Reduction in child malnutrition is another MDG related to an improvement in child welfare. Child malnutrition significantly increases the risk of infant and child death, with some estimates suggesting that child malnutrition is responsible for half or more of child deaths in the developing world. The NFHS-2 data analyzed in the previous chapter showed a strong relationship between under-five child mortality rates and child underweight rates across the various regions of India (see Figure II.22 in Chapter II). There is also a large body of evidence from around the world relating under-nutrition in childhood to lower levels of school performance, cognitive development, health, and, ultimately, to lower levels of labor productivity in adulthood. Thus, the economic and human costs of child malnutrition in India are likely to be very high.

The millennium development goal is to reduce the percentage of underweight children by one-half between 1990 and 2015. For India, this would imply a reduction in the child underweight rate from 54.8% in 1990 to 27.4% in 2015.

Patterns and Trends

Levels

Child malnutrition rates in India are extraordinarily high. The NFHS-2, which is the most recent household survey containing information on child nutrition, indicates that nearly one-half of children aged 0-35 months are underweight or stunted, which translates into approximately 37 million malnourished children. About 18-23 percent of children are severely underweight or stunted in the sense of being more than three standard deviations below the relevant NCHS standards. This suggests that Indian children suffer from short-term, acute food deficits (as reflected in low weight-for-age) as well as from longer-term, chronic under-nutrition (as manifested in high rates of stunting).

Trends

Both the NFHS-1, conducted in 1992-93, and the NFHS-2, conducted in 1998-99, provide information on child malnutrition in India. The NFHS-1 showed that the child underweight rate was 45.8% in 1992-93, while the NFHS-2 showed a rate of 27.4% in 2015. This represents a significant reduction in the prevalence of child malnutrition over this period.

Another important form of malnutrition that is not pursued in this report is inadequate consumption of micronutrients, such as Vitamin A, iron and iodine.

For instance, based on worldwide evidence, Pelletier and Frongillo (2002) estimate that a 5 percentage point reduction in the prevalence of low weight-for-age could reduce child mortality by about 30% and under-5 mortality by 13%.

The World Bank (1998) suggests that the cost of undernutrition in India is at least US$10 billion annually in terms of lost productivity, morbidity and mortality.

While the nutrition MDG is based on the weight-for-age indicator, it should be recognized that there are other important indicators of child malnutrition. Weight-for-age is an indicator of both short- and long-term malnutrition. Height-for-age or stunting is a better indicator of long-term (cumulative) malnutrition, while weight-for-height or wasting is generally considered the appropriate indicator for tracking short-term fluctuations in nutritional status.

The most reliable estimate is available from the NFHS-1 for 1992-93. The rate shown for 1990 is projected from the change observed between 1992-93 and 1998-99.

As in the literature, a child is considered underweight when his or her weight-for-age is more than two standard deviations below the NCHS reference weight. A child is stunted when his or her height-for-age is more than two standard deviations below the NCHS reference. Severe underweight and stunting occur when the relevant nutrition indicator is more than three standard deviations below the NCHS reference.

Wasting rates (i.e., low weight-for-height) are significantly lower than underweight or stunting rates, but this is typically the case in most low-income countries.
obtained information on child anthropometry. A comparison of the estimates of these two surveys indicates a modest decline of about 11% (from a rate of 52.7% to 47%) during the 6-year period – amounting to an annual rate of decline of 1.9%. In contrast, underweight rates in neighboring Bangladesh fell from 68% in 1992 to 51% in 2000 – an annual rate of decline of 3.6% (World Bank 2003). In Vietnam, the child underweight rate fell from 49% in 1993 to 36% in 1998 – an annual rate of decline of 6.1% (World Bank 1999)!

India thus appears to be an under-performer in reducing child malnutrition during the 1990s.

Inter-state variations

An average child underweight rate of 47% masks wide variations in child malnutrition across states. Child underweight rates vary from a low of 24-28% in the Northeastern states and Kerala to 51-55% in the states of Bihar, Rajasthan, Uttar Pradesh, Madhya Pradesh and Orissa (Figure III.1). Likewise, the decline in child underweight rates over time has also varied greatly across states. In Punjab, for instance, the child underweight rate fell at an annual rate of 7.6% between 1992-93 and 1998-99, while Rajasthan saw an increase of 2% per annum in the child underweight rate during the same period. Based on 1992-93 and 1998-99 values, Figure III.2 shows the 2015 MD goals for each of the states.

