CHAPTER 1 WHAT ARE THE DIMENSIONS OF THE UNDERNUTRITION PROBLEM IN INDIA?

The consequences of child undernutrition for morbidity and mortality are enormous – and there is, in addition, an appreciable impact of undernutrition on productivity so that a failure to invest in combating nutrition reduces potential economic growth. In India, with one of the highest percentages of undernourished children in the world, the situation is dire. Moreover, inequalities in undernutrition between demographic, socioeconomic and geographic groups increased during the 1990s. More, and better, investments are needed if India is to reach the nutrition MDGs. Economic growth will not be enough.

The prevalence of underweight among children in India is amongst the highest in the world, and nearly double that of Sub-Saharan Africa. In 1998/99, 47 percent of children under three were underweight or severely underweight, and a further 26 percent were mildly underweight such that, in total, underweight afflicted almost three-quarters of Indian children. Levels of malnutrition have declined modestly, with the prevalence of underweight among children under three falling by 11 percent between 1992/93 and 1998/99. However, this lags far behind that achieved by countries with similar economic growth rates.

Undernutrition, both protein-energy malnutrition and micronutrient deficiencies, directly affects many aspects of children's development. In particular, it retards their physical and cognitive growth and increases susceptibility to infection, further increasing the probability of malnutrition. Child malnutrition is responsible for 22 percent of India's burden of disease. Undernutrition also undermines educational attainment, and productivity, with adverse implications for income and economic growth.

Disaggregation of underweight statistics by socioeconomic and demographic characteristics reveals which groups are most at risk of malnutrition. Most growth retardation occurs by the age of two, and is largely irreversible. Underweight prevalence is higher in rural areas (50 percent) than in urban areas (38 percent); higher among girls (48.9 percent) than among boys (45.5 percent); higher among scheduled castes (53.2 percent) and scheduled tribes (56.2 percent) than among other castes (44.1 percent); and, although underweight is pervasive throughout the wealth distribution, the prevalence of underweight reaches as high as 60 percent in the lowest wealth quintile. Moreover, during the 1990s, urban-rural, inter-caste, male-female and inter-quintile inequalities in nutritional status widened.

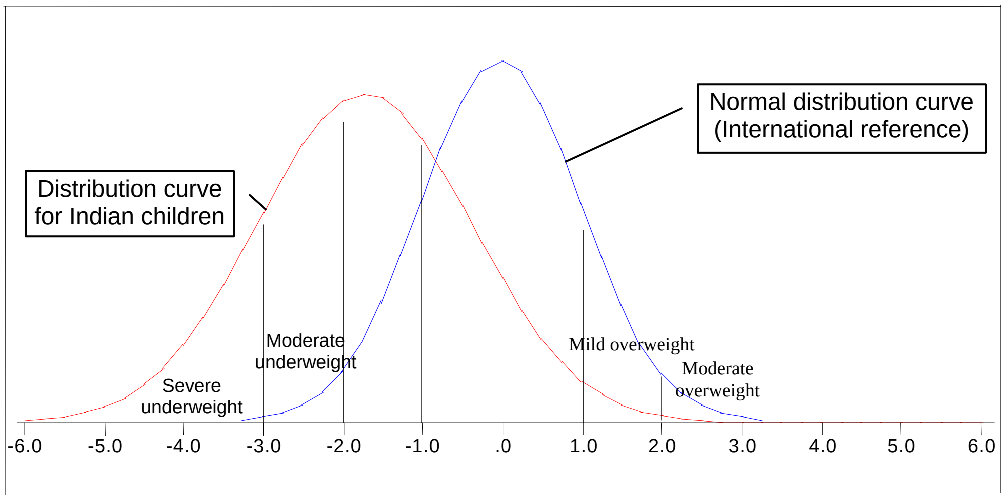
There is also large inter-state variation in the patterns and trends in underweight. In six states, at least one in two children are underweight, namely Maharashtra, Orissa, Bihar, Madhya Pradesh, Uttar Pradesh, and Rajasthan. The four latter states account for more than 43 percent of all underweight children in India. Moreover, the prevalence in underweight is falling more slowly in the high prevalence states. Finally, the demographic and socioeconomic patterns at the state level do not necessarily mirror those at the national level and nutrition policy should take cognizance of these variations.

Undernutrition is concentrated in a relatively small number of districts and villages with a mere 10 percent of villages and districts accounting for 27-28 percent of all underweight children, and a quarter of districts and villages accounting for more than half of all underweight children,.

Micronutrient deficiencies are also widespread in India. More than 75 percent of preschool children suffer from iron deficiency anemia (IDA) and 57 percent of preschool children have sub-clinical Vitamin A deficiency (VAD). Iodine deficiency is endemic in 85 percent of districts. Progress in reducing the prevalence of micronutrient deficiencies in India has been slow. As with underweight, the prevalence of different micronutrient deficiencies varies widely across states.

The profile of malnutrition in India is one where the distribution of children's age-standardized weight is dramatically to the left of the global reference standard (see Figure 1 below), suggesting a major undernutrition problem. Simultaneously, there is a small, but increasing percentage of overweight children who are at greater risk for non-communicable diseases such as diabetes and cardio-vascular heart disease later in life. Although the term "malnutrition" refers to both under- and overnutrition, in view of the size and urgency of the undernutrition problem in India, and its links to human development, this analysis deals only with the problem of undernutrition, i.e. macro- and micro-nutrient deficiencies[a].

Figure 1 Weight-for-age distribution: children under three in India compared to the global reference population



Source: Calculated from NFHS data
Note: Prevalence of severe, moderate and mild underweight are given in parentheses.

In 1998/99 (i.e. the latest date for which nationally representative data are available), 47% of children under three in India were underweight and 18% were severely underweight. A further 26% were mildly underweight so that, in total, underweight afflicted almost three-quarters of Indian children. 46% of children were stunted and 16% could be classified as wasted. Given that

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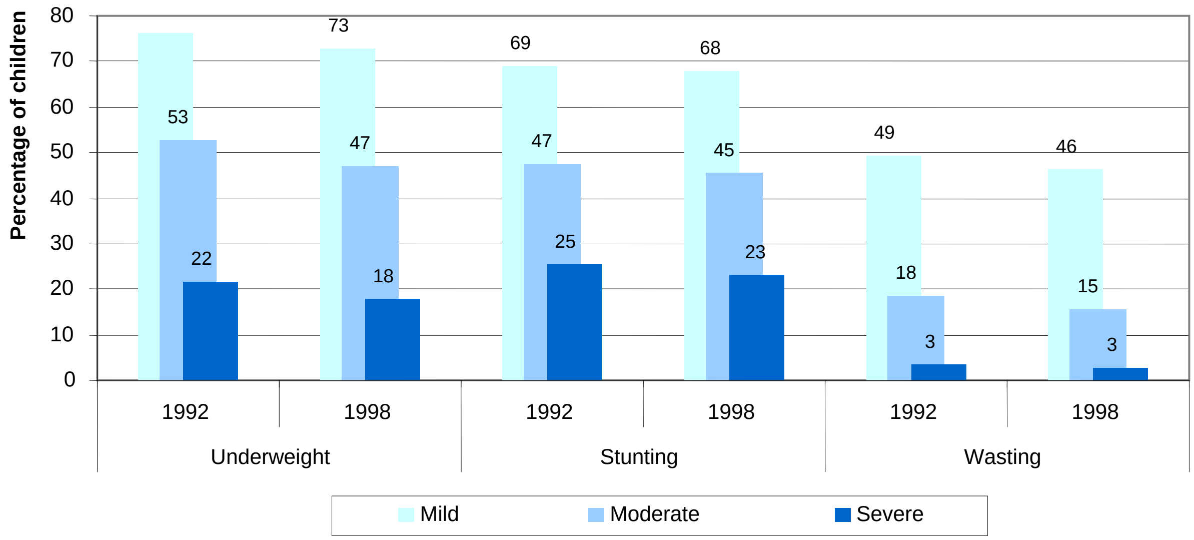
[a] Nutritional status is typically described in terms of anthropometric indices, such as *underweight, stunting* and *wasting*. The terms underweight, stunting and wasting are measures of protein-energy undernutrition and are used to describe children who have a weight-for-age, height (or recumbent length)-for-age and weight-for-height measurement that is less than two standard deviations below the median value of the NCHS/WHO reference group. This is referred to as moderate malnutrition. The terms severe underweight, severe stunting and severe wasting are used when the measurements are less than three standard deviations below the reference median, and mild underweight, stunting and wasting refer to measurements less than one standard deviation below the reference population. Underweight is generally considered a composite measure of long and short-term nutritional status, while stunting reflects long-term nutritional status, and wasting is an indicator of acute short-term undernutrition. In addition, there are some indicators of micronutrient malnutrition. The most commons forms of micronutrient malnutrition referred to in this document are Vitamin A deficiency, iodine deficiency disorders and iron-deficiency anemia.

even mild malnutrition is linked to a two-fold increase in mortality, and to much lower productivity levels, these levels of undernutrition significantly compromise health and productivity. There was, however, a modest improvement in the situation during the 1990s. Between 1992/93 and 1998/99, the prevalence of underweight fell by almost 11%, equivalent to a 1.5% annual reduction (see Figure 2).

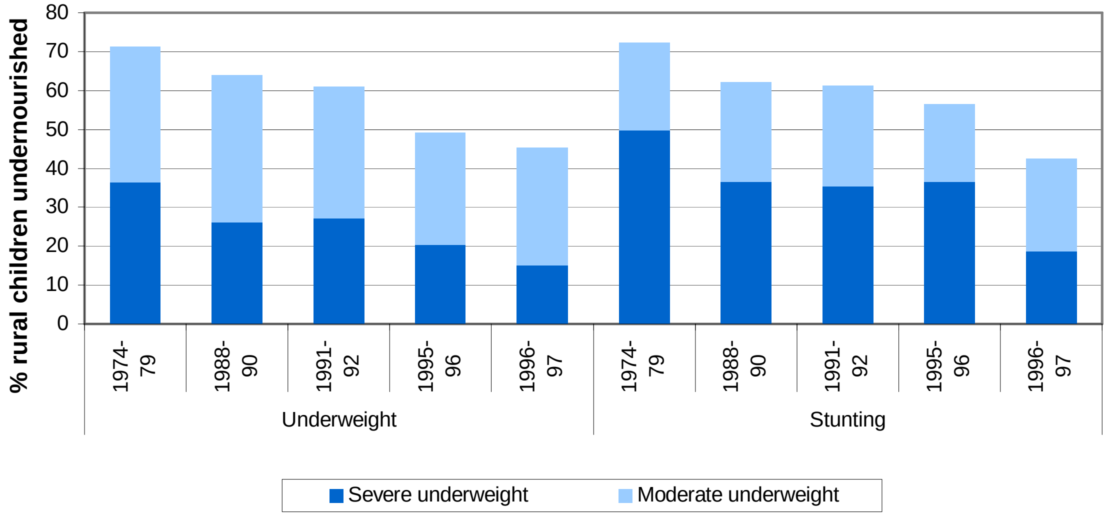
Figure 2 A modest reduction in the prevalence of undernutrition during the 1990s



Source: Underweight figures calculated directly from NFHS I and NFHS II data; other figures obtained from StatCompiler DHS (ORC Macro 2004).
Note: Figures are for children under the age of three

The reduction in the prevalence of underweight in India in the 1990s is in line with gains made in earlier decades. According to the WHO Global Database on Child Growth and Nutrition, the prevalence of malnutrition among children *under five* in rural India fell from over 70% in the late 1970s to below 50% at the end of the 1990s for both underweight and stunting measures. The prevalence of severe stunting also declined over this period, from almost 50% to less than 25%, while that of severe underweight declined from 37% to less than 20%.

