vectors), nutrient deficiency (calories, protein and micronutrient), injury (accidental and intentional), and personal illness control (personal preventive measures and medical treatment).

By concentrating on mother and child care during antenatal,-natal and postnatal periods, Jain (1988) argues that the chances of infant and child survival depend upon the timing (prenatal, natal and postnatal periods) and the type of (medical and nonmedical) care with which the child is brought up. He identified 6 proximate factors of infant mortality, namely prenatal medical care, prenatal non-medical care, medical care at birth of the child, postnatal non-medical care, postnatal preventive medical care and postnatal curative medical care. On the other hand, Mahadevan (1986) and Rajaretnam (1998) have tried to explain the determinants of child mortality more in terms of the cultural and behavioural aspects of the household and parents than in terms of the biological and medical aspects of the child. Rajaretnam classified the determinants of infant mortality broadly under 5 groups, namely cultural, environmental, socioeconomic, demographic and MCH services. Mahadevan classified the determinants under 12 groups, namely polity and policy, ecology, cultural, familial, marital, parental, conception and pregnancy, perinatal, norms on childcare and socialisation, morbidity and genetic, calamity and accident, and interventions.

A close perusal of these models indicates that many factors, and probably the most important factors, are common in all the models, though they have been treated differently in different models. As we have very limited information in the NFHS on the various cultural and behavioural aspects of the households, we propose to follow the Mosley and'Chen (1984) model which is less dependent on them and also the model is directly focused on the nutritional status of young children. However, depending on the availability of information in the NFHS, we propose to add a few sociocultural variables or attributes so as to make the model more comprehensive.

Variables Selection

In the following paragraphs we provide a brief review of the factors influencing nutritional status of young children (and, infant and child mortality) on the lines of the Mosley and Chen

(1984) model, and identify appropriate variables for the analysis depending on their availability in the NFHS. Mosley and Chen (1984) consider age of the mother at childbirth, birth order of the child and birth interval as the important maternal factors influencing the nutritional status of young children. Though these variables especially the first two are correlated, their individual and joint effects on the nutritional status of young children are considered substantial. Many studies have found that infant and child mortality, or undemutrition, is higher among children bom to mothers at age below 18 and at age after 34, among children of higher birth orders (often order 4 and above), and among children bom with a short birth interval of less than 24 months, than their counterparts (UNICEF, 1984; Population Information Program, 1984; International Statistical Institute, 1984; Gai and Kalamdani, 1987; Lalou and Cheikh, 1993; Desai, 1993; Sommerfelt and Stewart, 1994). We have included all the three variables in this analysis.

Mosley and Chen (1984) refer environmental contamination to the transmission of infectious agents to children (and mothers). The four categories representing the main routes whereby infectious agents are transmitted to human host are air; food/water/fingers; skin/soil/inanimate objects; and insect vectors. A more practical way to assess the relative intensity of environmental contamination is to measure the number of recent episodes (incidences) of acute infectious diseases in the cohort of children under study. A number of studies conducted in different parts of India and elsewhere reveal that infectious diseases, in particular diarrhoeal diseases, are the important causes of malnutrition among children (Punhani and Mahajan, 1989; Martorell and Ho, 1984; Sommerfelt and Stewart, 1994). In the NFHS, we have information on the incidence of diarrhoea and acute respiratory infection (cough with fast breathing) during the 15 days before the survey. We have included both the variables in this analysis.

Mosley and Chen (1984) also suggest that the level of potential exposure to disease can be approximated and scaled by using a series of simple physical indices that are known to be strongly correlated with the levels of biological contamination of the environment. These include housing condition, environmental sanitation, personal hygiene and drinking water, among others. A study by Rajaretnam (1990) in rural Tamil Nadu showed that infant mortality is not much related to housing condition (type of house, number of rooms, etc.) but highly related to environmental sanitation (openair defecation adjoining the house, location of cattleshed in or adjoining the house, sullage nuisance around the house, etc.). With respect to drinking water, the relationship is not clearcut (Shariff, 1996; Sommerfeltand Stewart, 1994;

Registrar General, India, 1983). Since environmental contamination includes a variety of aspects including housing condition and source of drinking water, the individual factors may not be revealing much but their combined effect might be substantial. So, we have constructed an index loosely called housing environment index by combining some aspects of environmental sanitation, housing condition and source of drinking water and it is used in this analysis.'

'The specific aspects included in the housing environment index (with the weights in parentheses) are type of house (2 ifpucca or permanent, 1 ifsemipucca, 0 otherwise), source of drinking water (2 if piped into residence or ground hand-pump within yard, 1 if public tap or public hand-pump, 0 otherwise), toilet facility (2 if flush, 1 if other types, 0 if none), source of lighting (1 if electricity/gas, 0 otherwise), and fuel for cooking (2 ifLPG/Bio-gas/electricity, 1 if Kerosene/coal/charcoal, 0 otherwise). Index grouping: low (0), medium (1-2) and high (3-9).

Nutrient availability to the child as well as to the mother during pregnancy and lactation is an important factor determining the nutritional status of the child. An appropriate way to assess nutrient deficiency is to measure the nutrient intake by the mother and the child. SINCE no such information were collected in the NFHS, we considered nutrient deficiency in mothers by some aspects of pregnancy outcome that are closely related to nutrient intake, such as prematurity of birth and birthweight of the baby,[2] and in children by age at initiation supplementary feeding and duration of breast-feeding. Studies highlight that pregnant mothers with better dietary intake are less likely to deliver their babies prematurely and/or with low birth-weight (Raina, 1971; Natu and Patnaik, 1988;Xu et al., 1995). It is also found in many studies that longer duration of breast-feeding and initiation of supplementary feeding at age 4-6 months of the child help improve its nutritional status (Vijayasree and Satyavani, 1992; Punhani and Mahajan, 1989). We have included all the four variables in this analysis.

The proximate factor 'injury' is measured in terms of the incidence of recent injuries or the cumulative prevalence of injury-related disabilities. However, it is not clear as to what type of injuries are to be considered because certain injuries can cause death of the child without effecting growth faltering. Whatever may be the case, in the NFHS no information related to injury or injury-related disabilities were obtained, and hence this factor is not considered in this analysis.