Although the proportion of children aged 0-3 years in India who were under-weight declined from 52.7% in 1992-93 to 47% in 1998-99, the absolute number of underweight children hardly changed over this period because of a large increase in the population of children aged 0-3. Indeed, only about a quarter million fewer Indian children aged 0-3 were underweight in 1998-99 as compared to 1992-93. There were wide variations in the absolute decline in the number of underweight children across states. Tamil Nadu and Andhra Pradesh each saw declines in the absolute number of underweight children of about...
0.5 million, but Rajasthan and Bihar saw an increase of 0.5 million each in the number of underweight 0-3 year olds (Figure III.3). Uttar Pradesh and Madhya Pradesh each recorded an increase of about 0.2 million underweight children aged 0-3 during the same period.

Figure III.4 suggests that there is no systematic association between the initial level of child malnutrition in 1992-93 and the rate of decline in malnutrition between 1992-93 and 1998-99. Nagaland, which had a child underweight rate of only 27.7% in 1992-93, experienced an annual rate of decline of 2.3% over the following 6 years – the same rate of decline experienced by Bihar, which began with a much higher child underweight rate of 62.6% in 1992-93.

Is child malnutrition related to living standards? The cross-state data suggest an inverse, albeit not perfect, association between the child underweight rate and gross state domestic product per capita (Figure III.5). That Kerala emerges as a positive outlier – having a much lower child underweight rate than would be suggested by its per capita income – is no big surprise, but the fact that Gujarat and Maharashtra have significantly higher child underweight rates relative to their per capita income is surprising. On the other hand, Andhra Pradesh, which is a middle-income state, has a lower child underweight rate than would be predicted by its gross state domestic product per capita. This suggests that cultural and social – not just economic – factors have an important role to play in determining child malnutrition in India.

**Public Spending on Nutrition**

Much of the public spending on child nutrition in India takes place on the Integrated Child Development Services program. This program consists of anganwadi centers (AWCs) in each village, typically staffed by a village woman with 5-8 years of schooling and an
The *anganwadi* worker receives a cash income of Rs. 1,000 per month to provide growth monitoring, food supplementation, and pre-school education to targeted children aged 0-6 years in the village. Although the program covers all the villages in the country, recent surveys from a few states suggest that relatively few (only about 10-30%) children aged 0-6 years in states such as Uttar Pradesh, Madhya Pradesh, and Rajasthan regularly attend the AWC in their community (Heywood 2003). This may be because the amount of food supplementation provided to children is meager or irregular or both. While the Central government pays for the salaries of the *anganwadi* worker and assistant, the individual states are responsible for lifting the food grains from the stocks of the Food Corporation of India and paying for the cost of transporting and distributing these food grains to the AWCs. This is the component of the ICDS that is typically under-funded (World Bank 1998, 2001).

Figure III.6 shows the total amount (excluding training) spent by various states in the country on the ICDS program. The amounts are expressed in terms of spending per child aged 0-6 years, since that is the target group of the ICDS.\(^5^1\) Two observations can be made from this figure; first, the amounts spent by most states are low – typically below Rs. 200 per child per annum. Second, there are large inter-state disparities in spending on nutrition. The poor, high-malnutrition states, such as Bihar, Uttar Pradesh, Madhya Pradesh and Rajasthan, spend only Rs. 30-50 per child, while Gujarat, Punjab, and

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51 Even though the target group is 0-6 years, the ICDS has historically focused on children aged 3-6 years. The focus on 3-6 year olds is a major design flaw of the ICDS, since malnutrition typically sets in much earlier in childhood. Experience from other countries, as well as from other nutritional interventions in India (e.g., Tamil Nadu Integrated Nutrition Project, discussed in Box III.1), has shown that child malnutrition can be addressed much better by targeting nutritional supplementation to children in the younger age groups.
Haryana spend Rs. 90-100. Tamil Nadu’s expenditure is about Rs. 170, while spending in the Northeastern states is above Rs. 500.

