India's Integrated Child Development Services Nutrition Program

Who Does It Reach and What Effect Does It Have?

Monica Das Gupta
Mdasgupta@worldbank.org

Michael Lokshin
Mlokshin@worldbank.org

Oleksiy Ivaschenko
oivaschenko@worldbank.org

Development Research Group
The World Bank

This background paper was prepared for the World Bank South Asia Region's Analytical and Advisory Service on nutrition (Task Manager Michele Gragnolati).We are grateful for helpful suggestions and comments on an earlier version of this paper from Harold Alderman, Jere Behrman, Michele Gragnolati, and Yi-Kyoung Lee. The findings, interpretations, and conclusions expressed in this paper are those of the authors and do not necessarily represent the views of the World Bank, its Executive Directors, or the governments they represent. Working papers describe research in progress by the authors and are published to elicit comments and to further debate.

Abstract

Levels of child malnutrition in India have fallen only slowly during the 1990s, despite significant economic growth and much spent on the ICDS, a large supplementary feeding program. We assess the program's placement and its outcomes, using National Family Health Surveys (NFHS) data from 1992 and 1998. We find that program placement is clearly regressive across states. The states with the greatest need for the program—the low-income Northern states with high levels of child malnutrition and nearly half India's population—have the lowest program coverage, and the lowest budgetary allocations from the central government. Program placement within a state is more progressive: poorer and larger villages have a higher probability of having an ICDS center, as do those with other development programs or community associations. We find little evidence of program impact on child nutrition status. Applying the propensity-score matching (PSM) methodology to the two rounds of cross-sectional NFHS data, we find little evidence of program impact on overall child nutrition status. However, our results indicate that the impact of the program is determined to a large degree by unobserved factors, and that any evaluation that does not control for such factors would produce biased results. Special survey instruments and availability of panel data are necessary for rigorous impact evaluation of the Integrated Child Development Services (ICDS) program.

August 2004

Contents

1. Introduction 1
2. The ICDS Program 3
   Problems with the Implementation of the Program 4
3. Data and Definitions 6
   Main Constructed Variables 7
4. Trends in Malnutrition by Child's Age, Socioeconomic Status and Gender, 1992 and 1998 8
5. Assessment of the ICDS's Program Placement 9
   Descriptive Results: Program Placement across States 9
   Descriptive Results: Program Placement across Villages 11
   Descriptive Results: Growth of Program Coverage 11
   Modeling of Program Placement in a Multivariate Framework 12
6. Evaluation of Outcomes: Impact of the ICDS program 14
   Descriptive Statistics 14
   Modeling the Impact of the ICDS Program on Child Nutritional Status 14
7. Discussion 16
Appendix 35

1. Introduction

India is in the curious position of having very high levels of malnutrition despite large stocks of foodgrains resulting from increased agricultural productivity — as well as good capacity for transporting these foodgrains for relieving food shortages. There are two main reasons for this. Firstly, a substantial proportion of the population is too poor to buy enough food. Secondly, they can become malnourished due to exposure to diseases — in particular diarrhoeal diseases and parasitic infections resulting from poor sanitation and living conditions — and malnutrition in turn increases future susceptibility to disease.[1] Under these difficult circumstances, childcare practices need to be especially meticulous to avoid a heavy toll on the child. Because of these synergies, poor people are financially hampered by low labor productivity and high outlays on health care, and their children have high levels of stunting, morbidity and mortality.[2]

Levels of child and maternal malnutrition in India are high. A national survey estimated that in 1998, 47% of children aged below 3 years were moderately or severely under-nourished and that this figure had declined only modestly during 1992-98, from around 52% in 1992.[3] Half of the adults in a survey of eight states suffered from chronic energy deficiency.[4] Amongst ever-married women aged 15-49 in 1998, 36% had a low BMI, 52% were anemic, and 17% were moderately or severely anemic.[5] This contributes to a high prevalence of low birthweight children in India.[6]