Figure 3 Trends in the prevalence of underweight and stunting among children under five in rural India



Source: WHO Global Database on Child Growth and Malnutrition (WHO 2004a); original data from NNMB (1974-79, 1988-90, 1991-92), DWCD (1995-96) and Vijayaraghavan and Rao (1996-97).
Note: Prevalence is not strictly comparable across time periods since each round of surveys used different sampling methodologies and calculated prevalence across different age groups[b].

The prevalence of micronutrient deficiencies among children and women of reproductive age in India is also consistently among the highest in the world. For example, the prevalence of iron deficiency anemia (IDA) among preschool children is over 75%; although the nationwide prevalence of clinical Vitamin A deficiency (VAD) is less than 1-2%, up to 60% of preschool children have subclinical VAD[c]; and, about one in four school children have goiter, a sign of severe iodine deficiency[1]. 52% of all ever-married women aged 15 to 49 years have some degree of anemia, with the prevalence of anemia among pregnant women even higher (up to 87%); clinical and subclinical VAD is widespread, affecting about 5% and 12% of women, respectively; and, iodine deficiency in pregnant women in India is estimated to have so far caused the congenital mental impairment of about 6.6 million children[2].

[b] The NNMB data include children aged 0-4 years in eight states, the DWCD data include children aged 1-4 years in 18 states and the Vijayaraghavan and Rao data are for children aged 0-4 years in 11 states.

[c] Clinical VAD is a severe form of Vitamin A deficiency, resulting in xerophthalmia, symptoms of which include night blindness, Bitot's spots, xerosis, and keratomalacia. If not treated early enough, it can eventually leads to blindness. Subclinical VAD, defined by a serum retinol concentration of less than 0.7 µmol/L, is associated with increased vulnerability to a variety of infectious diseases and, therefore, an increased risk of mortality and morbidity.

Table 1 Prevalence of micronutrient deficiencies in South Asia

	Iron deficiency				Vitamin A deficiency			Iodine deficiency			Folate deficiency
	IDA in children <5y (%)	IDA in women 15-49y (%)	IDA in pregnant women (%)	Maternal death from severe anemia/yr (no.)	Child deaths precipitated (no.)	Children <6 w/ subclinical VAD (%)	Children <6 w/ clinical VAD (%)	Children born mentally impaired (no.)	Total Goiter Rate (TGR) (%)	Total Goiter Rate (TGR) in school children (%)	Neural tube defects (no.)
Afghanistan	65	61	-	-	50,000	53	-	535,000	48	-	2,250
Bangladesh	55	36	74	2,800	28,000	28	0.7	750,000	18	50	8,400
Bhutan	81	55	68	<100	600	32	0.7	-	-	14	150
India	**75**	**51**	**87**	**22,000**	**330,000**	**57**	**0.7**	**6,600,000**	**26**	**19**	**50,000**
Nepal	65	62	63	760	6,900	33	1.0	200,000	24	40	1,600
Pakistan	56	59	-	-	56,000	35	-	2,100,000	38	-	11,000
South Asia Region Total				25,560	471,500			10,185,000			73,400
World Total				50,000	1,150,000			19,000,000			204,000

Source: UNICEF 2003b; WHO 2000; UNICEF and MI 2004a

The fact that approximately 37 million children *under the age of three*[3] are underweight and many more suffer from various micronutrient deficiencies makes undernutrition an urgent policy priority.

1.1 WHY INVEST IN COMBATTING UNDERNUTRITION?

Failing to deal effectively with the undernutrition problem in India has dire consequences for children's development. It retards their physical growth and increases their susceptibility to disease in childhood and adulthood. It also affects cognitive and motor development, limits educational attainment and productivity, and ultimately perpetuates poverty. Moreover, in a country where undernutrition is so widespread, the consequences of undernutrition go well beyond the individual, affecting total labor force productivity and economic growth.

1.1.1 The effect of undernutrition on morbidity, mortality, cognitive and motor development

Through precipitating disease and speeding its progression, malnutrition is a leading contributor to infant, child and maternal mortality and morbidity. It has been estimated to play a role in about half of all child deaths[4] and more than half of child deaths from major diseases, such as malaria (57%), diarrhea (61%) and pneumonia (52%), as well as 45% of deaths from measles (45%)[5]. Pediatric malnutrition is a risk factor for 16% of the global burden of disease and for 22.4% of India's burden of disease[6]. In turn, infections contribute to malnutrition through a variety of mechanisms, including loss of appetite and reduced capacity to absorb nutrients.[7]

In this section, the consequences of protein-energy malnutrition (PEM) and micronutrient deficiencies for morbidity, mortality, cognitive and motor development are reviewed.

1.1.1.1 Protein-energy malnutrition[d] (PEM)

Isolating the effects of protein and energy deficiencies on health and development outcomes is confounded by the fact that when food intake is low, the intake of many other nutrients is usually also inadequate[8]. Nevertheless, it is generally accepted that children who are underweight or stunted are at greater risk for childhood morbidity and mortality, poor physical and mental development, inferior school performance and reduced adult size and capacity for work[9].

Protein-energy malnutrition weakens immune response and aggravates the effects of infection[10] and, so, children who are malnourished tend to have more severe diarrheal episodes and are at a higher risk of pneumonia. Underweight and stunted women are also at more risk of obstetric complications (because of smaller pelvic size) and low birth weight deliveries[11]. The result is an intergenerational cycle of malnutrition since low birth weight infants tend to attain smaller stature as adults. In addition, malnutrition in early infancy is associated with increased susceptibility to chronic disease in adulthood, including coronary heart disease, diabetes and high blood pressure[12].

Although the precise mechanisms are not clear[13], protein-energy malnutrition in early childhood is also associated with poor cognitive and motor development. The magnitude of the effect is very much dependent on the severity and duration of malnutrition as well as its timing. There is evidence that moderate protein-energy malnutrition of long-term duration has worse consequences for cognitive development than transient severe undernutrition. With respect to timing, it is nutritional status in the period between the last trimester of pregnancy and two to three years of age that is most important for mental development.

1.1.1.2 Micronutrient deficiencies

Iron and Vitamin A deficiencies are leading risk factors for disease in developing countries, especially those with high mortality rates[14]. Iodine deficiency, too, is a mortality risk.

Vitamin A: Sub-clinical Vitamin A deficiency (VAD) is a well-known cause of morbidity and mortality, especially among young children and pregnant women. In young children, it can cause xerophthalmia and keratomalacia and lead to blindness[15]; limit growth; weaken the immune system, exacerbate infection and increase the risk of death[16]. VAD has been shown to increase the mortality of children, mainly from respiratory and gastrointestinal infections, and often occurring concurrently among children with PEM, is estimated to be responsible for about 1 million child deaths annually[17]. Pregnant women, especially in the third trimester when micronutrient demands are at their highest, often exhibit a high prevalence of night blindness. Recent studies have shown that VAD may also be associated with an increased risk of mother-to-child transmission of HIV, even though Vitamin A supplementation does not lower the risk of

[d] Protein-energy malnutrition develops in children and adults whose consumption of protein and energy is insufficient. In most cases, both protein and energy deficiencies occur simultaneously. If protein deficiencies predominate, PEM may manifest as kwashiorkor (which usually appears around the age of 12 months when breastfeeding ceases, but can also occur later in childhood) and is characterized by edema, hair discoloration and peeling skin. If energy deficiencies predominate, PEM may manifest as marasmus (which usually develops in children aged 6 to 12 months who have been weaned from breastmilk or suffer from weakening infections, such as diarrhea) and is characterized by stunted growth and wasting.

transmission[18]. Vitamin A supplementation has proven successful in reducing the incidence and severity of illness, and has been associated with an overall reduction in child mortality by 25-35%[19], especially from diarrhea, measles and malaria[20].

Iron: Iron deficiency anemia (IDA) is common across all age groups, but highest among children and pregnant and lactating women, and affects about 2 billion people in developing countries. The consequences of IDA in pregnant women include increased risk of low birth weight or premature delivery, peri-natal and neonatal mortality, inadequate iron stores for the newborn, lowered physical activity, fatigue and increased risk of maternal morbidity[21]. It is also responsible for almost a quarter of maternal deaths[22]. Inadequate iron stores as a newborn child, coupled with insufficient iron intake during the weaning period, have been shown to impair intellectual development by adversely affecting language, cognitive, and motor development. Iron deficiency among adults contributes to low labor productivity[23].

Iodine: Iodine deficiency during pregnancy is associated with low birth weight, increased likelihood of stillbirth, spontaneous abortion and congenital abnormalities such as cretinism and irreversible forms of mental impairment. During the childhood period, it impairs physical growth, causes goiter and decreases the probability of child survival. It is also the most common cause of preventable mental retardation and brain damage in the world[24]. Globally, 2.2 billion people (38% of the world's population) live in regions where iodine deficiency is endemic.

Iodine and iron deficiencies have also been linked to the retardation of cognitive processes in infants and young children. Maternal iodine deficiency has negative and irreversible effects on the cognitive functioning of the developing fetus, while postnatal iodine deficiency may also be associated with cognitive deficits[25]: iodine-deficient children have been shown to have IQs that are, on average, 13.5 points lower than iodine-sufficient children[26]; iron deficiency anemia has been associated with half a standard deviation reduction in IQ[27].

1.1.2 The effect of undernutrition on schooling, adult productivity and economic growth

The cognitive and physical consequences of undernutrition – both underweight and micronutrient deficiencies – undermine educational attainment and labor productivity, with adverse implications for income and economic growth.

1.1.2.1 Schooling

Malnutrition at any stage of childhood affects schooling and, thus, the lifetime-earnings potential of the child[28]. Some of the pathways through which malnutrition affects educational outcomes include a reduced capacity to learn (as a result of early cognitive deficits or lowered current attention spans) and fewer total years of schooling (since caregivers may invest less in malnourished children or schools may use child size as an indicator of school readiness)[29]. For example, in rural Pakistan, malnutrition has been found to decrease the probability of ever attending school, particularly for girls[30]. In the Philippines, children with higher nutritional status during the preschool years start primary school earlier, repeat fewer grades[31] and have higher high school completion rates[32] than other children. In Zimbabwe, stunting, via its association with a 7 month delay in school completion and 0.7 loss in grade attainment, has been shown to reduce lifetime income by 7-12%[33].