Is there an association between child underweight rates and per-child spending on the ICDS? Pooled data on 14 states for two years – 1992-93 and 1998-99 – suggest an inverse association (Figure III.7). However, since there is no control for other variables, such as per capita income, the association does not necessarily indicate a positive effect of public spending on nutrition. Indeed, there does not appear to be any association between changes in the level of per-child spending on ICDS and changes in the child underweight rate (Figure III.8).

However, the data do suggest an inverse association between changes in the child underweight rate and changes in gross state domestic product per capita (Figure III.9). States that experienced greater growth in real gross state domestic product per capita between 1992-93 and 1998-99 experienced larger declines in the child under-weight rate during the same period.

**Intra-State Variations**

Map III.1 shows the child underweight rate in 1998-99 for different regions in the country. The child underweight rate ranges from a low of 11% in the Hills region of Assam to a high of 60% in Chhattisgarh. More than a third of the regions have child underweight rates of 50% or greater, confirming the ubiquity of child malnutrition in the country.

What is even more worrying is that more than a quarter of the regions in the country for which underweight data are available

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52 It is not possible to obtain reliable district-level estimates of child malnutrition in India. Regional-level estimates are more reliable, given the sample size of the NFHS-2 survey. Data from the NFHS-2 are not available for a few of the regions.
experienced an increase in child underweight rates between 1992-93 and 1998-99 (Map III.2). These regions are scattered around the country – in the poor states (Jharkhand, Bihar, Orissa, and Uttar Pradesh) but also in the more prosperous states, such as Gujarat, Maharashtra, and Haryana.

Concentration of Child Malnutrition
Child malnutrition in India is not as heavily concentrated geographically as, say, infant deaths. For instance, the four states – Uttar Pradesh, Madhya Pradesh, Bihar and Rajasthan – account for 51% of all infant deaths in the country, but for 43% of all under-weight children under the age of 3 (Figure III.10). Nevertheless, in absolute terms, these are large numbers.

Disaggregating further, one finds that child malnutrition is relatively concentrated across districts and villages in the country. A mere 10% of districts and villages account for 27-28% – and a quarter of districts and villages account for more than half – of all the underweight children in the country (Figure III.11).53

53 Since, as noted in chapter II, the NFHS-2 covered only a fraction of all the villages in the country and the number of sampled households in each village is too small to be representative, these numbers are merely indicative of possible patterns. It would be worthwhile to explore the use of promising new methodologies available to more accurately identify villages with the largest number of underweight children in the country, so that nutritional interventions could be better targeted to these villages.
Proximate Causes of Child Malnutrition

Infant feeding practices

An important correlate of child nutritional status is nutrient intake, which in turn depends on the nature and duration of feeding (including breastfeeding) practices. Feeding practices are especially critical during the first few days and months of an infant’s life, since growth is faster and protection against illnesses and infections is most needed during this crucial period. Ideally, a baby should be put to the mother’s breast immediately after birth. However, NFHS-2 data indicate that nearly one-half of Indian babies have to wait to be breastfed for more than a day after they are born (Figure III.12). In the poor states of Bihar, Uttar Pradesh, Madhya Pradesh, Orissa and Rajasthan, this ratio is even higher (62%). This is how the cycle of child malnutrition begins very early in an Indian child’s life. The delay in breastfeeding is often related to an incorrect perception that the first breast milk (colostrum) is an inferior food, when in fact colostrum is rich in antibodies and highly beneficial to the newborn infant.

Another common feeding practice in India that has adverse implications for child malnutrition is the early termination of exclusive breast-feeding and introduction of supplementary feeding. One reason why mothers give up exclusive breast-feeding early is their perception that they are producing...
insufficient quantities of milk due to their poor nutrition and heavy workload. Premature introduction of foods other than breast milk greatly increases the risk of infection in the small infant, and this sets in motion the process of malnutrition. It also puts the infant at greater risk of malnutrition, since weaning diets are often inadequate in India. Supplementary feeding begins with a thin gruel of rice, often heavily diluted with water and with some vegetables or legumes added as a relish depending on season and availability, but generally in very small quantities. The consequent low energy density of this weaning food leads to a reduced intake of calories and protein, and is an important cause of growth faltering during the weaning period, from six months to two years of age. The NFHS-2 data indicate that nearly 49% of children aged 0-4 months and 58% of children aged 0-6 months are not exclusively breastfed (i.e., supplementary feeding is introduced), which is not in line with the recommendations of WHO and UNICEF that exclusive breastfeeding continue for the first six months of a child’s life.