To ameliorate the situation, the government of India has developed several major programs for increasing access to food. The Public Distribution System[7] makes some staple foods such as foodgrains and sugar available at controlled prices through "fair-price shops". Another thrust has been a range of food-for-work programs and employment guarantee programs, where people are typically paid directly in foodgrains for working on building or maintaining public infrastructure. Over the years, these programs have been variously re-named and re-structured, including into the National Rural Employment Programme and the Rural Landless Employment Guarantee Programme, which were merged in 1989 into the Jawahar Rozgar Yojana and as of 2001 re-formulated into the Sampoorna Grameen Rozgar Yojana[8]. A third approach has been

---

1 See for example Esrey and others (1990), and Scrimshaw and SanGiovanni (1997).

2 There is a large literature on this, but see the review and analysis in Behrman and others (2004).

3 IIPS (2000): Table 7.17 and Figure 7.3.

4 National Nutrition Monitoring Bureau, cited in Radhakrishna and Reddy (2002). See also Radhakrishna (2002).

5 IIPS (2000): Tables 7.5 and 7.7.

6 The Government of India (1999) estimated that 33% of newborns were of low birthweight, constituting 35% of the total low birthweight children in the developing world (Department of Women and Child Development, cited in Greiner and Pyle, 2000.)

7 Initiated under wartime rationing during the Second World War, this has expanded greatly thereafter (Nawani 1994).

8 Government of India, Planning Commission (no date), and Government of India, Ministry of Rural Development (no date).

targeted towards women and children directly: this includes mid-day meal programs for school-going children, and nutrition supplementation programs. By far the biggest nutrition supplementation program is the Integrated Child Development Services (ICDS).

The ICDS program aims to provide child growth monitoring, supplementary feeding, and some basic health services to young children and their mothers, as well as pre-school education. With support from UNICEF and many other donors, it has emerged from small beginnings in 1975 to become India's flagship program in these areas. During the 1990s, it has expanded rapidly, partly because of increased funding through World Bank projects. The Indian government's aim is to achieve universal coverage of the program to all administrative blocks. The program is expensive: in 1999-2000, the budgetary allocation for the program was around $170 million.[9]

Nutritional supplementation programs have been tried in many settings, and their outcomes have been mixed. Programs which seek to achieve highly specific forms of supplementation (such as salt iodization or Vitamin A doses) offer many examples of success not only under controlled conditions but also in actual implementation in some large programs.[10] For example, it is estimated that goiter rates halved in the PRC after their national salt iodization program (Gillespie and Haddad, 2001:25). Broader efforts to improve children's nutritional status through providing complementary inputs of foods with higher density of energy and/or other nutrients have been found to be successful in some controlled trials, but of limited or little effectiveness in others (Gillespie and Haddad, 2001:17).

Some longitudinal community-based projects have improved child growth by delivering supplementary feeding through intensive efforts in small areas, which would be very difficult to replicate on a larger scale. A study in Guatemala found that children in villages with supplementary feeding had higher growth than those without it (Guzman and others, 1968). The same was found in a study in Haiti, which had temporary targeted supplementary feeding for children with growth faltering (Berggren and others, 1985).

But there is little evidence of the impact of large-scale programs for supplementary feeding. Reviews of large-scale supplementary feeding programs[11] find that these show little evidence of success due to a variety of problems, including leakage; inadequate institutional capacity to meet the formidable challenges of implementing such programs on a wide scale; and inadequate effort to target needy children at the optimal ages for influencing growth. An exception is the *Progresa* program in Mexico, which is estimated to have had a significant positive impact on the growth of the poor children targeted for the intervention (Behrman and Hoddinott, 2001). An evaluation of the "glass of milk"

---

9 Government of India (2000). Estimates vary: according to (Greiner and Pyle, 2000:19) in 1998-99, the Central Government expenditure on ICDS was about $230 million.