Personal illness control factors have two components, namely preventive measures and curative measures. The preventive measures include such services as antenatal care and immunisation. For curative measures, the providers of care and the types of therapy taken for specific conditions are assessed. It is found in many studies that women who availed one or the other antenatal, natal and postnatal services have fewer undernourished children than their ! counterparts (Ramachandran, 1989; Punhani and Mahajan, 1989; Xu *etal.,* 1995). Further, Basu (1990) argues that even if the physical environment is poor, better antenatal and natal care would reduce morbidity and mortality among children. It is also found that stunting and underweight are more among children who are not vaccinated against childhood diseases than among children who are fully vaccinated (Sommerfelt and Stewart, 1994; Punhani and Mahajan, 1989). In this analysis we have included two variables on preventive measures namely antenatal/ natal care and child immunisation (each in the form of an index[3]), but no variables on curative measures as information were not available on these aspects in the NFHS.

"The NFHS asked questions on both actual and perceived birth weights of the baby. Since the response to the actual birth weight was very poor (85 percent not weighed or missing as per NFHS report), we have used the perceived birth weiglit in this analysis. The question on the perceived birth weight of baby reads as follows: when (name of child) was born, was he/she large, average, or small? The baby size at birth as perceived by tlie mother is a reasonable substitute for the actual birthweight.

•^itenatal/natal care index (with the weights in parentheses) is based on the number of antenatal visits to the mother by health functionaries and by the mother to health functionaries and clinics (3 if 5 or more visits, 2 if 3-4 visits, 1 if 1 -2 visits, 0 if none), number of doses ofTT injections received (0-3), whether received iron tablets (FSTs)? (1 if yes. 0 otherwise), and delivery attendant (3 if institution, 2 if subcentre/home by health staff, 1 if home by trained birth attendant. 0 otherwise). Index grouping: none (0). low (1-4), medium (5-7) and high (8-10). The child immunisation index includes administration ofBCG and measles vaccines (each one dose), and polio and DPT vaccines (each three or more doses, excluding polio 0). Index grouping: 'none' if received no doses of any immunisation, 'full' if received all doses of each immunisation, and 'partial' otherwise

Sociocultural factors are very important in the analysis of nutritional status of children (or, infant and child mortality). While analysing the determinants of infant and child mortality, Mahadevan *et al*. *(*1986) argue that broadly biofamilial factors are the predominant causes of infant mortality and familio-environmental factors are the important causes of child mortality. Further, in India, male children are valued higher than are female children, and there are evidences of discrimination in respect of food and health care. As a result, the prevalence of undemutrition is often found higher among girls than among boys (Gupta, 1986; Geetha and Swaminathan, 1996; Gopalan, 1995; Reddy *et al*., 1989; Punhani and Mahajan, 1989;
Chakravarthy and Shukia, 1989; Visaria, 1987). However, there are also evidences that the differences are not well marked (Arokiasamy, 1992; International Institute for Population Sciences, 1995). Education of parents is another important factor determining the nutritional status of their young children. Studies have found that literate and educated parents have fewer undernourished children than do illiterate parents have (Ramachandran, 1989; Punhani and Mahajan, 1989; Sommerfelt and Stewart, 1994). Religion and caste are also regarded as factors closely associated with the nutritional status of children. It is often observed that prevalence of malnutrition is higher among children of the socalled low-caste families than among children of the high-caste families (Singh, 1989). However, Shariff(1996) found that religion and caste are not significant factors determining the nutritional status of young children. Depending on the availability of data in the NFHS we have included in this analysis religion, caste (scheduled caste/scheduled tribe or other), education of mother and sex of the child as sociocultural factors. For economic variables, apart from the housing environment index included under environmental contamination, we have considered an index of durable goods possessed by the household,[4] which is related not only to the economic status but also to the modern life style of the households. A few more variables, namely region (group of states)[5] and place of residence (urban or rural) are also included in this analysis.

Nutritional Status Indicators

Nutritional status can be measured in two ways: one, based on 'input' indicators such as food and nutrient intake, and, the other, based on 'output' indicators such as anthropometry (e.g., height, weight and arm circumference) and clinical signs (e.g., colour of eyes and hair, and Hb level). Between the input and output indicators, the input indicators for an individual can vary quickly while the output indicators are relatively more stable over period except in case of sudden, severe illness. Further, the data needed to measure the output indicators can

"The specific aspects included in the index of durable goods possessed (with the weights in parentheses) are refrigerator (2), television (2), radio without television (1), motorcycle/scooter/car (2), bicycle without motorcycle/ scooter/car (1), fan (1), clock/watch (1), and sewing machine (1). Index grouping: low (0), medium (1 -2) and high (3-9).

^le states of India are grouped into 5 regions, namely, the south comprising of Tamil Nadu, Kerala, Kamataka and Andhra Pradesh; the west consisting of Goa, Maharashtra and Gujarat; the north including Punjab, Haryana, National Capital Territory of Delhi, Himachal Pradesh, and Jammu region ofJammu and Kashmir; the large states viz., Uttar Pradesh, Madhya Pradesh, Bihar and Rajasthan; and me Northeast consisting ofOrissa, West Bengal, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Arunachal Pradesh.

be obtained from a single survey whereas a variety of methods are required to measure the input indicators. Even among the output indicators, anthropometry has many advantages over the other indicators in assessing the nutritional status of children. The foremost advantage is that body measurements are sensitive to the full range of malnutrition. The disadvantage is that it lacks specificity and is sensitive to extraneous factors like infection, climate, stress and genetics (Martorell and Ho, 1984).

Different anthropometric measurements are recommended for children of different age groups. From birth to age five, the preferred measurements are weight, height and arm circumference. As data related to weight and height are available in the NFHS, these measurements are used in this paper to assess the nutritional status of children. In this paper we have considered three indices based on weight and height measurements, namely weight-for-age, height-for-age and weight-for-height indices. The height-for-age index measures the linear growth of children. Children who are more than two standard deviation (SD) units (or, Z score) below the median value of a reference population in terms of height-for-age index are considered short for age, or stunted. Stunting is typically associated with inadequate food intake as well as adverse environmental condition for an extended period of time. The weight-for-height index measures body mass in relation to body length. Children who are more than two SD units below the median value of the reference population in terms of weight-for-height index are considered thin, or wasted, indicating the prevalence of acute undemutrition and recent episodes of illness especially diarrhoea. The weight-for-age index is a composite measure that takes into account both chronic and acute undemutrition. Children who are more than two SD units below the median value of the reference population in terms of weight-for-age index are considered underweight (International Institute for Population Sciences, 1995).