Infections

Illness and infection, especially diarrheal infections, are strongly associated with child malnutrition. Infections reduce the ability of the body to absorb critical nutrients from food, which in turn leads to malnutrition.54 The NFHS-2 data indicate that an average infant begins suffering from diarrheal diseases very early in his or her life; by the age of 6 months, he or she has already experienced an average of 2.2 diarrheal episodes, and by the age of 12 months, 5.2 illness episodes (Figure III.13). Diarrhea is even more prevalent among infants in the poor states

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54 The association reflects two-way causality; while infections lead to malnutrition, malnourished children are more susceptible to infections.
of Bihar, Madhya Pradesh, Uttar Pradesh, Orissa and Rajasthan. The NFHS-2 data also show that children who have suffered a diarrheal episode are 15% more likely to be underweight than children who have not experienced diarrhea.55

Maternal weight and low birth weight

For a large number of Indian children, malnutrition begins very early in life – when they are born with low birth weight. As Figure III.14 shows, children born with a weight of less than 2.5 kgs are at significantly greater risk of subsequent malnutrition than children whose birth weight is above 2.5 kgs. Nationally, about 22% of births classify as low birth weights, with wide variations across states. In Uttar Pradesh and Madhya Pradesh, more than a third of all children weigh less than 2.5 kgs at birth. Even in Kerala, the proportion of low birth weights is as high as 18%.

Low birth weight in turn is determined by a number of factors, but important among them is maternal nutrition. Malnourished or low-weight mothers are more likely to give birth to low-weight babies, which implies that children of low-weight mothers are more likely to be malnourished than children of heavier mothers. Figure III.14 shows this trend; nearly three-quarters of children under 3 born to mothers whose weight is less than 35 kgs. are likely to be underweight. This ratio drops to just over a quarter for mothers weighing 50 kgs or more.

55 It is not just diarrhea that reduces nutrient absorption of the body; even repeated bouts of fever (indicating infection) and acute respiratory infections can slow down weight gain and lead to malnutrition. It is unlikely however that a single bout of diarrhea, fever or cough could lead to severe malnutrition. What is more likely is that the children who report being ill during the two-week reference period are the ones who repeatedly come down with diarrhea, fever or cough. It is this chronic fever and cough that is associated with a higher risk of malnutrition. Indeed, malnutrition also increases a child’s susceptibility to infections, and so the ‘causality’ can go in the reverse direction.
Socio-economic Correlates of Child Malnutrition

Living standards

There is remarkably little variation in child underweight rates across economic groups. Indeed, the prevalence of child malnutrition is virtually identical across the bottom four consumption quintiles, with only the top quintile (representing the richest 20% of individuals) showing significantly lower child underweight rates (Figure III.15). The fact that nearly a third of the top consumption quintile in the country – a group that is likely to have good economic access to food – is malnourished suggests that cultural and social factors have an important role to play in determining child malnutrition in India. This is also consistent with the evidence, cited earlier, that the child underweight rate is relatively high in prosperous states like Gujarat and Maharashtra.

Social groups

The NFHS-2 data also indicate somewhat higher child underweight rates for scheduled castes and tribes and other backward castes relative to the forward castes (Figure III.16). Scheduled castes and other backward castes appear to be at a greater disadvantage relative to the forward castes in the poor states than in the non-poor states.

Maternal schooling

There is a large literature from around the world that documents the many benefits of maternal schooling for child outcomes – infant and child mortality, child nutrition, and child schooling. The NFHS-2 data show a sharp decline in the incidence of child malnutrition with mother’s schooling (Figure III.17).

56 Consumption quintiles are based on predicted household consumption expenditure per capita, the estimation of which is described in footnote 24 in chapter II.
Children of mothers with no schooling are nearly two times more likely to be underweight than children of mothers with more than 8 years of schooling. Children of mothers with 6-8 years of schooling are more than two times more likely to be underweight than children of mothers with more than 12 years of schooling. Interestingly, unlike the case of infant mortality, the gender disparity in child underweight rates does not seem to narrow with mother’s schooling.