1.1.2.2 Adult productivity and economic growth

Measuring the productivity losses associated with undernutrition is complex and since different studies incorporate different types of productivity gains, estimates can vary widely[e]. Moreover, since a large share of productivity losses are measured in terms of foregone wages, when productivity losses are expressed in dollar terms rather than as % GDP, the productivity losses in India may appear lower relative to other countries with higher average wages. In general, in low-income agricultural Asian countries, the physical impairment associated with malnutrition is estimated to cost more than 2-3% of GDP per annum - even without considering the long-term productivity losses associated with developmental and cognitive impairment[34]. Iron deficiency in adults has been estimated to decrease productivity by 5-17%, depending on the nature of the work performed[35]. Other data from ten developing countries have shown that the median loss in reduced work capacity associated with anemia during adulthood is equivalent to 0.6% of GDP, while an additional 3.4% of GDP is lost due to the effects on cognitive development attributable to anemia during childhood[36]. The impact of iodine deficiency disorders (IDD) on cognitive development alone has been associated with productivity losses totaling approximately 10% of GDP[37].

A few attempts have been made to estimate the productivity losses associated with malnutrition in India. As with the global estimates above, these are intrinsically imprecise, requiring many assumptions and approximations. One study estimates that the productivity losses due to PEM, IDD, and IDA, in the absence of appropriate interventions, amounts to around US$114 billion between 2003 and 2012[38]. A more recent study, examining only the productivity losses associated with foregone wage-employment resulting from child malnutrition, estimates the loss to be US$2.3 billion (or Rs.103 billion)[39]. Other studies suggest that micronutrient deficiencies alone may cost India US$2.5 billion annually[40] and that the productivity losses (manual work only) from stunting, iodine deficiency and iron deficiency together are responsible for a total productivity loss of almost 3% of GDP[41] (see Table 2).

[e] Estimating the economic costs of malnutrition typically involves taking into account the prevalence of a particular macro- or micro-nutrient deficiency among men and women and their average levels of participation in market economic activity and heavy labor. Economic calculations are based only on market activities and exclude non-market losses even though these may be socially valuable. The calculations also require estimating the degree to which different nutritional conditions may coexist.

Table 2 Productivity losses due to malnutrition in India

	(i) DALYs lost due to malnutrition in India	(ii) Estimated total annual losses due to malnutrition[42] ($ billions)	(iii) Estimated loss of adult productivity, as % GDP[43]
Protein-energy malnutrition (stunting)	**2,939,000**	**8.1**	**1.4**
Vitamin A deficiency	**404,000**	**0.4**	
Iodine deficiency disorder	**214,000**	**1.5**	**0.3**
Iron deficiency	**3,672,000**	**6.3**	**1.25**

Source: (i) World Bank 2004c; (ii) and (iii) Horton 1999
Note: Productivity losses include only market activities

1.2 UNDERWEIGHT

1.2.1 An international perspective

Whether undernutrition is measured as the prevalence of underweight, stunting or wasting, it is clear that the nutritional situation in India is amongst the worst in the world (see Table 3). India's prevalence of underweight (47%) compares to Bangladesh (48%) and Nepal (48%), but is much higher than all other countries within South Asia and far higher than the averages for other regions of the world. High prevalence combined with India's large population means that of the 150 million malnourished children *aged under five* in the world, more than a third live in India[44].

Table 3 Underweight, stunting and wasting, by global region, 2000

Region	% of under-fives (2000) suffering from		
	Underweight	Stunting	Wasting
Latin America and Caribbean	6	14	2
Africa	24	35	8
Asia	28	30	9
India	**47**	**45**	**16**
Bangladesh	48	45	10
Bhutan	19	40	3
Maldives	45	36	20
Nepal	48	51	10
Pakistan	40	36	14
Sri Lanka	33	20	13
All developing countries	22-27	28-32	7-9

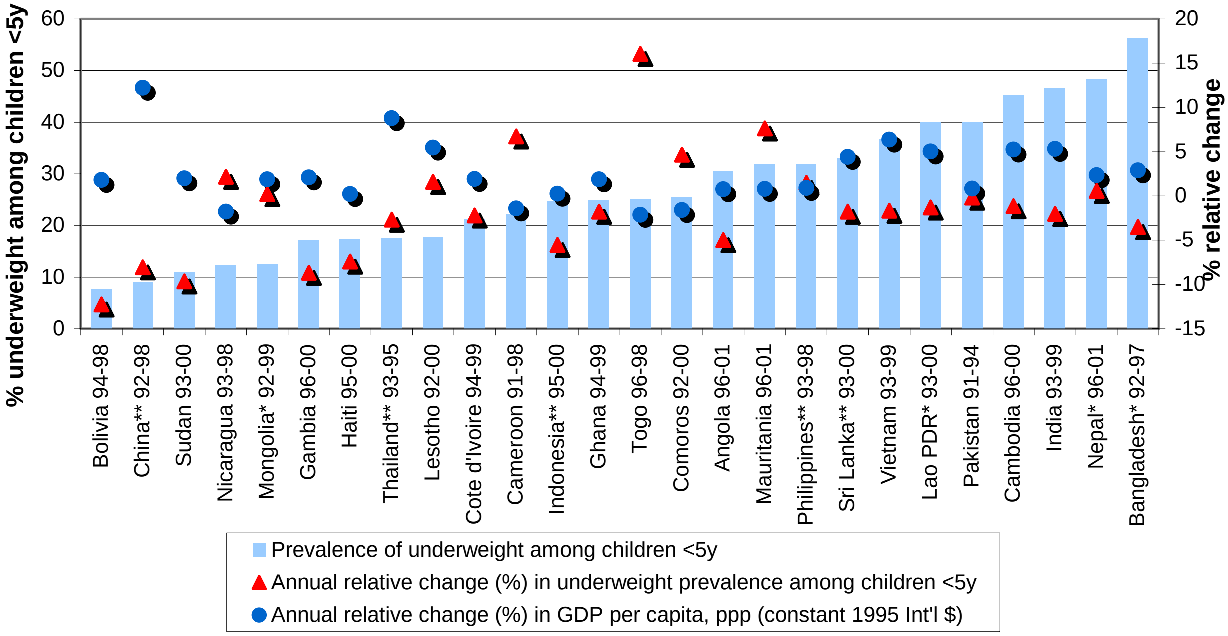
Source: ACC/ SCN 2004

The decline of the prevalence of underweight during the 1990s has also been less rapid than in most other countries with similar socioeconomic or geographical characteristics. Figure 4 plots the prevalence of underweight among children *under five* and its annual relative change against *per capita* economic growth[f]. It shows that despite an average annual increase in *per capita* GDP of 5.3%, the average annual prevalence of underweight in India fell at a rate of only 1.5%. In some other countries, underweight prevalence fell by more than 5%, even though annual growth

[f] GDP per capita is adjusted for purchasing power parity (PPP) and in constant 1995 international dollars.

in *per capita* GDP was around 2% or less. In China, the prevalence of child underweight fell at an annual rate of more than 8%, backed by a 12% annual growth rate. In Bangladesh, despite economic growth that lagged behind that of India, the prevalence of underweight declined at a higher rate (3.5%).

Figure 4 Underweight: comparing India to other countries with similar levels of economic development



Source: GDF and WDI Central Database 2004

Note: Countries chosen[g] for this table are either in Asia or comparable to India in terms of *per capita* GDP at PPP (1995 constant international dollars), i.e. in the range $1,333-$2,333 where India's *per capita* GDP was $1,833 in 1995. Countries in Asia with somewhat lower *per capita* GDP (<$1333) are denoted by * and with higher *per capita* GDP (>$2333) by **.

The South Asian Enigma: Why is undernutrition in South Asia so much higher than in Sub Saharan Africa?

In 1997, Ramalingaswami *et al.* wrote, "In the public imagination, the home of the malnourished child is Sub-Saharan Africa…but … the worst affected region is not Africa but South Asia". These statements were met with incredulity. However, undernutrition rates in South Asia, including and especially in India, *are* nearly double those in Sub-Saharan Africa today. This is not an artifact of different measurement standards or differing growth potential among ethnic groups: several studies have repeatedly shown that given similar opportunities, children across most ethnic groups, including Indian children, can grow to the same levels, and that the same internationally recognized growth references can be used across countries to assess the prevalence of malnutrition[45]. This phenomenon, referred to as the "South Asian Enigma", is real.

The "South Asian Enigma" can be explained by three key differences between South Asia and Sub-Saharan Africa:

- Low birth weight is the single largest predictor of undernutrition; and over 30% Indian babies are born with low birth weights, compared to approximately 16% in Sub-Saharan Africa.
- Women in South Asia tend to have lower status and less decision-making power than women in Sub-Saharan Africa. This limits women's ability to access the resources needed for their own and their children's health and nutrition, and has been shown to be strongly associated with low birth weight, as well as poor child feeding behaviors in the first twelve months of life
- Hygiene and sanitation standards in South Asia are well below those in Africa, and have a major role to play in causing the infections that lead to undernutrition in the first two years of life.

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[g]All countries included in the table had at least two household h surveys between 1990 and 2002. When more than two surveys were available, information collected around 1992/93 and 1998/99 was used, to enhance comparability with India NFHS data. Countries with a prevalence of underweight of less than 10% among children under 5 in the first survey were dropped.

1.2.2 National patterns and trends

The prevalence of underweight among children *under three* and recent trends in underweight vary substantially across different subgroups of the Indian population. Table 4 summarizes these patterns, which are discussed in more detail in the paragraphs that follow.

Table 4 Disparities in underweight, by location, wealth quintile, gender and caste, 1992/93-1998/99

	Underweight			Severe underweight		
	Prevalence 1992/93	Prevalence 1998/99	Percentage change	Prevalence 1992/93	Prevalence 1998/99	Percentage change
Total	*53*	*47*	*-11*	*22*	*18*	*-18*
Urban	44	38	-13	16	12	-27
Rural	55	50	-10	24	20	-16
Quintile 1 (Poorest)	61	59	-4	30	27	-8
Quintile 2	60	56	-6	26	23	-12
Quintile 3	56	52	-6	23	21	-7
Quintile 4	49	44	-11	18	15	-12
Quintile 5 (Wealthiest)	36	33	-9	11	8	-26
Female	52	49	-6	21	19	-11
Male	53	45	-15	22	17	-24
Scheduled Castes	57	53	-7	25	21	-15
Scheduled Tribes	57	56	-2	29	26	-9
Other Castes	51	44	-14	20	16	-23

Source: Calculated from NFHS I and NFHS II data

1.2.2.1 Patterns

Disaggregation of the 1998/99 national averages for children *under three* shows that there are certain groups that are more likely to be underweight than others.