In this exercise, the SD units (Z score) is derived using the Epi Info software developed by the Centers for Disease Control and Prevention, Atlanta, USA in collaboration with the World Health Organisation, Geneva, Switzerland (Dean *et al.,* 1995). In this report we mention underweight, stunted and wasted (in general, undernourished) to refer to children with Z score less than -2 (i.e., more than 2 SD units below the reference median value) for weight-for-age, height-for-age and weight-for-height indices, respectively. We also mention severely underweight, severely stunted and severely wasted (in general, severely undernourished) to refer to children with Z score less than -3. Further, we refer to children with positive Z score as well nourished.

Quality of Data

Though the three nutritional status indicators, namely weight-for-age, height-for-age and weight-for-height indices help to assess the degree of undernutrition among children more accurately, the measurement of height and weight and the assessment of age pose severe problems in accurately estimating these indices. So, we have made an attempt here to assess the quality of data with particular reference to the coverage of children for height and weight measurement and the heaping of age, height and weight of children.

TABLE 1: NUMBER OF CHILDREN OF AGE 0-47 MONTHS ELIGIBLE FOR WEIGHT AND HEIGHT MEASUREMENTS AND PERCENTS OF CHILDREN MEASURED WEIGHT AND HEIGHT, BY AGE OF CHILD, ALL-INDIA, 1992-93

Age of *Children* (in months)	Eligible children *for measurement of*		Percentage of children *actually measured*		
	Weight	*Height*	*Weight*	*Height*	*Both*
00-05	6106	4842	81.0	79.8	*79.6*
06-11	5839	4324	87.8	86.5	86.2
12-17	6327	5006	87.4	86.3	86.0
18-23	5295	4017	86.5	85.3	85.0
24-29	5697	4487	84.9	83.8	83.4
30-35	4986	3766	83.8	83.1	82.6
36-41	5760	4539	82.0	80.7	80.3
42-47	5362	4046	80.9	80.4	79.7
00-47	45372	35027	84.3	83.2	82.9
12-47	33427	25861	84.3	83.3	82.9

Notes: Eligible children for weight measurement are all children in the sample households of all states, and for height measurement are all children in the sample households of phase II and phase III states only (i.e., excluding Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Tamil Nadu and West Bengal). The percent of children measured both height and weight is based on the number of children eligible for height measurement. All figures are unweighted.

Table 1 presents the number of children of age 0-47 months eligible for weight and height measurements and percent of children actually measured weight and height, by age of child. Overall, 84 percent of the children of age 0-47 months are measured weight. The proportion of children measured weight is only 81 percent in the age group 0-5 months; it increases to 88 percent in the age groups 6-11 and 12-17 months, and then slowly decreases and reaches 81percent in the age group 42-47 months. The proportion of children measured height is about 1 percentage point less than the percent of children measured weight in almost all age groups. It is to be noted that height was not measured in the phase-I states, namely Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Tamil Nadu and West Bengal. The proportion of children measured both height and weight is again 0.2 to 0.7 percentage points less than the percent of children measured height. The major reasons stated for not measuring height/weight (table not shown) are that the mother refused to allow the investigator/measurer to take measurement of the child (39 per cent), the child was not present for taking measurement (33 per cent), the child did not allow or cooperate (16 per cent), and the child was sick (10 per cent). An analysis of the coverage of children for weight and height by region, place of residence, religion, housing environment index, sex of child, order of birth, age of mother at childbirth, and education of mother (table not shown) showed that the differences are negligible.

It is a known fact that many parents in India do not maintain a record of the date of birth of their children. In the NFHS, the respondents (evermarried women age below 50) were asked a series of questions to assess the most probable date of birth of their children. For the evaluation of the age data, we have divided the age (measured in completed months) as assessed in the

survey by 6 and obtained the per cent distribution of children by the remainder number (0-5). Any unequal distribution of children by the remainder-number is a reflection of age heaping, For example, a higher proportion of children with remainder-number zero (0) is an indication ol heaping of age in half and full years. The analysis of the data (see Table 2) showed that then is no significant concentration of children in any of the remainder-numbers, including the| number 0. That is, heaping of age of children especially in half years and full years is negligible. |

TABLE 2: PERCENT DISTRIBUTION OF CHILDREN BY REMAINDER-NUMBER/TERMINAL-DIGIT FOR (i.e., heaping of) AGE, WEIGHT AND HEIGHT OF CHILDREN, ALL-INDIA. 1992-93

*Digit**	*Age*	*Weight*	*Height*
0	18.1	12.8	16.6
1	17.5	8.6	10.1
2	17.0	12.4	14.4
3	16.3	7.6	10.3
4	15.7	9.1	8.5
5	15.3	15.9	12.5
6	NA	8.9	8.1
7	NA	6.2	6.5
8	NA	8.9	6.6
9	NA	9.5	6.4
Total	100.0	100.0	100.0

'Digit' refers to remainder-number for age, and terminal-digit for weight and height.
'NA' Not applicable.

According to the NFHS report, the weight of each child was measured to the nearest 100 grams using a salter scale (hanging spring balance) and the height/length was measured to the nearest millimetre using an adjustable measuring board. Further, the height was measured in standing position for children of age 24 months and above and in lying-down position otherwise (International Institute for Population Sciences, 1995). However, the data (table not shown) indicated that 1 to 2 percent of children of age below 12 months, 13 percent of children of age 12-17 months and 23 percent of children of age 18-23 months are measured height in standing position. On the other hand, 21 percent, 13 percent, 5 percent and 2 percent of children of age 24-29 months, 30-35 months, 36-41 months and 42-47 months, respectively, are measured height in lying-down position. Therefore, necessary adjustments are made in the data before estimating the degree of undernutrition[6].