**Birth order**

As with infant mortality, the birth order of a child has a significant association with the probability of him or her being underweight. The disparity across birth order is greater for girls than for boys. For instance, while the underweight rate is 42% for first-born girls under 3, it is as high as 58% for birth order four or higher girls (Figure III.18).

**Infrastructure**

Given that repeated bouts of infection, especially gastrointestinal and diarrheal, are an important reason for child malnutrition in India, access to safe drinking water and sanitation can improve child nutrition by reducing a child’s exposure to water- and vector-borne diseases. Likewise, access to electricity can also improve nutritional status by improving the hygiene, cooking and health practices in the household and in the community. Rural roads enable easier access to markets and health workers and thereby better information to child nutrition-improving information.

The NFHS-2 data show significant associations between child underweight rates and the infrastructural variables (Figure III.19). The child underweight rate is about a third lower in villages having regular electricity supply than in villages with no electricity. Likewise, access to piped water and some toilet facilities is associated with significantly lower child underweight rates, although piped water access
appears to be less important to child malnutrition in the non-poor states.

**Multivariate Analysis of Child Malnutrition**

To examine the likelihood of the various states in India attaining the child underweight MD goal, we have estimated a multivariate model of child underweight rates, using the NFHS-2 unit record data (at the child level).[57] The multivariate model has the advantage of controlling for several variables that may be simultaneously associated with child malnutrition. The estimation results are reported in Annex Table 2, while only the broad findings of the empirical analysis are discussed here.

The multivariate model confirms most of the bivariate relationships discussed earlier. Older children are observed to have a higher risk of malnutrition, but at a decreasing rate, such that the risk of malnutrition peaks at age 24 months. Mother’s age reduces the probability of a child being underweight, but at a decreasing rate. Controlling for other factors, children belonging to scheduled castes, scheduled tribes and other backward castes are significantly more likely to be underweight than children belonging to forward castes. As with infant mortality, girls per se are not at significantly greater risk of malnutrition than boys, but sex interacts with birth order such that higher birth order girls have a significantly greater risk of being underweight than higher order boys.

Infrastructure generally has strong associations with child malnutrition. Children in households having no access to a toilet are, on average, 8.6% more likely to be underweight than children in households having access to a toilet. Surprisingly, piped water access has no significant (independent) association with the probability of malnutrition, probably reflecting the fact that it is highly correlated with toilet access. As in the case of infant mortality, access to electricity is strongly associated with child malnutrition, but the association is much weaker with irregular electricity supply. Finally, proximity to sealed (pucca) roads is also associated with a sharp reduction in child underweight rates.

Other variables that are significantly associated with child malnutrition are the mother’s schooling, whether there was a medical professional at the time of the child’s birth, log of predicted monthly consumption expenditure per capita (proxying for the household’s income and living standard), and log of government expenditure on nutritional programs per child aged 0-6 years in the child’s state of residence. The significant association between government nutritional expenditures per child and

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[57] Since the dependent variable in the model is a dichotomous variable (i.e., whether or not a child is underweight), the model has been estimated by the maximum-likelihood probit method.
child malnutrition is supported by the finding, discussed below, that the risk of a child being underweight is inversely associated with the presence of an Integrated Child Development Services (ICDS) center in the child’s village of residence. Much of the government nutritional expenditure in India is on the ICDS program. The empirical results further indicate that the (inverse) association between child malnutrition and levels of government nutritional expenditure is stronger in the poor states than in the non-poor states. However, neither public spending on health and family welfare per capita nor per capita GDP in the child’s state of residence has a significant association with child underweight rates.58

**Simulations to 2015**

Based on the multivariate probit model estimated earlier, we have undertaken simulations of the child underweight rate for the poor and the non-poor states under different intervention scenarios. These are shown in Table III.1. If the poor states were simply 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 child underweight rate would be of the order of about 8 percentage points (or 15%). If the magnitude of the proposed interventions were scaled up so as to bring the poor states to the average level prevailing in the non-poor states, the cumulative reduction in the child underweight rate would be 21 percentage points or 38%.

Below we use the probit results discussed above to simulate cumulative changes in the child underweight rate in the poor states from 2000 to 2015 based on certain intervention scenarios. The nature and magnitude of the interventions are detailed in Table III.2. As noted already in chapter II, the scope and magnitude of the assumed interventions are only meant to illustrate the likely reduction in child malnutrition under one possible scenario. It is obviously not possible to predict whether the assumed interventions will indeed take place, and, even if they do, whether they will proceed as the pace assumed in Table III.2.