Location: The rural underweight prevalence of 50% exceeds that of urban areas. Rural areas bear a particularly large share of the total *severe* underweight prevalence.

Wealth: As expected, both underweight and severe underweight prevalence increases as household wealth falls, although at a decreasing rate. Underweight prevalence is as high as 60% in the lowest quintile, but is so pervasive throughout the wealth distribution that even in the wealthiest fifth of the population 33% of children are underweight and 8.5% are severely underweight.

Gender: Underweight (and severe underweight) prevalence is slightly higher among girls, 48.9% (18.9%), than among boys, 45.5% (16.9%).

Caste: Both underweight (and severe underweight) prevalence is much higher among scheduled castes 53.2% (21.3%), and scheduled tribes 56.2% (26.3%) than among other castes, 44.1% (15.7%).

Thus, most at risk for underweight are girls whose families are poor, belong to scheduled tribes or castes, and live in rural areas. Assuming independence of conditional probabilities, the chance that a girl with all these characteristics is underweight is as high as 0.92[h] (Figure 5).

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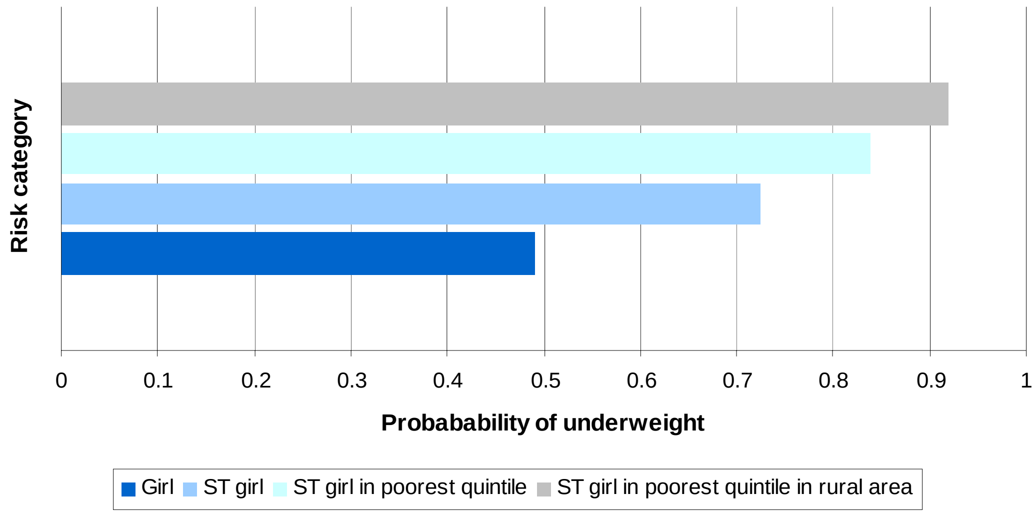
[h] The estimate here is an upper-bound since economic status of the child, for example, is unlikely to be completely independent of urban-rural location or caste.

Figure 5 How the probability of underweight increases for girls in increasingly vulnerable positions

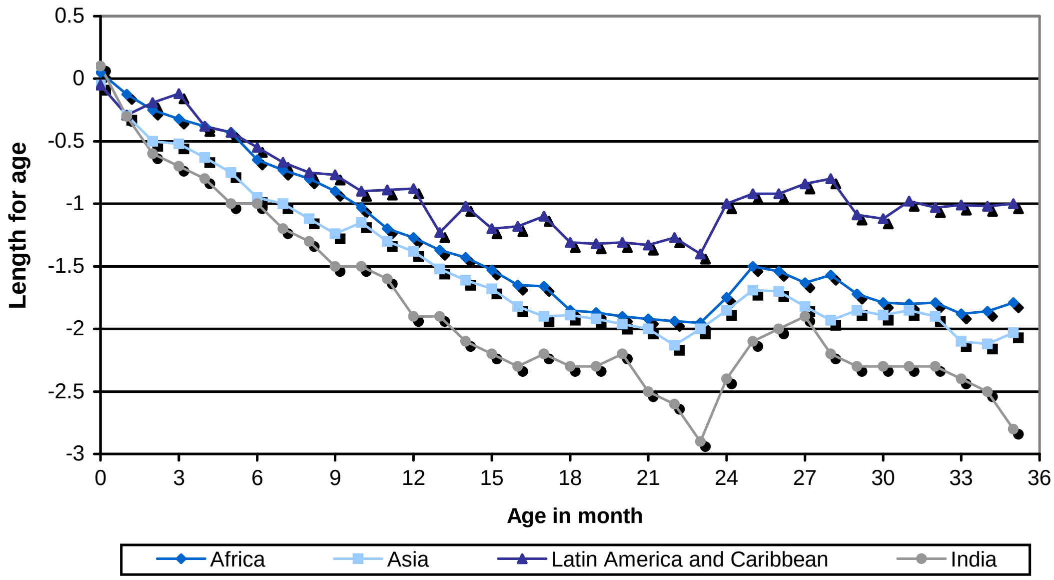


Source: Calculated from NFHS II data

The age-wise pattern of undernutrition is an important dimension of the problem in India, and indeed all over the world: growth retardation originates early in life, and most of this early damage is irreversible[46]. Most growth-faltering occurs either during pregnancy, such that approximately 30%[i] of children in India are born with low birth weight, and the rest of the damage happens during the first two years of life. Indeed, by the age of two years most growth retardation has already taken place (Figure 6). Consequently, the period between pregnancy and the first two years of life is the major "window of opportunity" in which to address undernutrition, and efforts to fight undernutrition need to focus on this age group, if they are to be successful.

[i] Measuring the incidence of low birth weight in developing countries is challenging because of measurement error, as observed by the heaping of data at the low birth weight cut-off of 2,500g, and because relatively few babies are weighed at birth.

Figure 6 By the age of two, most of the damage has been done



Source: Regional estimates from Shrimpton et al. 2001; India data from IIPS and ORC Macro 2000;
Note: A graph (Figure A) with the pattern of age-specific weight-for-age estimates can be found in the Appendix

1.2.2.2 Recent trends

Both underweight and severe underweight prevalence fell during the 1990s, but it has fallen more slowly among those segments of the population that were already more likely to be underweight in 1992/93. Consequently, over time, urban-rural, inter-caste, male-female and economic inequalities in nutritional status have widened. According to Figure 7 below:

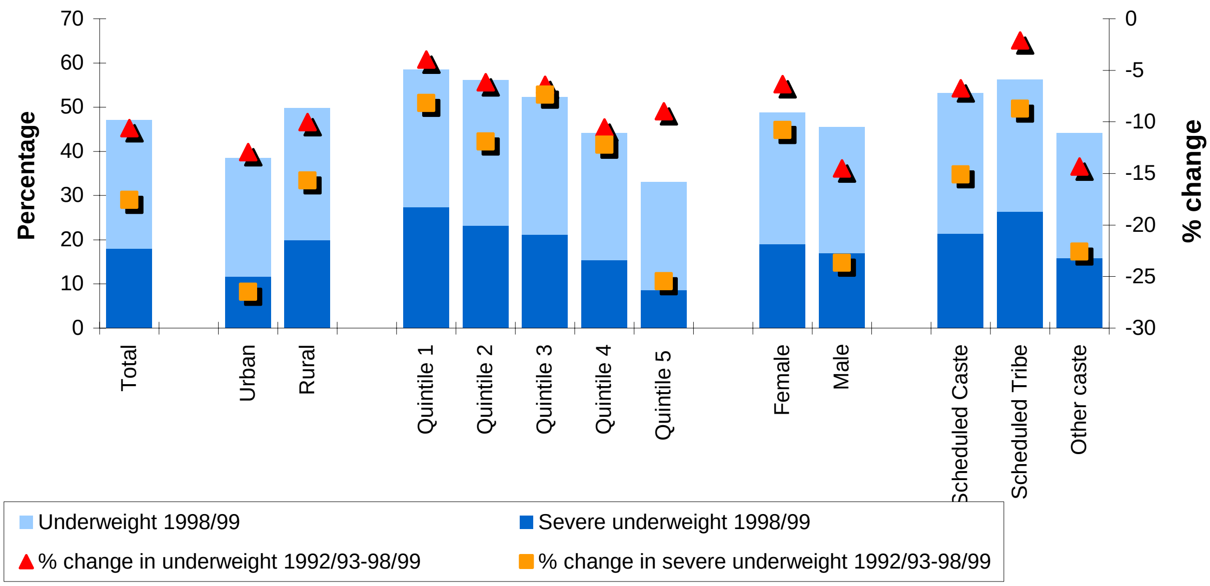
Location: The percentage reduction in severe underweight prevalence from 1992/93 to 1998/99 was dramatically higher in urban areas (26%) than in rural areas (16%), and somewhat higher for underweight prevalence.

Wealth: It is encouraging to see that, by 1998, the percentage of children in the poorest quintile and second poorest quintile who are underweight had fallen below the 60% mark. However, the reductions in the percentage of malnourished children in the lower quintiles is smaller than the reductions in the upper quintiles, indicative of a growing health disparity between children of relatively low and relatively high economic status. In fact, the greatest percentage reduction in the prevalence of underweight, and especially severe underweight, accrued to children in the wealthiest quintiles.

Gender: What is especially remarkable is the decline in male underweight prevalence, which fell by 14.3% (from 53.2% to 45.5% between 1992/93 and 1998/99) compared to the 6% decline in female underweight prevalence (from 52.2% to 48.9%). The effect of this is a reversal of the underweight gender gap so that, on aggregate in India, girls now lag far behind boys. The same reversal is observed for severe underweight prevalence, and is actually even more pronounced. Severe underweight prevalence fell by 23.7% (from 22% to 17%) for boys and by 10.8% (from 21% to 19%) for girls.

Caste: Despite the ostensible targeting of nutrition and health interventions to vulnerable castes, the percentage decline in underweight prevalence during the 1990s was smaller for scheduled castes and tribes than for others. Scheduled tribes, in particular, lagged far behind. Compared to other castes where underweight (and severe underweight) prevalence was reduced by 14.3% (22.6%) in the 1990s, the reduction for scheduled caste groups was only 6.7% (15.1%) and for scheduled tribe groups only 2.1% (8.7%). The effect of these differential gains was a marked widening of the gap in nutritional status between scheduled and non-scheduled castes, and particularly between scheduled caste and scheduled tribe groups. Divergence is more acute for severe underweight than for underweight.