For a child, its length (measured in lying position) is usually higher than its height (measured in standing position). The EPI Info software used in this exercise to derive Z score requires that the height be measured in lying position if the child is less than 24 months old and in standing position otherwise. As such the NFHS data needed some correction factors and it was done as follows. If the child was age below 12 months, its height was taken as measured in lying position even if its height was reported as measured in standing position, as it is extremely unlikely that the child could be measured in standing position. If the child was age 12-23 months and its height was measured in standing position men one centimetre was added to its recorded height. If the child was age 24-35 months and its height was measured in lying position men 1.5 centimetres was deducted from its recorded height. And, if the child was age 36-47 months and its height was measured in lying position then 2 centimetres was deducted from its recorded height. Further, wherever 'the way height measured' was missing, it was assumed as 'in lying position' if the child was age less than 24 months and as 'in standing position' otherwise.

In the absence of weight and height heaping, we expect that the proportion of children in each terminal digit (0 to 9) when weight is recorded to the nearest 100 grams and height to the nearest millimetre, would be 10 percent. Any significant deviation from this would be an indication of heaping of height and weight. An analysis of the data (see Table 2) reveals that, the heaping is substantial in the terminal digits 5,0,2 (16 to 12 percent of cases) for weight, and in the digits 0,2, 5 (17 to 12 percent of cases) for height. On the other hand, the digits 7 to 9 recorded each 6 to 9 percent of the cases only. That is, the heaping of weight and height is substantial in the digits 0, 2 and 5, and to that extent it will have some impact on the estimated degree ofundemutrition. Further, a preliminary analysis of the Z score showed that around one percent of the cases was recorded with extreme values of weight/height. These cases are excluded from the further analysis.

Extent of Children Undernourished

Table 3 gives the percent of children classified as severely undernourished (Z score less than -3), percent classified as undernourished (Z score less than -2) and percent classified as well nourished (Z score greater than or equal to 0) according to weight-for-age, height-for-age and weight-for-height indices of nutritional status, by age of child. The table clearly shows that both chronic and acute undemutrition (stunting and under-weight, respectively) are widely prevalent in India. According to the data, majority of the children of age 0-47 months are underweight (54 percent) and an equal proportion are stunted. The proportion of children severely undernourished is also substantial: 23 percent according to weight-for-age index and 31 percent according to height-for-age index. If we consider the age group 12-47 months, the proportion of children undernourished is still higher: around 62 percent according to both weight-for-age and height-for-age indices, and the proportion of children severely undernourished is 27 percent and 37 percent, respectively. However, wasting (Z score less than -2 for weight-for-height index) is not as serious as underweight and stunting but still substantial: 18 per cent for the age group 0-47 months and 20 per cent for the age group 12-47 months. One reason for this is the fact that majority of the children are both underweight and stunted. On the other hand, the proportion of children of age 0-47 months classified as well nourished is below 7 per cent according to weight-for-age index and less than 12 percent according to height-for-age index. The figures for the children of age 12-47 months are 4 percent and 8 per cent, respectively. All these indicate a dismal picture of the nutritional status of the children in India.

The prevalence of undernutrition is relatively low among the children of age 0-11 months than among the children of age 12-47 months. The proportion of children underweight increases rapidly from 19 percent in the age group 0-5 months to 46 percent in the age group 6-11 months and to 65 percent in the age group 12-23 months. The proportion then declines slowly to 63 percent in the age group 24-35 months and to 59 percent in the age group 36-47 months. On the other hand, the proportion of children stunted increases progressively in the whole age range 0-47 months, though the rate of increase is much less in the age range 12-47 months than in the age range 0-11 months. For example, the proportion of children stunted

increases from 22 percent in the age group 0-5 months to 36 percent in the age group 6-11 months and to 57 percent in the age group 12-23 months. It further increases slowly to 61 percent and 67 percent in the age groups 24-35 months and 36-47 months, respectively. The analysis indicates that undernutrition is not a serious problem during the first 6 months of the child, but as the child grows further the prevalence of underweight rapidly increases and reaches a maximum level by age around 23 months and the prevalence of stunting continues to increase through age 47 months.

TABLE 3: PERCENT DISTRIBUTION OF CHILDREN OF AGE 0-47 MONTHS, AND PERCENT OF CHILDREN SEVERELY UNDERNOURISHED, PERCENT UNDERNOURISHED AND PERCENT WELL NOURISHED FOR WEIGHT-FOR-AGE. HEIGHT-FOR-AGE AND WEIGHT-FOR-HEIGHT INDICES, BY AGE OF CHILD, ALL-INDIA, 1992-93

Age Group	*Children* (percent)	*Severely under-nourished*	*Under nourished*	*Well-nourished*
Weight-for-age				
00-05	13.8	4.8	18.9	19.3
06-11	13.1	17.2	45.9	7.9
12-23	26.4	29.6	646	3.8
24-35	23.1	28.5	63.3	4.8
36-47	23.6	23.9	59.3	3.9
00-47	100.0	23.0	54.3	6.7
12-47	73.1	27.4	62.5	4.1
Height-for-age				
00-05	14.4	11.0	21.5	27.4
06-11	12.0	17.1	36.2	15.7
12-23	26.8	31.4	56.5	8.5
24-35	23.1	37.2	61.4	8.0
36-47	23.7	41.6	66.5	7.4
00-47	100.0	30.5	52.5	11.7
12-47	73.5	36.5	61.3	8.0
Weight-for-height				
.00-05	13.5	4.1	11.6	31.9
06-11	12.1	4.4	17.1	24.8
12-23	27.0	7.7	30.0	12.8
24-35	23.3	3.5	15.6	16.8
36-47	24.0	2.7	12.0	19.9
00-47	100.0	4.6	18.3	19.5
12-47	74.4	4.8	19.7	16.3

Note: Height-for-age and weight-for-height indices are based on data for phase II & phase III states only. The \ figures are weighted for all India sample design.