Figure III.20 shows the projected changes in the child underweight rate in the poor states when the seven interventions shown in Table III.2 are pursued simultaneously. It is obvious that, while each of the interventions contributes to the reduction in child malnutrition, the ones that are associated with the largest declines in child malnutrition are increased per-child public spending on nutritional programs, increases in household consumption expenditure per capita, and expansion of adult female schooling. What is encouraging is that, together, the seven interventions are associated with a reduction of 25 percentage points in the child underweight rate in the poor states – enough for them to reach their MD goal of 27.3% of children being underweight. This suggests that while attaining the child nutrition MDG will be challenging in the poor states, it is clearly feasible with a package of interventions that include economic growth, increased public spending on nutritional programs, improved physical infrastruct-

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58 As an alternative, the probit equation was estimated with a set of 23 state dummy variables, which replaced all the state-level variables (e.g., log of gross state domestic product per capita, log of state government nutrition per child, interaction between the log of government nutrition expenditure per child and a dummy variable for the poor states, and log of health expenditure per capita). Although the full set of state dummy variables was significant at the 5% level, the explanatory power of the regression, as measured by a pseudo R-squared measure, actually declined from 0.172 to 0.170 with the substitution of the state fixed effects for the four state-level variables. This suggests that the state fixed-effects model is not a superior model to the one reported here in terms of goodness-of-fit.
### Table III.1: Projected decline in child underweight rates (percentage points) with various interventions in the poor and non-poor states

<table>
<thead>
<tr>
<th>Type of Intervention</th>
<th>National average</th>
<th>Non-poor states' average</th>
<th>50% coverage</th>
<th>100% coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>No access to toilet (%)</td>
<td>-0.5</td>
<td>-1.4</td>
<td>-2.0</td>
<td>-5.7</td>
</tr>
<tr>
<td>(0-6)</td>
<td>(-0.6)</td>
<td>(-0.8)</td>
<td>(-1.6)</td>
<td>(-5.3)</td>
</tr>
<tr>
<td>Access to regular electricity supply (%)</td>
<td>-0.4</td>
<td>-0.8</td>
<td>-1.3</td>
<td>-3.1</td>
</tr>
<tr>
<td>(0-2)</td>
<td>(-0.8)</td>
<td>(-0.2)</td>
<td>(-1.3)</td>
<td>(-2.0)</td>
</tr>
<tr>
<td>Access to irregular electricity supply (%)</td>
<td>-0.3</td>
<td>-1.1</td>
<td>-1.6</td>
<td>-4.3</td>
</tr>
<tr>
<td>(0-2)</td>
<td>(-0.2)</td>
<td>(-0.2)</td>
<td>(-1.3)</td>
<td>(-2.0)</td>
</tr>
<tr>
<td>Female schooling (years)</td>
<td>-1.3</td>
<td>-3.9</td>
<td>-5.8</td>
<td>-8.0</td>
</tr>
<tr>
<td>(1.8)a</td>
<td>(-1.8)</td>
<td>(-1.8)</td>
<td>(-5.8)</td>
<td>(-8.0)</td>
</tr>
<tr>
<td>Monthly consumption expenditure per capita (Rs.)</td>
<td>-1.0</td>
<td>-2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Government expenditure on nutrition per child aged 0-6 yrs (Rs.)</td>
<td>-2.9</td>
<td>-6.9</td>
<td>-6.2</td>
<td>(-3.3)</td>
</tr>
<tr>
<td>Percent of villages in district connected by a pucca road (%)</td>
<td>-1.0</td>
<td>-2.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical attention at time of child’s delivery (%)</td>
<td>-0.3</td>
<td>-1.1</td>
<td>-0.5</td>
<td>-2.1</td>
</tr>
<tr>
<td></td>
<td>(-1.0)</td>
<td>(-1.0)</td>
<td>(-1.0)</td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** Figures in parentheses refer to the underweight reduction obtained in the non-poor states.

a The assumed coverage level in this case is 6.5 years of schooling.

b The assumed coverage level in this case is 8 years of schooling.