Figure 7 Demographic and socioeconomic variation in the prevalence of underweight, among children under 3, 1992/93 – 1998/99

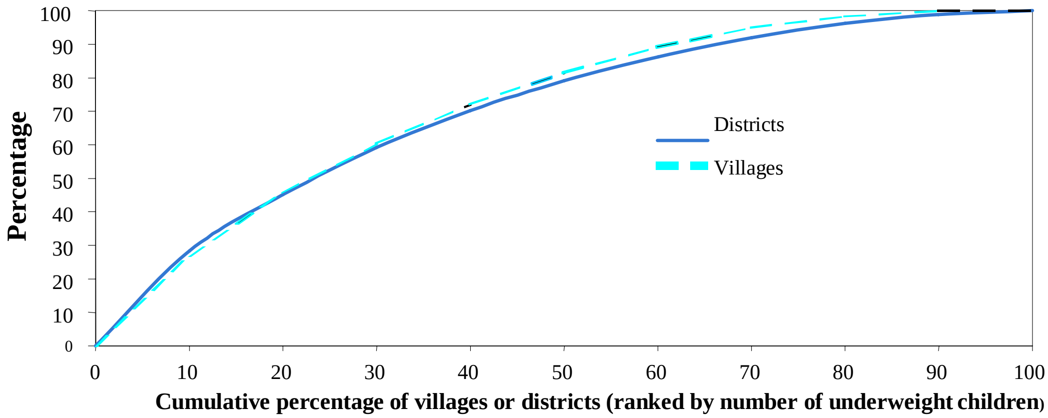


Source: Calculated from NFHS I and NFHS II data

1.2.3 Inter-state variation and within-state variation in the prevalence of underweight

Although underweight prevalence is widespread across the states of India, much of the total underweight prevalence is concentrated in a relatively small number of districts and villages (Figure 8). A mere 10% of villages and districts account for 27-28% of all underweight children in the country, and a quarter of districts and villages account for more than half of all underweight children[47].

Figure 8 Cumulative distribution of all underweight children under three across villages and districts in India, 1998/99



Source: World Bank 2004a

The geographic concentration of the prevalence of underweight in India means that tailoring an appropriate response to malnutrition in a country as large and diverse as India requires a more richly-textured picture of malnutrition patterns and trends than the national picture presented above. It also suggests that actions to combat undernutrition could be targeted to a relatively small number of districts/villages. The remainder of this section examines how the prevalence in underweight and its trends varied across states between 1992/93 and 1998/99, and across the different socio-economic groups within states. Since data from only two points in time are used, however, it cannot be assumed that these trends are representative of longer-term changes in undernutrition.

1.2.3.1 By state

There is large inter-state variation in both the prevalence of underweight and the extent to which it fell (or occasionally rose) during the 1990s (see Table 5). Underweight prevalence in Bihar and Madhya Pradesh fell from 60% to around 55% during the 1990s so that by 1998/99 there was no longer any state in India that had a malnutrition prevalence exceeding 60%. Yet, there remain six states where at least one in two children are underweight, namely Maharashtra, Bihar, Madhya Pradesh, Uttar Pradesh, Orissa and Rajasthan. A combination of large populations and high underweight prevalence means that four of these states account for 43% of all underweight children in India – Uttar Pradesh (11%), Madhya Pradesh (11%), Bihar (11%) and Rajasthan (10%)[48]. Moreover, most of these high prevalence states are also experiencing the smallest reductions in the prevalence of underweight in India. Rajasthan and Orissa even registered a sharp increase in total underweight prevalence.

Table 5 Matrix classifying states according to prevalence and change in prevalence of underweight

	Below average prevalence (<47%)	Above average prevalence (≥47)
Increase in malnutrition (>0%)	Manipur (28; 4)	Rajasthan (51; 14) Orissa (55; 4)
Below average reductions in malnutrition (0-11.6%)	Kerala (27; -0.5) Gujarat (46; -6) Himachal Pradesh (45; -2) Haryana (35; -2) Mizoram (28; -1)	Madhya Pradesh (55; -8) Maharashtra (50; -3) Tripura (50; -6) Uttar Pradesh (52; -10)
Above average reduction in malnutrition (>11.6%)	Arunachal Pradesh (25; -35) Nagaland (24 -14) Andhra Pradesh (38; -20) Assam (37 -27) Delhi (35; -16) Goa (29; -16) Jammu & Kashmir (35; -19) Karnataka (44; -13) Meghalaya (38; -15) Punjab (29 -37) Tamil Nadu (37; -22)	Bihar (55; -12) West Bengal (49; -14)

Source: Calculated from NFHS I and NFHS II data

Note: The first figure in parentheses refers to prevalence (1998/99) and the second figure to the change in prevalence between 1992/93 and 1998/99. Since the latter is based on only two time points, trends cannot be extrapolated beyond this time period.

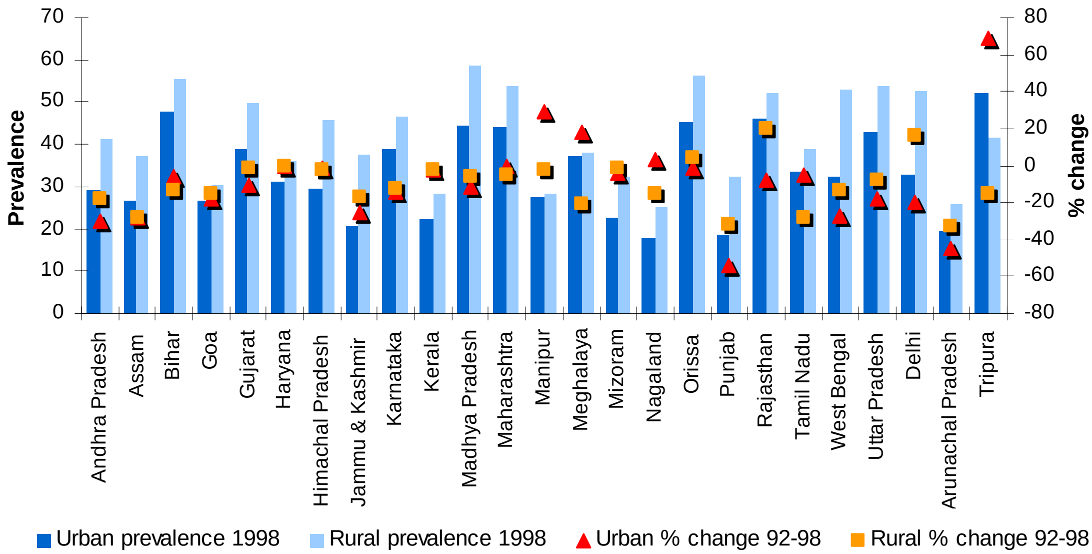
1.2.3.2 By location

In addition to the seven states identified (in Table 5) as having above-average total underweight prevalence, there are some states that have very high urban- or rural-specific underweight prevalence. Gujarat (50%) has a rural underweight prevalence that is higher than the 49% rural average, and Tripura's urban underweight prevalence of 52% is not only higher than the national urban average of 38%, but also exceeds the rural underweight prevalence in all other states.

There are clear and consistent urban-rural disparities in underweight prevalence and in all states, except Tripura, the percentage of underweight children is higher in rural areas than in urban areas (see Figure 9). The magnitude of these differentials varies by state, though. The largest differences are observed in Delhi, West Bengal, Punjab and Jammu and Kashmir where the percentage of underweight children in rural areas is, respectively, 61%, 64%, 78% and 81% greater than the percentage in urban areas. It is also noteworthy that although Rajasthan, Orissa and Manipur are the only states identified as experiencing increases in total underweight prevalence from 1992-1998, Delhi also registered significant increases in *rural*[j] malnutrition prevalence and the north-eastern states of Meghalaya, Manipur, Nagaland and Tripura experienced increases in *urban* malnutrition.

[j] The rural population of Delhi is not strictly comparable to the rural populations of the states, however; most of the "rural" population in Delhi consists of poor urban populations on the periphery of the city.

Figure 9 Urban-rural disparities in underweight, by state, 1992/93-1998/99



Source: Calculated from NFHS I and NFHS II data

1.2.3.3 By gender

Although at the national level the prevalence of underweight among female children exceeds the prevalence of underweight among male children by more than 3 percentage points and the rate of decline in the prevalence of male underweight is about 2.3 times that of female underweight (Figure 7), it would be incorrect to assume that this pattern of gender disparities characterizes every state. Indeed, while the national trend of a decline in the prevalence of male underweight that far outstrips the decline amongst females is observed in the states of Assam, Bihar, Gujarat, Karnataka, Kerala, Madhya Pradesh, Meghalaya, West Bengal and Uttar Pradesh, in other states such as Goa, Jammu and Kashmir, Nagaland, Tripura and Mizoram, the female prevalence of underweight fell faster than the male prevalence. Moreover, in the three states where total underweight prevalence increased, namely Manipur, Orissa and Rajasthan, this increase was observed for both males and females.

This heterogeneity in the gender differentials in the prevalence of underweight is most apparent in Table 6, which classifies states into one of four categories. In states such as Delhi and Orissa, the percentage of underweight boys is higher than the percentage of underweight girls in both 1992 and 1998, while the pattern is reversed in Punjab, Tamil Nadu and West Bengal. In other states, such as Jammu and Kashmir, girls were in a relatively worse position than boys in 1992, but not in 1998. In the last group of states, girls fared better than boys in 1992, but by 1998 appeared to have lower nutritional status. This last group of states includes the BIMARU (Bihar, Madhya Pradesh, Rajasthan and Uttar Pradesh) states with high prevalence of underweight, as well as Kerala, Karnataka and Assam.

Table 6 Classification of states by the change in gender differentials in the prevalence of underweight

% underweight girls exceeds % underweight boys in both 1998 and 1992: Andhra Pradesh, Gujarat, Haryana, Manipur, Punjab, Tamil Nadu, West Bengal
% underweight boys exceeds % underweight girls in both 1998 and 1992: Goa, Nagaland, Delhi, Arunachal Pradesh, Tripura, Orissa
% underweight girls exceeds % underweight boys in 1998, but not 1992*:* Assam, Bihar, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Uttar Pradesh and Rajasthan
% underweight boys exceeds % underweight girls in 1998, but not 1992: Himachal Pradesh, Jammu and Kashmir, Mizoram

Source: Calculated from NFHS I and NFHS II data

1.2.3.4 By caste

The national pattern whereby the prevalence of underweight is highest among scheduled tribes, followed by scheduled castes and then other castes, obscures variations at the state level. For example, in Himachal Pradesh, Jammu and Kashmir, Nagaland, Arunachal Pradesh and Tripura, underweight prevalence in 1998/99 was higher among scheduled castes than other castes. In Assam, Goa and Manipur, the underweight prevalence was, in fact, higher among other castes than among scheduled groups.