Undernutrition by State

Table 4 presents the percent of children of age 12-47 months undernourished and percent severely undernourished by state. The proportion of children underweight (Z score less

TABLE 4: PERCENT OF CHILDREN OF AGE 12-47 MONTHS SEVERELY UNDERNOURISHED (Z score less than-3) AND PERCENT UNDERNOURISHED (Z score less than-2) FOR WEIGHT-FOR-AGE, HEIGHT-FOR-AGE AND WEIGHT-FOR-HEIGHT INDICES, BY STATE, 1992-93

Region And states	*Weight for -age*		*Height for Age*		*Weight for -age*	
	severely undernourished	*under nourished*	*severely undernourished*	*under nourished*	*severely under-nourished*	*under-nourished*
South						
Andhra Pradesh	23.9	61.1	u	u	u	u'
Kamataka	25.2	63.6	30.1	58.4	3.4	18.5
Kerala	8.0	34.3	12.0	32.5	1.7	'13.6
Tamil Nadu	17.8	56.1	u	u	u	u
West						
Goa	12.2	40.3	13.7	35.4	4.0	18.5
Gujarat	23.1	58.4	32.2	56.5	5.0	20.9
Maharashtra	27.8	64.8	30.7	60.0	6.0	22.1
North						
Delhi (NCT)	16.1	50.2	25.6	52.9	3.9	13.5
Haryana	11.6	46.7	24.9	55.8	1.2	7.3
Himaehal	18.3	58.9	u	u	u	u
Jamniu	17.2	51.6	22.4	46.8	4.6	17.2
Punjab	18.1	54.3	19.2	46.2	4.8	24.2
Large states						
Bihar	40.8	72.4	50.5	72.4	5.7	24.4
Madhya Pradesh	34.5	67.8	U	u	u	u
Rajastlian	25.7	48.5	34.5	50.1	10.0	23.6
Uttar Pradesh	31.0	68.7	45.2	70.6	3.5	17.2
North-east						
Assam	23.9	60.0	33.2	60.7	2.2	12.6
Orissa	27.8	61.1	30.7	55.7	5.8	25.1
West Bengal	26.4	66.6	u	u	u	u
Small states						
(North-east)						
Arunaclial	17.8	46.6	38.8	63.5	6.1	13.5
Manipur	12.3	40.4	23.9	44.9	2.5	10.8
Meglialaya	22.7	52.6	48.5	62.7	7.4	19.0
Mizorain	4.4	32.8	19.2	49.4	1.1	3.0
Nagaland	11.3	36.9	18.6	41.3	3.8	15.5
Tripura	21.0	55.4	25.1	52.7	1.3	19.2

Note: The figures are weighted for the sample design of the respective states. A' u' indicates that the index is not worked out, as the children in the state are not measured height.

than -2 for weight- fbr-age) varies from a high of 72 percent in Bihar to a low of 33 percent in Mizoram. Apart from these two states, Uttar Pradesh, Madhya Pradesh, West Bengal, Maharashtra, Karnataka, Assam, Andhra Pradesh and Orissa have recorded more than 60 percent of the children underweight, and Goa, Manipur, Nagaland and Kerala have recorded around 40 per cent or less than 40 percent of the children underweight. The pattern is almost the same in respect of children severely underweight (Z score less than -3 for weight-for-age):
it ranges from 41 percent in Bihar to 4 percent in Mizoram.

With respect to stunting (Z score less than -2 for height-for-age), again Bihar shows the highest figure of 72 percent, closely followed by Uttar Pradesh (71 percent). The other states with a figure of 60 percent or more are Assam, Maharashtra, Meghalaya and Arunachal Pradesh. On the other hand, Kerala shows the lowest figure of 33 per cent, closely followed by Goa (35 percent). The proportion of children severely stunted (Z score less than -3 for height-for-age) is also highest in Bihar (51 percent), closely followed by Meghalaya (49 percent). The lowest is again Kerala (12 percent), and the next lowest is Goa (14 percent). As in the case of weight-for-age index, most of the states showing a higher proportion of children stunted also show a relatively higher proportion of children severely stunted (correlation coefficient 0.91).

The weight-for-height index shows that the states Bihar, Gujarat, Maharashtra, Orissa, Punjab and Rajasthan have more than 20 percent of the children wasted (Z score less than -2 for weight-for-height), and only two states namely Haryana and Mizoram have less than 10 percent of the children wasted. A close look at the weight-for-age and height-for-age indices reveal that in all the northeastern states except Tripura, the proportion of children severely stunted is higher than the proportion of children severely underweight. The differences are especially high in the states of Mizoram, Meghalaya and Arunachal Pradesh. Further, most of the states showing a higher proportion of children underweight also show a relatively higher proportion of children stunted (correlation coefficient 0.8).

Determinants of Nutritional Status

For the present analysis of determinants of nutritional status, we have considered children of age 12-47 months only. We have not included children of age 0-11 months as the coverage of children in the age group 0-5 months is relatively low and there is a steep increase in the proportion of children undernourished by age up to 11 months, which means that their nutritional status is unstable. Further, the nutritional status of children of age 0-11 months is determined more by the factors associated with the health and nutritional status of their mothers during pregnancy and even earlier and we have very little information on these aspects. With respect to the choice of nutritional status indices for the analysis, as the proportion of children undernourished (Z score less than -2) is very large (above 60 percent) for both weight-for-age and height-for-age indices and the proportion of children severely undernourished (Z score less than -3) is substantial (27 to 37 percent), we have considered it more appropriate to concentrate on the study of detenninants of severe undernutrition, based on these two indices. This will help to identify the specific factors determining severe undernutrition, which are

more relevant for policy considerations. With respect to weight-for-height index, we have decided to examine the determinants of wasting (Z score less than -2) as only 20 percent of the children in the age group 12-47 months are wasted. As these indices (dependent variables) are dichotomous in nature, we have applied logistic regression (logit) model to the data.