Empty cells indicate no substantial reduction in infant mortality due to the specific intervention being considered.

### Table III.2: Assumptions about various interventions to reduce the child underweight rate in the poor states, 1998-99 to 2015

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Starting value in 1998-99</th>
<th>Assumed change per year</th>
<th>Ending value in 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female schooling (years)</td>
<td>2.7</td>
<td>0.3</td>
<td>7.8</td>
</tr>
<tr>
<td>Per child government expenditure on nutrition programs (Rs.)</td>
<td>51</td>
<td>4%</td>
<td>98</td>
</tr>
<tr>
<td>Consumption expenditure per capita (Rs.)</td>
<td>422</td>
<td>3%</td>
<td>698</td>
</tr>
<tr>
<td>Population coverage of regular electricity supply (%)</td>
<td>27.7</td>
<td>1% point</td>
<td>44.7</td>
</tr>
<tr>
<td>Population coverage of professionally assisted deliveries (%)</td>
<td>32.3</td>
<td>1.5% points</td>
<td>57.8</td>
</tr>
<tr>
<td>Village access to pucca roads (%)</td>
<td>59.5</td>
<td>1% point</td>
<td>76.5</td>
</tr>
<tr>
<td>Population with no access to toilets (%)</td>
<td>76.5</td>
<td>-2% point</td>
<td>42.5</td>
</tr>
</tbody>
</table>
ure (electricity, sanitation access, medical attendance at birth and rural roads), and expansions in female schooling.

The caveats noted in chapter II apply here as well. The fact that public spending on nutritional programs is associated with lower rates of child malnutrition does not mean that increasing government nutritional expenditure is sufficient. There is considerable evidence that nutritional programs in India, such as the ICDS, National Mid-Day Meal Program, and the various micronutrient programs, have poor coverage, targeting and implementation. The ICDS, for example, mostly focuses on children aged 3-6 years, but the consensus among nutritionists is that it is critical for direct nutritional interventions to reach 6-24 month olds and pregnant women to prevent malnutrition (World Bank 1998, 2001).59 Further, the ICDS anganwadi center health worker – one per center – is typically over-burdened, as she has to manage pre-school education, supplementary feeding, and outreach activities. Another problem with the ICDS program is the frequent disruptions in food supplies that take place at the anganwadi center. The responsibility for the food component of the program lies with the state governments, which typically under-finance this component owing to cost and logistical difficulties. One evaluation of the ICDS found that disruptions in food distribution were very common at most anganwadi centers, with the average center going without any food rations for 64 days per year (out of an intended 300 feeding days) (National Institute of Public Cooperation and Child Development 1992).

But it is also the case that spending on direct nutritional programs is very low in India; it amounts to only 0.19 percent of GNP. In contrast, neighboring Sri Lanka spends about one percent of GNP on direct nutritional programs (World Bank 1998). A major World Bank report on malnutrition argues that, given the magnitude of the malnutrition crisis, India should be prepared to spend a minimum of 0.5 percent of GNP on direct nutrition programs – more than double what it currently spends (World Bank 1998). It goes without saying that the scaling-up of direct nutritional interventions would have to go hand in hand with revamped design, greater devolution, and better implementation of such interventions. The highly-successful Tamil Nadu Integrated Nutrition Program (TINP), which has been in operation for more than twenty years (and preceded the ICDS) in the state of Tamil Nadu, offers important lessons for the design of direct nutritional interventions (see Box III.1).

59 There is also some anecdotal evidence that the ICDS has done better (in terms of addressing child malnutrition) in states such as Tamil Nadu and Rajasthan which have better targeted the program to younger age groups.
ICDS and Child Malnutrition

Since the Integrated Child Development Scheme (ICDS) accounts for much of the public spending on nutrition in India, it may be instructive to analyze the impact of that scheme on child nutritional outcomes. Unfortunately, such an evaluation is stymied by the lack of availability of relevant data and by the fact that, by now, the scheme extends to virtually every village in the country. As such, there are no ‘control’ villages that offer a counterfactual – viz., the prevalence of child malnutrition in the absence of the program.