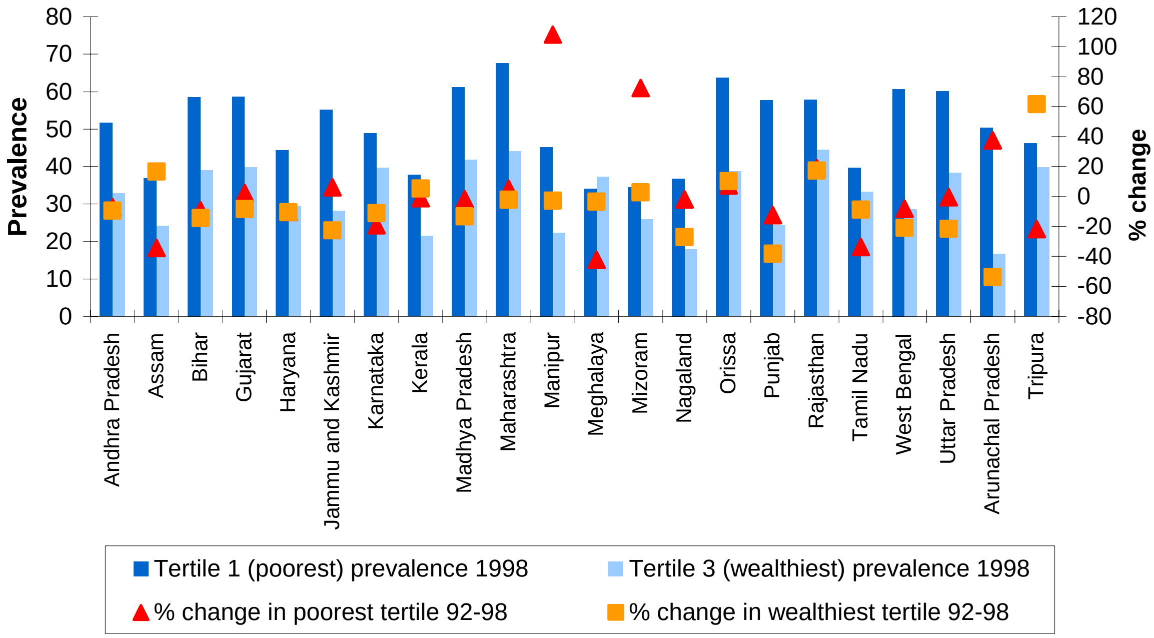
Within each state, the trend in underweight prevalence (from 1992/93 to 1998/99) can vary dramatically across the castes within that state. In Maharashtra, Uttar Pradesh, Tripura and Gujarat, for example, the underweight prevalence of scheduled tribes increased while the underweight prevalence of other scheduled and non-scheduled castes declined. A similar sort of pattern is observed for scheduled castes in Kerala and Himachal Pradesh and, surprisingly, for non-backward castes in Meghalaya and Haryana.

1.2.3.5 By wealth

The expected correlation between wealth and nutritional status is evident in the graph below: with almost no exceptions, the prevalence of underweight, both in 1992 and 1998, is much higher among households that lie within the lower tertile (relatively poor) of the all-India wealth distribution than among those in the upper tertile (relatively well-off)[k].

[k] Principal components analysis, conducted on a set of variables including household assets and housing characteristics, was used to generate the cut-points for the wealth tertiles, which divide the population of each state into three categories based on the individual's position in the *all India* wealth distribution. Tertiles are used rather than quintiles since, in some states, the latter results in too few observations in particular quintiles.

Figure 10 Change in the prevalence of underweight, by wealth tertile and state, 1992/93-1998/99



Source: Calculated from NFHS I and NFHS II data
Note: Manipur data has very few observations in tertile 1 in 1992

More troubling is that the aggregate reduction in the prevalence of underweight between 1992/93 and 1998/99 was smaller for the lowest tertile (poorest third) than for the upper tertile (richest third). Not only is this true in aggregate, but it applies to most states in India, indicating that in most states there are growing disparities in the prevalence of underweight among the well-off and the not-so-well-off. There are, however, some notable exceptions where the percentage reduction in underweight prevalence among the lower tertile was much greater than the upper tertile, indicating some catch-up effect in nutritional status among the relatively poor. Table 7 below summarizes the situation in different states.

Table 7 Wealth disparities in the trend of underweight prevalence, by state, 1992/93-1998/99

Growing inter-tertile nutritional inequalities as a result of:
Malnutrition declining less among tertile 1 than tertile 3: Andhra Pradesh, Bihar, Madhya Pradesh, Nagaland, Punjab, West Bengal, Uttar Pradesh
Malnutrition increasing in tertile 1 while declining in tertile 3: Gujarat, Jammu and Kashmir, Maharashtra, Manipur, Arunachal Pradesh
Malnutrition increasing more in tertile 1 than tertile 3: Mizoram, Rajasthan
Narrowing inter-tertile nutritional inequalities as a result of :
Malnutrition declining less among among tertile 3 than tertile 1: Karnataka, Meghalaya, Tamil Nadu
Malnutrition increasing in tertile 3 while declining in tertile 1: Assam, Kerala, Tripura
Malnutrition increasing more in tertile 3 than in tertile 1: Orissa

Source: Calculated from NFHS I and NFHS II data

1.3 MICRONUTRIENT DEFICIENCIES

1.3.1 Prevalence of iron deficiency anemia (IDA)

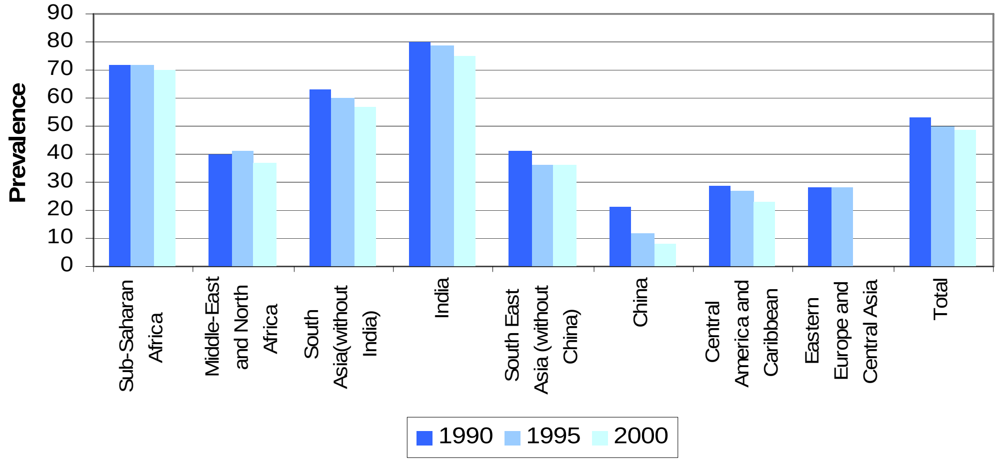
Although the exact prevalence figures vary from study to study, there is no doubt that iron deficiency anemia (IDA) is an extremely serious public health problem in India, especially among pregnant women and children. At least half of all ever-married women aged 15-49 years and adolescent girls are believed to have some degree of IDA[49]. One recent study showed that the prevalence of iron deficiency anemia among both pregnant and lactating women is over 75% and that more than half of pregnant women and a third of lactating women are moderately or severely anemic[50]. In some states, an anemia prevalence as high as 87% has been found among pregnant women from disadvantaged groups[51]. Severe anemia from iron deficiency is believed to claim the lives of 22,000 women during pregnancy and childbirth each year.

The prevalence of IDA among children is much higher than among adult women, and may be partly attributable to the high prevalence of hookworm among children. The overall prevalence of anemia among children aged 6 to 35 months is 74% and most suffer from mild (23%) or moderate (46%) anemia[52]. A recent study found that anemia prevalence among children aged 1 to 5 years is a little lower than the above estimate, but two-thirds of these children can still be classified as anemic, with the majority suffering from moderate anemia[53].

1.3.1.1 Trends

Progress in reducing the prevalence of IDA has been very slow in India. A recent estimate of IDA prevalence among both non-pregnant and pregnant women aged 15 to 49 years shows that there was very little progress in reducing prevalence between 1990 and 2000. Moreover, population growth added 34.1 million non-pregnant and 2.3 million pregnant anemic women during this time period[54]. Although it has fallen somewhat from almost 80% in 1990, the prevalence of IDA among preschool children was still around 75% in 2000[55]. By contrast, the prevalence of IDA in neighboring countries such as Bangladesh and Pakistan has fallen to 55%. The reduction of IDA prevalence in China is especially remarkable: the prevalence of IDA was halved from over 20% to the current level of 8% within a decade.

Figure 11 Trends in prevalence of iron deficiency in preschool children, by region, 1990-2000



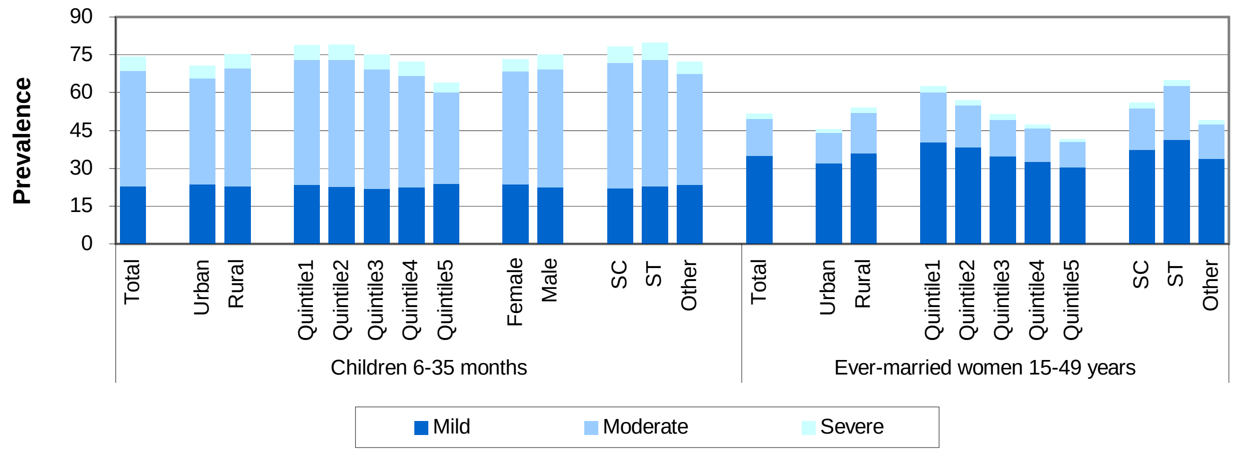
Source: UNICEF and MI 2004b

1.3.1.3 Variation by demographic and socioeconomic characteristics

Among children aged 6 to 35 months, there is a noticeable variation in the prevalence of moderate IDA (1998/99) by demographic and socioeconomic characteristics. It tends to be higher among children from disadvantaged groups, namely those living in rural areas, poor households, and from scheduled castes/tribes. The prevalence of mild and severe anemia is less variable, however, hovering around 23% and 5%, respectively. There is almost no difference in the prevalence of IDA by children's gender.

The pattern of IDA prevalence among ever-married women aged 15-49 years is somewhat similar to that among children, but the variation is larger. The total prevalence among women from scheduled tribes and the poorest 20% of population, for example, is at least 10% higher than the national average (52%), so that the total prevalence among these two groups is above 63%. Figure 12 also reveals that IDA is a condition that afflicts not only the poor: more than 40% of women in the richest two quintiles are also anemic.