10 See for example the reviews by Allen and Gillespie (2001), and Gillespie and Haddad (2001). See also Rogers and Coates' (2001) annotated bibliography.

11 Kennedy and Alderman (1987); Beaton and Ghassemi (1982), Anderson and others (1981), and Allen and Gillespie (2001): 69-87, and Appendix 1.

program in Peru found that although the program was quite well targeted, there was no evidence of nutritional impact (Stifel and Alderman, 2003).

Given the importance of the ICDS program's objectives and the size of the budget, it is important to assess whether it is effective in its main objective of enhancing child nutritional status. This depends on whether the program is placed where levels of child malnutrition are highest, and how well the program is implemented once it is in place. A large number of studies have monitored program implementation, and we summarize their findings. There has been little formal analysis of program placement, and therefore we focus on this issue. We analyze the characteristics that determine a village's likelihood of program placement, to see how progressive this is in practice.

Program impact evaluation is constrained by a lack of prospective data on recipients and non-recipients of the program. As a result, most evaluations of the program's impact on child nutritional status compare outcomes between areas where the program is present and those where it is not — without controlling for the differences in characteristics of the children, households and villages.[12] The challenge that we face in this analysis is whether it is possible to evaluate the impact on ICDS program with the data at hand. In an attempt to overcome some of the data limitations, we use a more rigorous methodology for evaluating the program's impact on child nutritional outcomes. We use propensity score matching to ensure that the children in the treatment and control villages are matched along a wide range of dimensions, in an effort to control for various factors that could bias the estimates of program effect.

Our analysis uses data from the National Family Health Surveys (NFHS) in India and other secondary sources to evaluate the placement of the ICDS program and its impact on child nutrition outcomes, as measured by anthropometric indices. We find that the program is regressively distributed across states: states with the highest prevalence of child malnutrition have the lowest coverage by the program and receive the lowest funding for it. Within states, the distribution seems to be more progressive. We find little evidence of impact of the program on overall child nutritional status. The result of our impact evaluation analysis indicate that there could potentially be strong unobserved factors that influence the mechanisms of how the program affects child nutritional outcomes, and that without panel data we cannot do a proper evaluation of the effect of the program.

2. The ICDS Program

The government of India started the ICDS program in 1975, with support from UNICEF. The government perceives child development to be hindered by "poverty, poor environmental sanitation, disease, infection, inadequate access to primary health care, and inappropriate child care and feeding practices" (Government of India, 2000). The ICDS programs aims to alleviate some of these problems by providing a holistic package of services, including:

12 Amongst the national level studies, see NIPCCD (1992), and Deolalikar (2004).

- Supplementary nutrition and some basic health services for children aged below 6 years, and pregnant and lactating mothers
- Nutrition and health education for mothers, and
- Growth monitoring, de-worming, and pre-school education for children.

To do this, ICDS (*Anganwadi)* centers are established in villages in selected administrative blocks. Most of these are in rural and tribal areas: only 6% of the sanctioned ICDS blocks in 2003 were in urban slums (Parliament of India, 2003). The center is staffed by a worker whose task is to provide some services directly to a rotating roster of children and pregnant women. Health and nutrition education is given by visiting homes of women who are pregnant or have infant children. The worker is also expected to liaise with other frontline workers, in particular from the health department, to assure that children and pregnant women receive key frontline MCH services, including immunization, health check-ups, and referral services. They are responsible also for ensuring ancillary health services, such as distributing folic acid to pregnant women, and de-worming children.

The program has expanded rapidly, especially in recent years: the number of blocks covered rose from 33 in 1975, to 4,200 around 2000, and over 5,500 in 2003[13]. The expenditure on the program rose sharply as well (Government of India, 2000). An average of 700 million rupees was spent per year on the program between 1975-1992, but by 1992-97 this had risen over six-fold to 4,542 million rupees per year. For 1999-2000, the budgetary allocation for the program was over 8,557 million rupees. The number of program beneficiaries also rose, from around 16 million until 1992 to nearly 28 million in 1999 (Government of India, 2000). The program has been supported by several donors, including UNICEF, SIDA, WFP, CARE, NORAD, and the World Bank. The World Bank has stepped up funding for the program during the 1990s, and currently has a $300 million credit for the program (World Bank, 1998).