However, at the time the NFHS-1 data were collected in 1992-93, ICDS did not fully cover all the villages in the country. Fortunately, the NFHS-1 village/community questionnaire obtained information on whether a sampled village had an ICDS anganwadi center (AWC). By merging the household information on child anthropometry and the village information on the existence of an AWC, it is possible to examine how the location of an AWC in a village is associated with child malnutrition levels in that village.

The NFHS-1 data indicate that 34.5% of villages in the NFHS sample had an AWC. Overall, the data show the child underweight rate (for children under 4) to be somewhat lower in the villages having an AWC than in village not having one (51% versus 55%). However, upon disaggregating the numbers by sex, it is found that the presence of an ICDS anganwadi center is associated with a much larger reduction in malnutrition for boys than for girls (Figure III.21).

Since it is important to control for other variables, such as household living standards and maternal schooling, in comparing the child underweight rate across AWC and non-AWC villages, we have estimated a multivariate probit model of child malnutrition with the NFHS-1 data, exactly along the lines of the model estimated with the 1998-99 NFHS-2 data (and shown in Annex Table 2) but with the addition of an explanatory variable indicating the presence of an ICDS anganwadi center in a child’s village of residence. The empirical results, shown in Annex Table 3, confirm the pattern observed in Figure III.21; the presence of an ICDS anganwadi center in a village is associated with a reduction of about 5% in the child underweight rate, but this association is observed only for boys. There is no significant association of an ICDS anganwadi center with the prevalence of malnutrition among girls aged 0-3. This

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60 This information was not collected in the NFHS-2 data, presumably because ICDS coverage (of villages) was near universal by the time of that survey.

61 Note that in the NFHS-1 (1992-93), anthropometric data were obtained for children under the age of 4 years, while the cut-off was 3 years in the case of the NFHS-2 (1998-99) data.
Child Malnutrition

Box III.1: The Tamil Nadu Integrated Nutrition Project

The Tamil Nadu Integrated Nutrition Project, which was started in 1980 by the state government of Tamil Nadu, was one of the first projects in the world to make large-scale use of growth monitoring of children aged 6-36 months old as a means to target the neediest children and monitor their progress. TINP has been hailed as the most successful nutrition intervention program in India (and probably the world) (Berg 1987). It began as an area-targeted (to the rural areas of six districts having the lowest caloric consumption in the state but subsequently extended to the entire state), age-targeted (concentrating exclusively on children 6-36 months of age, who accounted for 90 per cent of the pre-school deaths in the state, and pregnant and lactating women), and need-targeted program. The latter was achieved by monitoring the weights of all children 6-36 months old in the project villages, and enrolling only those children whose weight gain over a certain period fell below standard in a 90-day supplementation program that included daily feeding and counseling of mothers. Since the children were on the supplementation program only for the duration of time their weight gain was below standard, the project was basically seen as a short-term intervention that sought to reduce long-term dependence of beneficiaries on public assistance. To this day, TINP relies heavily on local nutrition workers, working in conjunction with local women’s and girls’ groups. The groups are taught behavior-change strategies. They learn to promote birth weight recording, regular monthly weighing, and spot feeding, while participating in community assessment, analysis, and problem-solving.

TINP links the delivery of health and nutrition services. Children who do not respond to the nutrition supplementation are provided health services, which include check-ups and referrals, treatment of diarrhea, deworming, and immunization. These services are also available to pregnant and lactating women. In addition, the program includes intensive counseling of mothers in nutrition and hygiene education.

Evaluation studies of the TINP have indicated significant effects of the program. Severe malnutrition fell significantly, by 44 percent between 1992 to 1997, although moderate malnutrition was still quite widespread. Beneficiary children were able to maintain their weight advantage for two years or longer after they completed the program, indicating long-term effects. Costs per beneficiary were lower than for less targeted nutrition programs. Indeed, one study estimated that the annual recurrent costs of the TINP were less than one-half of the ICDS program operating in Tamil Nadu, while it had an impact on severe malnutrition that was two times as much as the ICDS. The cost difference between the TINP and the ICDS arises almost entirely from the fact that the ICDS is a mass feeding program, while the TINP is highly-selective supplementary feeding program.


A surprising finding could reflect that parents tend to selectively bring their boys, but not their girls, for supplementary feeding at the center. Or it could indicate that *anganwadi* workers or helpers provide a larger allocation of food to boys than girls. This is an issue that merits further exploration.