The explanatory variables (each represented in categories) included in the analysis are: age of child as control variable; age of mother at child birth, birth order of child and birth interval as maternal factors; an index of housing environment, incidence of diarrhoea and symptoms of acute respiratory infection (during the 15 days before the survey) as factors of environmental contamination; prematurity of birth, size of baby at birth, age at initiation of supplementary feeding and duration of breastfeeding as indicators of nutrient deficiency; an index of antenatal and natal care and an index of child immunisation as personal illness control factors; and religion, SC/ST status, education of mother, sex of child, region, place of residence and an index of durable goods possessed as sociocultural and economic factors. We have not included interaction terms in this analysis as a preliminary analysis of the data showed that inclusion of the.terms like age of mother at child birth by birth order, experience of diarrhoea by housing environment, and education of mother by index of durable goods possessed, did not reveal significant interaction effects. The categories for the independent variables, the logistic regression estimate of odds ratios and the significance levels of the corresponding logistic regression coefficients for the three nutritional status indicators are presented in Table 5.

We have already discussed that the percent of children severely underweight increases with the age of the children up to 23 months and then slowly decreases as the age of the children further increases, while the proportion severely stunted increases throughout the age range 12-47 months. The multivariate analysis of the data also reveals almost the same pattern; the children of age 24-35 months are equally likely and the children of age 36-47 months are less likely to be severely underweight as that of the children of age 12-23 months. With respect to severe stunting, the odds ratio for children of age 24-3 5 months are 1.4 times higher and for children age 36-47 months 1.6 times higher than that of children age group 12-23 months. The analysis indicates that as children in India grow, they become less and less underweight but more and more stunted.

Maternal Factors

Generally, children born to mothers at age below 18 and at age above 34 are more susceptible to undernutrition than are children born to mothers at age 18-34. However, both weight-forage and height-for-age indices for the data show that the proportion of children severely undernourished decreases as the age of mother at child birth increases, even beyond age 34. As compared with the likelihood of children being severely undernourished among those born to mothers at age below 18, the likelihood of children being severely undernourished is slightly less if they are bom to mothers at age 18-24, substantially less if they are born to mothers at age 25-34, and further less if they are bom to mothers at age 35 and above. It is to be mentioned here that while only 5 percent of the children are born to mothers at age 35 and above, a significant proportion of 10 percent of the children are born to mothers at age below 18.

TABLE 5: LOGISTIC REGRESSION ESTIMATES OF ODD-RATIOS AND THE SIGNIFICANCE LEVELS OF THE CORRESPONDING REGRESSION COEFFICIENTS ,FOR CHILDREN OF AGE 12-47 MONTHS SEVERELY UNDERWEIGHT (Z SCORE LESS THAN -3 FOR WEIGHT-FOR-AGE INDEX), SEVERELY STUNTED (Z SCORE LESS THAN -3 FOR HEIGHT-FOR-AGE INDEX) AND WASTED (Z SCORE LESS THAN -2 FOR WEIGHT-FOR-HEIGHT INDEX), ALL-INDIA, 1992-93

Variables and categories	*Percent of children measured.*		*Odd-ratios and significance levels for children of age 12-47 months:*		
	Weight	*Height*	*Severely underweight*	*Severely stunted*	*Wasted*
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Age of child (in months)					
12-23!	36.3	36.5	1.00	1.00	1.00
24-35	31.7	31.4	1.02	1.39***	0.44***
36-47	32.0	32.1	0.75***	1.58***	0.32***
Age of mother at child birth					
<=17!	9.8	8.3	1.00	1.00	1.00
18-24	51.9	50.9	0.83***	0.83**	0.97
25-34	33.3	35.1	0.75***	0.69***	0.92
35-49	5.0	5.6	0.68***	0.65***	1.01
Order of birth					
I!	27.2	25.9	1.00	1.00	1.00
2-3	42.3	41.7	1.10*	1.04	1.08
4-5	9.3	20.3	1.24***	1.28**'	L10
6+	11.2	12.1	1.39***	1.46**'	0.98
Birth interval (in months)					
<24!	17.9	18.8	1.00	1.00	1.00
24+@	82.1	81.2	0.86***	0.86***	1.14*
Housing environment (index)					
Low!	27.9	26.2	1.00	1.00	1.00
Medium	37.7	37.3	0.90**	0.98	0.99
High	34.4	36.5	0.77***	0.87*	0.99
Diarrhoea during 15 days					
No!	90.9	90.4	1.00	1.00	1.00
Yes	9.1	9.6	1.50***	1.15**	1.18**
ARI during 15 days					
No!	93.6	93.7	1.00	1.00	1.00
Yes	6.4	6.3	1.02	1.01	1.01
Prematurity of birth					
On time!	97.9	98.3	1.00	1.00	1.00
Premature	2.1	1.7	1.31**	1.09	0.87
Baby size at birth					
Small!	18.9	18.7	1.00	1.00	1.00
Average	66.3	67.8	0.71***	0.90**	0.74***
Large	14.8	13.5	0.46***	0.73***	0.56***
Age at supplementary feeding (in months)					
<=3!	34.4	33.3	1.00	1.00	1.00
4-6.	31.7	31.6	1.02	1.11**	1.04

High	25.6	22.6	0.75***	0.68***	1.00
Child immunization					
None!	31.1	34.0	1.00	1.00	1.00
Partial	32.6	31.3	*0.92**	0.95	0.99
Full	36.2	34.7	0.92*	0.85***	0.96
Region					
South!	20.2	11.3	1.00	.00	1.00
Large states	42.8	48.8	1.49***	.77***	1.08
West	14.4	20.4	1.41***	.34***	1.29***
North	7.4	9.5	0.83*	.02	0.78*
North-east	15.3	10.0	1.08	.04	0.96
Residence					
Rural!	76.1	76.7	1.00	.00	1.00
Urban	23.9	23.3	1.00	.02	0.99
Religion					
Hindu!	80.3	78.7	1.00	.00	1.00
Muslim	15.5	16.1	1.06	.08	0.94
Christian	4.2	5.3	0.81*	0.94	1.28**
Belongs to SC/ST?					
No!	76.2	75.8	1.00	1.00	1.00
Yes	23.8	24.2	1.09*	0.93	1.24***
Education of mother (standard completed)					
Illiterate^	64.3	64.9	1.00	1.00	1.00
0-6	13.7	12.7	0.87**	0.84**	0.95
7-9	11.4	11.7	0.74***	0.66***	0.88
10+	10.5	10.7	0.54***	0.50***	0.75***
Sex of child					
Male!	50.8	51.3	1.00	1.00	1.00
Female	49.2	48.7	1.11***	1.15***	0.81***
Durable goods possessed (index)					
Low!	35.1	33.8	1.00	1.00	1.00
Medium	35.1	35.4	0.82***	0.86***	0.85***
High	29.9	30.8	0.65***	0.69***	0.85*
Unweighted cases			26309	20003	19882
-2 Log-Likelihood			7187.5	6055.5	4630.0
Chi-Squared(38df)			2045.4	1986.5	1077.1
Significance Level			0.0	0.0	0.0

***P< 0.001 **P<0.01 *P<0.05

! Reference category

@ Includes first order births

Includes illiterate among those who attended school.