Problems with the Implementation of the Program

A large number of monitoring studies[14] indicate that the ICDS program has many problems with implementation, as well as program design — including inadequate targeting of the interventions, lack of community ownership, and inattention to preventing diseases, which take a heavy toll on nutritional status.

Inadequate training, supervision, and support for AWWs. The program has expanded faster than the institutional capacity to manage it.[15] Under the circumstances, it has not been possible to provide adequate AWW training, so many workers have been sent to their workplace with little or no prior training, and have had to learn on the job itself. Refresher training is scarce. Nor is there the degree of supervision, which might help

13 Greiner and Pyle (2000:5), Government of India (2000), and Parliament of India (2003).

14 See, for example, NIPCCD (1992), NCAER (2001), Allen and Gillespie (2001), (Greiner and Pyle 2000), and Bredenkamp (2004).

15 World Bank (1998:2), Bredenkamp (2004).

AWWs learn more about how to do their job. Moreover, ICDS support services at state level are inadequately staffed. A World Bank supervision mission found in 2002 that in Mahrashtra 45% of sanctioned posts in the State Project Management Unit were vacant. As a result, the AWW has very little technical or other support in providing services which require not inconsiderable understanding of nutrition, pre-school education, and maternal and child health issues.

Erratic provision of supplies, leakage, and poor targeting. Supplies are erratic: a national evaluation (NIPCCD, 1992) in 1992 found that the average AWC was without food for 20% of the time, and for more than a quarter of the AWCs this was for over 30% of the time. Leakages in the ICDS are substantial at many levels, notably in procurement of food supplies (Greiner and Pyle, 2000). There is inadequate attention even at the policy level, to targeting children who are likely to benefit the most from supplementary feeding. Supplementary nutrition is not confined to malnourished children, though extra food is supposed to be provided to severely malnourished children (Greiner and Pyle, 2000). Nor does the program target children at the early childhood ages, which are the optimal window for influencing growth (Allen and Gillespie, 2001:36). Instead, it has attracted children aged 4-6, presumably largely because of the pre-school activities.[16]

Lack of community participation. The program is run in a very top-down fashion, with all the logistical and implementational inefficiencies and rigidities that such an approach entails. A program to provide daily services to young children and pregnant women requires strong participation and oversight by the community. Despite statements of intent to involve communities in the process, both the administration and the communities perceive it to be another of the government's programs (Greiner and Pyle, 2000). This impression is reinforced by the fact that in most places, the AWW is hired and paid by the government, and is not made accountable to the community amongst which she works. Also, the provision of equipment, food, and other supplies comes directly from the government. Because of her daily presence in the village, the AWW is asked to take on many additional duties to support the field outreach staff of other government agencies (education and health in particular), but they are not encouraged to work as closely with community organizations such as the Gram Panchayat or Mahila Mandal. Given the extensive decentralization that has been underway in India over the past decade, there is considerable scope for involving locally-elected village committees (Gram Panchayats) much more actively in implementing the ICDS program.

Lack of attention to cost-effective approaches. The program focuses heavily on nutritional supplementation, and relatively ignores more cost-effective approaches to enhancing child nutritional status. These include:

16 Many of these problems were addressed in Tamil Nadu's modification of the ICDS program (TINP), which halved the prevalence of severe malnutrition in the villages in which it was implemented by targeting the food to the needy and requiring them to eat it on the premises instead of taking it home to share with others (Heaver, 1989; Greiner and Pyle, 2000).