Figure 12 Prevalence of anemia among children aged 6-35 months and women of reproductive age, by demographic and socioeconomic characteristics, 1998/99



Source: IIPS and ORC Macro 2000

1.3.1.4 Inter-state variation

The prevalence of IDA varies widely across states, among both children and ever-married women. While less than half of children are anemic in Nagaland, Kerala and Manipur, more than 80% of children suffer from IDA in Punjab, Bihar, Rajasthan and Haryana. The prevalence of child anemia is generally higher in the states with a high prevalence of underweight, yet some states with a relatively low underweight prevalence (like Sikkim and Punjab where less than a third of children are underweight) have a surprisingly high IDA prevalence (77% and 80%, respectively).

The variation in IDA prevalence among ever-married women is even higher, ranging from 23% in Kerala to 70% in Assam. Manipur (29%), Goa (36%), and Nagaland (38%) also have a relatively low prevalence. By contrast, in seven states, namely Sikkim, Arunachal Pradesh, West Bengal, Orissa, Meghalaya, Bihar and Assam, more than 60% of ever-married women are anemic. In some states, such as Assam and Arunachal Pradesh, the prevalence of IDA among women is even higher than that among children under three. Figures for the prevalence of IDA among women and children, disaggregated by state and severity of IDA, can be found in Table B in the Appendix.

1.3.2 Prevalence of Vitamin A deficiency (VAD)

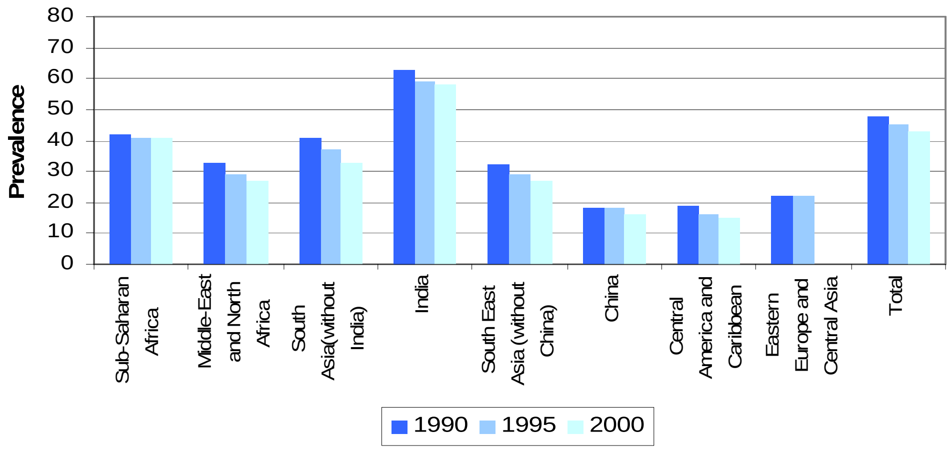
The prevalence of Vitamin A deficiency (VAD) in India is one of the highest in the world, especially among preschool children. The prevalence of subclinical VAD ranges from 31% to 57% among preschool children and a further 1% to 2% of children suffer from clinical VAD[56]. With its large population, India is home to more than a quarter of the world's population of preschool children suffering from subclinical VAD (35.4 out of 127.3 million) and a third of the preschool population with xerophthalmia (1.8 million out of 4.4 million)[57]. As a result of this high prevalence, VAD is estimated to precipitate the deaths of more than 0.3 million children annually in India[58].

VAD is also prevalent among women of reproductive age and clinical symptoms of night blindness are extremely widespread. About one in every twenty pregnant women has subclinical VAD and almost 12% of them suffered from night blindness during their most recent pregnancy[59]. An extremely high prevalence of maternal night blindness, coupled with a large number of pregnancies, means that approximately every second pregnant woman with night blindness lives in India (3.0 million out of 6.2 million). As might be expected, the prevalence of night blindness is much higher, in fact twice as high, in rural (13.7%) than in urban (6.4%) areas[60].

1.3.2.2 Trends

A trend analysis of the progress in reducing VAD in India shows that there has been some improvement, yet the prevalence of subclinical VAD remains one of the highest in the world. The prevalence of subclinical VAD fell relatively fast in the early 1990s, down to less than 60% among preschool children. However, progress slowed in the second half of 1990s, and recent sources estimate a current prevalence of around 57%[61].

Figure 13 Trends in prevalence of subclinical vitamin A deficiency among children under 6, by region, 1990-2000

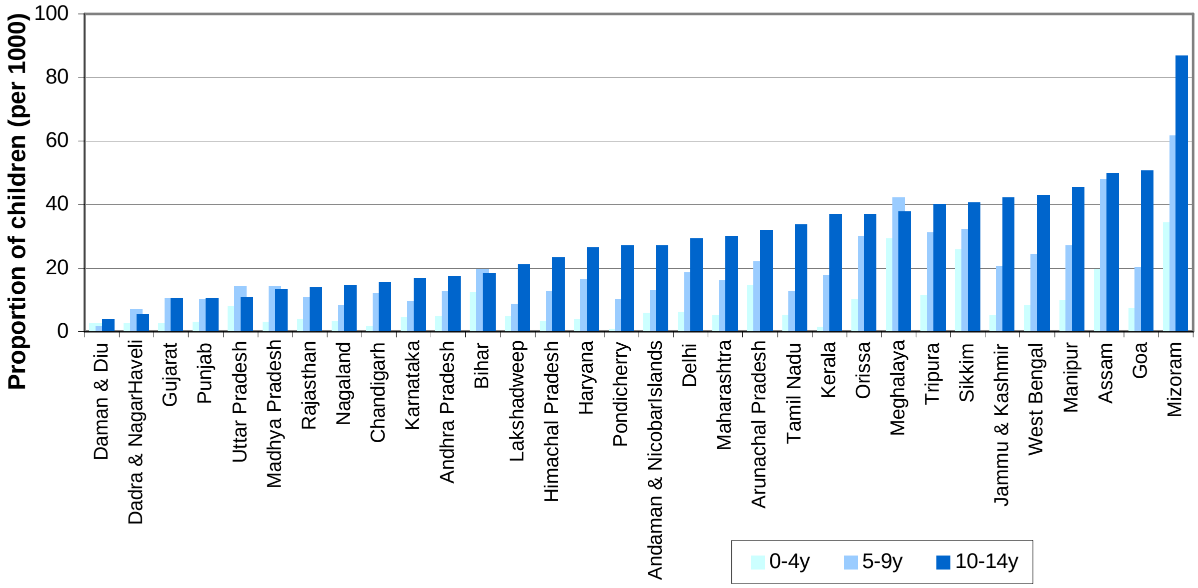


Source: UNICEF and MI 2004b

1.3.2.3 Inter-state variation

There is huge variation in the prevalence of VAD among children by state. The incidence of vision problems can, with some measurement error, be used an indicator of Vitamin A deficiency[1]. The number of children with vision problems has fallen below 10 per 1,000 children in several states and union territories, such as Gujarat and Punjab, but many states in the North-East, such as Tripura, Sikkim, Manipur, Assam, and Mizoram, as well as Jammu and Kashmir, West Bengal, and Goa have more than 30 per 1,000 children with vision problems[62].

Figure 14 Proportion of children (per 1000) experiencing day and night-time vision difficulties



Source: DWCD and UNICEF 2001

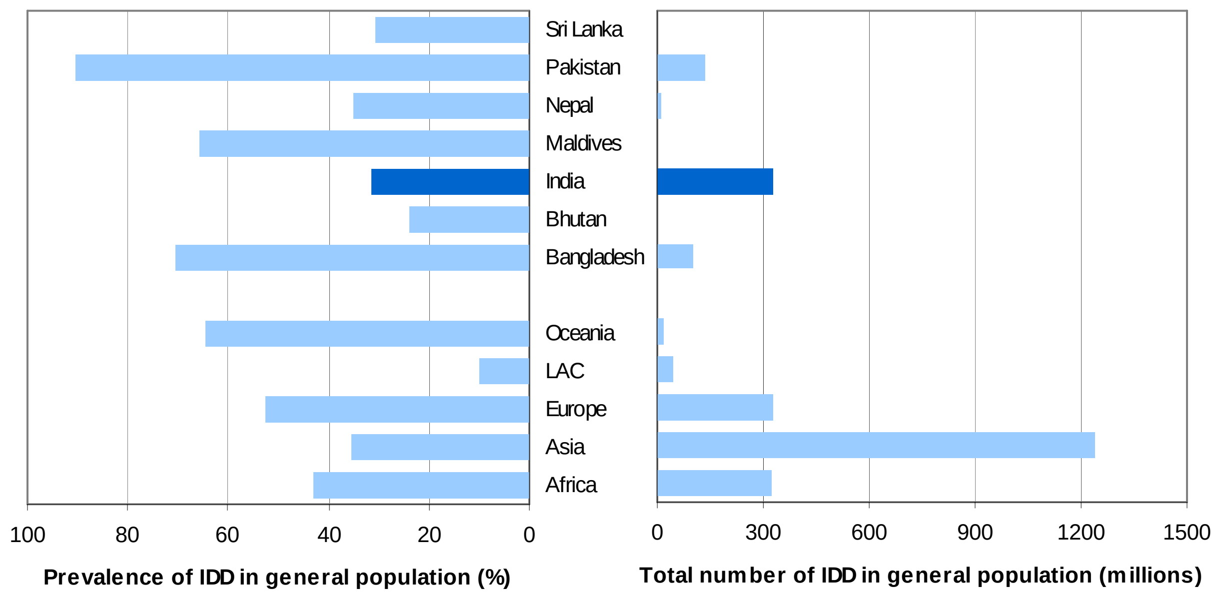
Note: The variation in day and night-time vision difficulties across states is used as an indicator of the variation in Vitamin A deficiency across states

1.3.3 Prevalence of iodine deficiency disorders (IDD)

Although the prevalence of iodine deficiency disorders (IDD) in India is lower than in most South Asian countries, the problem is ubiquitous and affects millions of people. One survey showed that more than 85% of districts (241 out of 282) are IDD endemic[63]. This places about 329 million people at risk, equivalent to a third of India's population or a sixth of the total global population that is at risk of IDD (see Figure 15). Of those who suffer from IDD in India, 51 million are school-aged children (aged 6 to 12 years). A third of all children in the world that are born with IDD-related mental damage live in India[64].

[1] In the source data (DWCD and UNICEF 2001), reports of day and night-time vision problems were used as indicators of Vitamin A deficiency. However, it is probable that not all vision problems are Vitamin A-related and that there may be some under-reporting in disadvantaged areas due to poorer diagnostic capabilities.

Figure 15 Prevalence and number of IDD in the general population, by region and country



Source: ACC/SCN 2004

1.3.3.1 Inter-state variation

Like other vitamin and mineral deficiencies, the prevalence of IDD varies widely across and within states. 17 states have been identified as goiter-endemic,[65] as have most hilly regions. More recently, there appears to have been an emergence of new endemic areas in the plains[66]. According to a 2001 five state study, the prevalence of IDD varies from 15% in Tamil Nadu to 46% in Karnataka. At the district level, the variation is even greater: for example, the East Godavari and Nellore districts in Andhra Pradesh and Kannur district in Kerala are effectively free of iodine deficiencies, while the prevalence is as high as 90% in Shimoga district in Karnataka[67].