The risk of severe underutrition increases with the birth order of the child and the pattern is true of both weight-for-age and height-for-age indices. As compared with children of first ' order births, the relative risk of being severely undernourished is slightly more for children of birth orders 2-3, higher for children of birth orders 4-5, and further higher for children of birth orders 6 and above. The analysis confirms that children of higher birth orders are at a greater risk of being undernourished than are children of lower order births. With respect to birth interval, children bom after 2 years of their immediate elder ones (or born as first order births) are at a lower risk of being severely undernourished than are children born within 2 years, and the relationship is statistically highly significant.

Environmental Contamination

Under environmental contamination, the index of housing environment shows a clear pattern of relationship with undemutrition among young children. After controlling for the effect of all other factors, the relative risk of a child being severely underweight and severely stunted is less if the housing environment in which the child lived is rated high than if it is rated low. The odds-ratios for the two measures of undemutrition are 0.77 and 0.87, respectively, which are significantly low. The analysis indicates that better housing environment is important for the healthy growth of children. Similarly, children who had diarrhoea during the 15 days before the survey show a clear sign of being severely undernourished especially with respect to weight-for-age index. The odds ratios of children being severely underweight are one and a-half times more if they had diarrhoea during the 15 days before the survey. In comparison, the value of odds ratios for severely stunted and wasted children is much lower. On the other hand, the impact of incidence of acute respiratory infection (ARI) during the 15 days before the survey on the nutritional status of the children is very weak. The relative risk of a child being severely undernourished (for different nutritional status indicators) is just the same whether a child had ART or did not have ARI during the 15 days before the survey. The analysis indicates that for young children, experience of diarrhoea is more problematic than ARI, and the impact is more on their weight than on their height.

Nutrient Deficiency

The four variables considered under this factor are prematurity of birth, baby size at birth, age at initiation of supplementary feeding and duration of breastfeeding. The data reveal that only about 2 percent of the children are reportedly born prematurely and, other things being equal, they are much more likely to be severely underweight than are the children born on time, and the relationship is statistically significant at 1 percent level. However, the height-forage and weight-for-height indices do not show any significant relationship with prematurity of birth. These indicate that prematurity inhibits weight gain and not the height of the child. The baby size at birth, as perceived by the mother, is 'small' in respect of 19 percent of the children, 'large' in respect of another 15 percent of the children and 'average' in respect of all others (66 percent). The analysis of the data shows that this variable is significantly related to all the three nutritional status indicators. As against children whose size at birth is perceived 'small', the relative risk of children being severely underweight is less if their size at birth is

perceived 'average' and more if their size at birth is perceived 'large'. The odds ratios of children being severely undernourished is twice as high if the size of children at birth is small compared to large and one and a-half times if the children are average in size. The corresponding figures are one and a-half times and 1.1 times for children being severely stunted, and almost twice and 1.3 times for children being wasted.

Studies recommend that breast-milk alone is sufficient during the first 4-6 months of the baby and then supplementary feeding should be initiated while continuing breast-feeding. However, in our sample, more than one-third (34 percent) of the children received supplementary feeding even before they are 4 months old, and an equal proportion received it only after they are 6 months old, including 13 percent who received it after infancy. The results of the logistic regression analysis is that there is no significant relationship between age at initiation of supplementary feeding and the prevalence of severe undernutrition among the children. A similar finding is evident with respect to duration of breastfeeding as well. In the sample, a good proportion of children (13 percent) was discontinued breastfeeding during infancy itself. However, children discontinued breastfeeding during infancy and continued breastfeeding beyond infancy do not differ in their nutritional status, and it is true of all the three nutritional status indicators. It is probably that age at initiation of supplementary feeding and duration of breastfeeding are weak indicators of the nutritional status of children as they do not take into account the frequency and intensity of feeding by age of the child.

Personal Illness Control

Under personal illness control factors, we have considered antenatal and natal care, and child immunisation. Antenatal and natal care are represented in the form of an index comprising of the number of antenatal visits made by health functionaries to the mother, the number of antenatal visits made by the mother to health functionaries and clinics, TT immunisation, participation in supplementary feeding programme and type of delivery attendant. In the sample data, the mothers of as many as 27 percent of the children have not received any of the above services, and the figure went up to 31 percent if only the second and third phase survey states are considered. On the other hand, the mothers of only 26 percent of the children have utilised most of the services. The logistic regression results reveal that there is a strong relationship between availing antenatal and natal services by the mothers and the nutritional status of their children in respect of both weight-for-age and height-for-age indices. However, the weight-for-age index does not show any significant relationship between low and medium utilisation categories. In general, as compared with children whose mothers received no antenatal and natal services, the children whose mothers received substantial (high) antenatal and natal services are less likely to be severely undernourished.

In a similar way, child immunisation shows some impact on the nutritional status of the children. In the sample, nearly one third of the children received no immunisation and another 36 percent received all the applicable immunisations (3 or more doses each of DPT and Polio, excluding polio 0; and one dose each of BCG and Measles). After adjusting for all other factors, a child who received partial or all immunisations is less likely to be severely underweight and severely stunted as that of a child who received no immunisation. Though

the differences are not substantial, the indications are that child immunisation tends* undemutrition among young children in India.