(i) Disease control. Child growth and health can be enhanced by improving environmental hygiene and domestic health management practices.[17] Recognizing this, the ICDS program has components for de-worming children and home visits to improve childcare practices, but these policies need to be implemented much more rigorously given the high prevalence of gastro-enteric infections in India. Some of these interventions clearly lie within the scope of the AWWs, if they are given more training and encouragement to work with communities to improve their sanitary practices. These duties were central, for example, for "barefoot doctors" in China in the 1970s.

(ii) Improving domestic feeding practices. Another key way of improving child growth is to show women how to use their own resources to feed their children more effectively. This approach has been used in many settings including the Republic of Korea, China, and Vietnam (Whang, 1981; Allen and Gillespie, 2001). A longitudinal study in Haiti[18] taught mothers to use inexpensive local foods to prepare nutritious food for their children. This was highly successful in helping mothers rehabilitate their malnourished children: compared with mothers who had growth monitoring and counseling services only, those who had demonstration-education reduced the mortality of their malnourished children by 68%, and their younger children were also less likely to become malnourished.

This approach needs to be seriously undertaken in the ICDS program. Studies indicate that weaning foods can be poor in India, due to local customs and beliefs (Roy, 1997), and much can be done to reduce this nutritional deprivation at a crucial age for growth. Exclusive breastfeeding in the first months of life is important to avoid infection, but water and other supplements are widely given even in early infancy (NFHS II: Table 7.10).

3. Data and Definitions

This paper uses the data from the two rounds of the National Family Health Surveys (NFHS) conducted in India during 1992/93 and 1998/99. The surveys cover all the states of India (with the exception of Sikkim in 1992/93, a total of 26 states at the time of survey), and the survey samples are designed to ensure that the data is representative at the state level.[19] Both surveys target about 90,000 households each, and approximately the same number of ever-married women was interviewed (see *Table A1, Appendix*). NFHS-1 (92/93) and NFHS-2 (98/99) use three types of questionnaire: the Village, Household, and the Woman's Questionnaire.

The Village Questionnaire collected information on the availability of various facilities in the village and amenities such as electricity and telephone connections, and type of the

17 See, for example, Esrey and others (1990), Scrimshaw and SanGiovanni (1997), Allen and Gillespie (2001: 26), Black and others (1984), and the review of studies in Bhan and others (2001).

18 King and others (1978), Berggren and others (1984). The study findings are summarized by Scrimshaw (1995).

19 The 1998/1999 survey is also intended to provide estimates at the regional level for four states (Bihar, Madhya Pradesh, Rajastan, and Uttar Pradesh) and estimates for three metro cities (Calcutta, Chennai, Mumbai), as well as slum areas in Mumbai.

drainage system. Respondents to the Village Questionnaire were also asked about development and welfare programs operating in the village. In particular, the Village Questionnaire identifies the villages that received the Integrated Child Development Services (ICDS) Program.

The Household Questionnaire includes information on age, sex, education, employment status, occupation, marital status, and relationship to the head of the household for each household member. It inquires about household dwelling conditions and the ownership of various assets. Information is also obtained on religion and caste/tribe of the household head. At the same time, the Household Questionnaire does not include any direct measures of household income or consumption expenditure.

The Woman's Questionnaire gathers information from all ever-married women age 15-49 who were usual residents of the sample households or visitors who stayed in the sample households the night before the interview. The questionnaire collects information about woman's education, age at marriage, reproductive behavior, child feeding practices and other background characteristics. In addition, measurements of height and weight were obtained for all young children in a household to assess their nutritional status.[20]

The main limitation of these data for the purposes of our analysis is that the information on the access to ICDS programs is available only at the village level. Therefore, we are unable to determine what households and children within the village have actually benefited from the program.