1.4 WILL INDIA MEET THE NUTRITION MDG?

The Millennium Development Goals (MDGs) are a set of internationally agreed goals that countries and institutions have committed to reach by 2015. The second MDG target, which we refer to as the nutrition MDG, is to halve between 1990 and 2015:

(i) the prevalence of underweight children (under five years of age)
(ii) the proportion of population below a minimum level of dietary energy consumption.

A few studies, using different assumptions[m], have considered the likelihood that India will attain the second nutrition MDG. Although their projections differ, in sum it seems unlikely that the prevalence of malnutrition in India will fall from its level of 54% in 1990 to 27%[n] by 2015[68]. NFHS data shows that, in 1998/99, even the wealthiest quintile had a prevalence of malnutrition (33%) that far exceeded the MDG goal. Our projections indicate that economic growth alone is unlikely to be sufficient to lower the prevalence of malnutrition. When combined with policy interventions, the projections are rosier, but a rapid scaling-up of health, nutrition, education and infrastructure interventions is needed if the MDG is to be met[69].

1.4.1 MDG projections: the effect of economic growth alone

The effect that India's economic growth in the coming decade will have on the prevalence of malnutrition in 2015 can be projected using estimates of the elasticity (i.e. responsiveness) of malnutrition to annual economic or income growth. The magnitude of these elasticities should ideally be calculated from household surveys[70], provided that surveys have appropriate income or expenditure data. In the absence of appropriate data, an alternative it to assume a rule-of-thumb elasticity and test its sensitivity.

In order to estimate that effect that economic growth will have on the prevalence of underweight, the following assumptions are made:

- a 3% average annual *per capita* growth rate, which was the actual average in India between 1990 and 2002[71].
- an income elasticity of underweight of 0.51[72].

Under these assumptions, the prevalence of underweight among children *under three* will fall to only 39% by the year 2015 (see Table 8). Under a more generous average annual *per capita* growth rate of 5%, the prevalence falls to 36.3% - still short of the MDG. Even under an unrealistically generous income elasticity assumption of 0.7, prevalence falls to only 35%. Under the assumption that the prevalence of underweight in 2002 has fallen somewhat since 1999, for example by 1% *per annum* to 43%, the change in the predicted prevalence is greater, but still remains far in excess of the targeted 27.4% mark. Only when an exceptional average annual *per capita* economic growth rate of 8% is assumed does underweight fall low enough to reach the MDG. This sensitivity analysis shows that this conclusion is robust to a wide range of assumptions: economic growth by itself cannot be expected to reduce the prevalence of underweight to MDG levels.

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[m] Wagstaff and Claeson (2004) use 1990-92 data from rural areas, as well as the later NFHS I (1992/93) and NFHS II (1998/99) data, and obtain an average annual reduction of 3.9%; Chhabra and Rokx (2004) and World Bank (2004a) obtain similar estimates (1.7% and 1.9% respectively) when using a constant rate of change and data from NFHS I and NFHS II with the differences in the estimates only attributable to rounding.

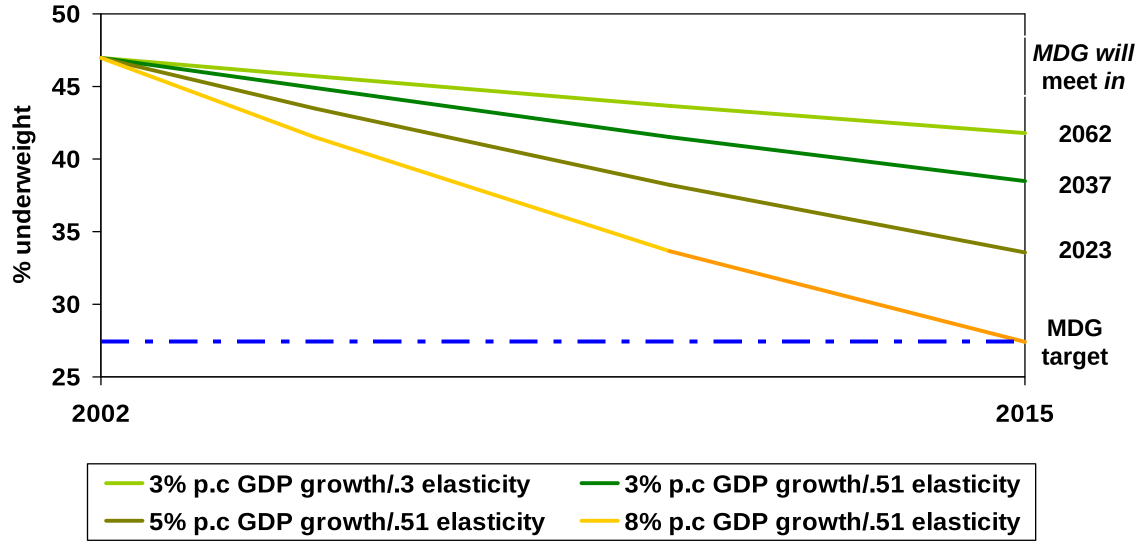
[n] The rate shown for 1990 is projected from the change observed between the two NFHS surveys in 1992/93 and 1998/99. This MDG target is calculated for children under three and, therefore, differs from the WHO target which focuses on children under five.

Table 8 Under all likely economic growth scenarios, India will not reach the nutrition MDG without direct nutrition interventions

Estimated prevalence of underweight 2002	Income elasticity of malnutrition	Average annual *per capita* GDP growth		
		3%	**5%**	**8%**
43%	**0.51**	35%	**31%**	
47%	**0.51**	**39%**	**36%**	**27.3%**
47%	**0.3**	41%	39%	
47%	**0.7**	**35%**	30%	

Note: Shaded cells show predicted prevalence of underweight among under-threes in 2015; see Table A in the Appendix for detailed calculations

Figure 16 Predicted prevalence of underweight in 2015, under different economic growth scenarios



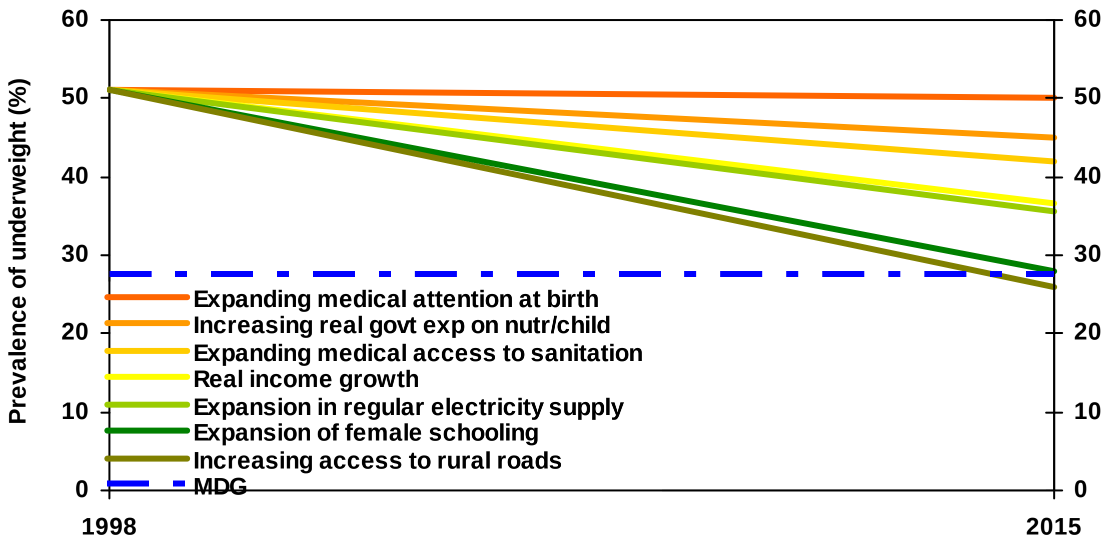
Note: This figure corresponds to the estimates in Table 8

1.4.2 MDG projections: the effect of economic growth plus an expanded set of interventions

Projections from a recent World Bank publication[73] combine economic growth assumptions *and* policy interventions. They show that even if poor states were brought up to the national average in terms of coverage of sanitation, road access, electricity, medical attention at time of delivery, female schooling, household income (consumption) and public spending on nutrition per child, the cumulative reduction in the national prevalence of underweight would only be about 8 percentage points (or 15%). If the magnitude of the proposed interventions were further scaled up so as to bring the poor states to the average level prevailing in the non-poor states, the cumulative reduction in the prevalence of underweight rate would be 21 percentage points or

38% – still short of the MDG. Only when seven particular interventions[o] (see Figure 17) are pursued simultaneously can one expect a reduction of 25 percentage points in the child underweight rate in the poor states – enough for them to reach their MD Goal of 27.4% of children being underweight.

Figure 17 Projected percentage of children under three who are underweight in poor states, under different intervention scenarios, 1998 to 2015



Source: World Bank 2004a.
Note: Graph shows cumulative effect of each additional intervention

1.5 CONCLUSIONS

It is clear that the problem of undernutrition in India is one of alarming magnitude, but also of great complexity. The prevalence of underweight is among the highest in the world, nearly double that in Sub-Saharan Africa, and the pace of improvement lags behind what might be expected given India's economic growth. Modest progress has been seen in reducing undernutrition over the last decade, but most of this progress has been driven by improvements among higher socioeconomic groups. Even if India comes close to achieving the nutrition MDG in 2015 (which it may not), it will still have levels of undernutrition equivalent to those that exist in Sub-Saharan Africa today[74]. Iron, iodine and Vitamin A deficiencies are widespread and have serious consequences for child survival and economic productivity.

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[o] The World Bank (2004a) estimates that reaching the 2015 MDG target is feasible under the following combination of economic growth and policy interventions: 0.3% increase in average years of female schooling, a 4% increase in per child government expenditure on nutrition programs, a 3% increase in consumption expenditure per capita, a 1 percentage point increase in the coverage of regular electricity supply, a 1.5 percentage point increase in the population coverage of professionally-assisted deliveries, a 1 percentage point increase in village access to *pucca* roads and a 2 percentage point decrease in the population with no access to toilets since 1998/99.

While aggregate levels of undernutrition are extremely high, the picture is further exacerbated by the significant inequalities across states and socioeconomic groups. Girls, rural areas, the poorest, and scheduled tribes and castes are the worst affected. In Maharashtra, Bihar, Madhya Pradesh, Uttar Pradesh, Orissa and Rajasthan, more than one in two children are underweight. Thus, while undernutrition is a national problem, the problem is clearly more acute among certain groups, and inequalities in malnutrition appear to be increasing.

We now turn to examine India's primary programmatic response to the child malnutrition problem – the Integrated Child Development Services scheme.