Sociocultural Factors

Under sociocultural factors, region, place of residence, religion, SC/ST status, education of mother, sex of child and an index of durable goods possessed are included. The analysis indicates that there are clear regional differences in the extent of children severely undernourished in respect of all the three nutritional status indicators. The likelihood of a child being severely undernourished is the lowest in the southern region (comprising Andhra Pradesh, Karnataka, Kerala and Tamil Nadu) and the highest in the four large states (namely Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan). As against the likelihood of a child being severely undernourished in the southern region, the likelihood of a child being severely undernourished is also higher in the western region (viz. Goa, Maharashtra and Gujarat) while the other regions showing no significant difference in the likelihood ratios. At the same time, it is surprising to note that the children of both rural and urban areas are equally likely to be severely undernourished in respect of all the three nutritional status indicators. That is, the nutritional status of urban children is no better than their rural counterparts once we control for the socioeconomic and environmental condition in which they live.

At household level, religion plays only a moderate role in the nutritional status of the children. There is no significant difference in Hindu and Muslim children being severely undernourished, however, Christian children are likely to be more severely stunted than Hindu or Muslim children. Though undernutrition is slightly less among Christian children, they represent a meagre 4 percent of all children in India. The analysis shows that religion as such does not play a significant role in determining the nutritional status of the young children in India. Further, nearly one-fourth of the children in the study sample are belonging to scheduled caste and scheduled tribe communities (SC/STs). For, as against the children of non-SC/ST communities, the likelihood of children of SC/ST communities being severely underweight is only slightly higher and being severely stunted is rather lower.

Education of mother has shown a strong influence on the nutritional status of the children in India. The odds ratio for the children of illiterate mothers to be severely undernourished are almost twice as high as that of children of mothers who completed high school education. The analysis clearly reveals that, other things being equal, even small achievements in female education will have substantial impact on the nutritional status of the children in India. With respect to sex of the child, it is often argued that female children are discriminated against childcare, food distribution and even medical care, and hence their nutritional status is poorer than their male counterparts. The NFHS data do support this contention but not very strongly. Both the weight-for-age and height-for-age indices consistently show that female children are more likely to be severely undernourished than male children. However, the weight-for-height index shows the reverse pattern: the likelihood of female children being wasted is less than that of male children.

We have already discussed that the index of housing environment is both an economic factor and a household level environmental factor, and is significantly related to the nutritional

status of the children. Similarly, possession of modem goods like television, radio, clock/ watch, sofa set, sewing machine, fan, bicycle, motorcycle/scooter, etc. by the household is an indicator of the economic status as well as the modem life style of the household. An index constructed based on possession of these modem goods (loosely called index of durable goods possessed) shows a strong relationship with the nutritional status of the children even after controlling for the effect of all other factors. Specifically, both the weight-for-age and height-for-age indices show that the children of households with a 'high' measure of durable goods are less likely to be severely undernourished as that of the children of households with a 'low' measure (possessed no listed items) of durable goods.

Summary and Conclusion

In this paper an attempt has been made to study the determinants of severe undernutrition (underweight, stunting and wasting) among children of age 12-47 months in India using the NFHS data collected during 1992-93. For this purpose, we have followed the Mosley and Chen (1984) model that considers growth faltering as a function of maternal factors, environmental contamination, nutrient deficiency, injury, and personal illness control. We have considered three indices of nutritional status based on weight and height namely weight-for-age, height-for-age and weight-for-height indices. An analysis of the quality of data on the coverage of children, age of child, and height and weight measurements showed that the quality is reasonably good though there are shortcomings. According to the data, majority of the children of age 12-47 months (62 percent) in India is underweight and an equal proportion is stunted. The proportion of children severely underweight is 27 per cent and the proportion severely stunted is 37 percent. The proportion of children undernourished varies from 30 to 72 percent among different states. It is exceptionally high in the states of Bihar, Uttar Pradesh and Madhya Pradesh and reasonably low in the states of Goa, Kerala and Mizoram.

A logistic regression analysis of the data showed that as the children of India grow above 2 years, they become less and less underweight but more and more stunted. With respect to maternal factors, children born to very young mothers (age below 18), children of higher birth orders (4+) and children bom with a birth interval of less than 2 years are at a higher risk of being severely undernourished than their counterparts. With respect to environmental contamination, the housing environment in which the children live is important for their health and growth. Similarly, children with recent episodes of diarrhoea are more likely to be severely undernourished, particularly severely underweight, than those not experienced diarrhoea. As a factor of nutrient deficiency, prematurity of birth tends to inhibit gain in weight but not in height. Further, low birthweight babies are at a greater risk of being severely undernourished as they grow than their counterparts. Though initiation of supplementary feeding at age 4-6 months and continuing breastfeeding beyond infancy are desirable for the healthy growth of children, they are not strong predictors of the nutritional status of the children. However, as compared with the children of mothers who received no antenatal and natal services, the children of mothers who received most of these services are less likely to be severely undernourished. Child immunisation also tends to reduce undernutrition among young children to some extent.

There are clear regional differences in the extent of children severely undernourished in respect of all the three nutritional status indicators. The proportion of children severely' undernourished is the highest in the four large states namely Uttar Pradesh, Bihar, Madhya Pradesh and Rajasthan, slightly less in the western region and relatively low in the other regions (south, north, and northeast). Similarly, education of mother has shown a strong influence on the nutritional status of the children. With respect to sex differentials in nutritional status, female children are at a disadvantageous position compared with male children, but the differences are not very large. On the other hand, there is no significant urban-rural difference in the nutritional status of the children once the socioeconomic and environmental factors are controlled. Household level factors such as religion and SC/ST status also do not show significant differences in the nutritional status of young children.

On the whole, the analysis of the NFHS data reveals that the nutritional status of the young children in India is poor and most of the proximate determinants of nutritional status are in place. The study clearly indicates that improvements in the nutritional status of the children in India requires improvements in the educational level of women, improvements in the nutritional status of mothers, better housing environment, improvements in the delivery ofMCH services, and strengthening of the family planning services with special reference to promoting reversible methods. The fact that undernutrition is widely prevalent in almost all communities cutting across religion, caste, urban-rural residence and even region and also the variation is exceptionally large with respect to education of mother, her nutritional status, housing environment, and economic and modem life style of the people, a broadbased socioeconomic development with more emphasis on equity distribution of income and intensive MCH and family planning services is essential for achieving better nutrition among young children in India.

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