Main Constructed Variables

To assess the level of household wealth in the absence of household income or expenditure data we construct, following the methodology of Filmer and Pritchett (2001), a linear index from a set of asset indicators using principal components analysis to derive the weights for each asset indicator. Our economic status index is the fist principal component of a number of household assets such as clock, radio, TV, VCR, refrigerator, ownership of bicycles, motorbikes, cars, as well as the type of utilities used in the household. The first principal component is an unobserved vector that explains the largest amount of variability in the observed data. The household assets based first principal component derived from NFHS-1 data accounts for 29.6 percent, and from NFHS-2 for 28.3 percent of the total variance of the relevant variables[21]. Availability of electricity,

---

20 While NFHS-1 collected measurements of weight and height for children born in the four years preceding the survey, NFHS-2 did it for children born in the three years preceding the survey. In NFHS-2 13 percent of eligible children were not measured, either because the child was not at home, or because the mother refused to allow the measurement. Also excluded from the analysis are respondents whose month and year of birth are not known, and those with grossly improbably height or weight measurement. NFHS-2 also collected anthropometrical information on the mothers. NFHS-1 did not collect the height measurement data in five states: Andhra Pradesh, Himachal Pradesh, Madhya Pradesh, Tamil Nadu and West Bengal.

21 The first principal component based on NFHS-1 data in Filmer and Pritchett (1998) explains 25.6 percent of total variation. However, their calculation was using a slightly different and smaller set of variables.

flush toilet, TV, and ceiling fan are the most influential variables in the estimation of the index. This finding is consistent across both surveys. The distribution of other factors in relationship to the economic status index also makes economic sense. For example, higher index households are more likely to live in pucca (brick) houses, and have such amenities as refrigerator, motorbike and radio. They are less likely to use kerosene for lightning and wood for cooking, as well as utilize unsafe drinking water.

Our main indicators of children's nutritional status are two indices that are commonly used to assess this from anthropometrical data. These indices are expressed in standard deviation units (z-scores) from the median for the international reference population (Dibley and others, 1987a,b).[22] Height-for-age z-score (HAZ) and weight-by-age z-score (WAZ) are defined as $(m_i-m_r)/\sigma_{rm}$, where m_i is the observed height (weight) of a child of a specified age and gender, m_r is the median height (weight), and σ_r is the standard deviation of the corresponding measurement for the reference population of children in that age-gender group. Low height-for age (stunting) reflects *chronic* under-nutrition and/or repeated bouts of illness. Low weight-for-age (underweight) reflects either or both *acute and chronic* malnutrition and /or illness. Children who are over two standard deviations below the median of the reference population in terms of these indices are considered to be severely to moderately under-nourished (stunted or underweight).

4. Trends in Malnutrition by Child's Age, Socioeconomic Status and Gender, 1992 and 1998

Children's growth begins to falter from birth through the second year of life, as has been noted in cross-regional data by Shrimpton and others (2001). While at the age of three months about 30% of the children were underweight, by the age of eighteen months almost 60 percent of the children were underweight, and remain at this level through the third year of life.

Children's nutritional status improves with socioeconomic status (Table 1). Looking at differences *by mother's education level*, in 1992 the share of stunted boys amongst mothers with no education was 55%, compared with 31% among mothers with secondary or higher levels of education. The corresponding shares of underweight boys were 59% and 38%, respectively. The differences *by household wealth* tertiles are equally sharp: for example in 1998, 29% of boys from the richest tertile, compared with 53% amongst the lowest tertile. Differences *between castes* are less sharp, though the boys of upper castes show better outcomes than lower castes or tribes.

All socioeconomic groups show a clear trend of improvement in boys' nutritional status between 1992 and 1998. However, higher socioeconomic groups show stronger gains than others. The gains are especially strong amongst the boys of mothers with secondary

22 This standard is recommended by the WHO, and the Nutrition Foundation of India (Agarwal and others, 1999) has concluded that it is generally applicable to Indian children (NFHS II India report, page 265). The use of this reference group is based on the empirical finding that well-nourished children in all population groups for which data exist follow very similar growth patterns (Martorell and Habicht, 1986).

school education and above, compared with lower education groups. The same applies to the upper castes versus the lower castes and tribes. Household wealth groups show less differences in improvement during1992-98.

Girls' outcomes have been poorer. Their position relative to boys deteriorated between 1992 and 1998: they had similar or marginally lower proportions stunted and underweight as boys in 1992, but by 1998 girls were nutritionally more disadvantaged than boys. In 1998, this gender differential holds across all socioeconomic groups. Girls from the highest socioeconomic groups showed improvement in nutritional status between 1992 and 1998. Amongst most of the other socioeconomic groups, girls showed much more modest declines in the prevalence of underweight. However, the proportion underweight increased amongst the poorest wealth tertile and the scheduled tribes. The prevalence of stunting rose amongst girls in all the lower socioeconomic groups.

This suggests that levels of discrimination against girls may actually have *risen* amongst the lower socioeconomic status groups between 1992 and 1998: including uneducated mothers and poorer households. It has risen sharply amongst the tribal populations. This could be because people are reducing family size in India — which, combined with strong son preference, puts pressure on reducing the number of girls in the family.[23] Higher socioeconomic groups have greater access to sex-selective abortion, and are therefore in a position to care more equally for the children that are born. Lower socioeconomic groups have limited access to prenatal sex selection technology, and this may lead to unequal treatment of children who are unwanted. There is, for example, considerable evidence that girls are less likely than boys to be taken for medical treatment, and the quality of treatment sought also differs — which could impact on their anthropometric status.

5. Assessment of the ICDS's Program Placement

Coverage of the ICDS program is high: a substantial proportion of India's villages are covered by the ICDS today, and this number rose sharply during the 1990s. Of the villages sampled by the NFHS, a third had an ICDS program in place in 1992, and more than a half of the surveyed villages had it in 1998 (Table 2). A few states, notably Kerala, had virtually complete coverage already by 1992. Program coverage is especially high in the southern region, the northeastern region, and the non-poor states of the northern region. The apparent decline in coverage in Tamil Nadu during the 1990s is probably the result of re-classification of the nutritional supplementation program to the TINP (Tamil Nadu Integrated Nutrition Program), which is broadly similar in concept to the ICDS.

Descriptive Results: Program Placement across States

For ease of discussion, we have grouped India's states by region: the South, the Northeast,[24] and the North. Since the Northern region is vast and highly heterogeneous —

23 Das Gupta and Bhat (1997). On son preference more broadly, see Miller (1981), Dyson and Moore (1983), and Das Gupta (1987). On gender differentials in tribal populations, see Maharatna (2000).

24 Sikkim is not included where data are required for 1992, since these are not available.

comprising both the poorest and the richest states in the country — we have divided it in this discussion into the "poor North" (Bihar, Uttar Pradesh, Orissa, Madhya Pradesh and Rajasthan), "rich North" (Punjab, Haryana, Gujarat and Maharashtra)[25] and "other North" (Himachal Pradesh, Jammu & Kashmir, and West Bengal) (Table 3). The poor Northern states have some of the poorest outcomes in the country not only in terms of malnutrition, but also in terms of human development outcomes such as education and child survival, reflecting a history of poor governance.

The need for the program varies substantially across states. It is especially high in the poor Northern states, where over half of the children aged below 3 were moderately or severely underweight (Figure 1). These are large populous states, comprising well over 40% of the population of the country according to the 2001 census, and therefore contribute a high proportion of the total malnourished children in the country. At the other end of the spectrum are states such as Kerala and several of the northeastern states, with the lowest levels of child malnutrition. The northeastern states tend also to have good human development indicators in terms of levels of education and child survival, despite being relatively poor in terms of State Domestic Product per capita.

It is apparent that the program is regressively distributed between states. The states with the highest prevalence of stunting and underweight children tend to have the least program coverage (Figure 2). Table 1 shows very low coverage in particular, Bihar and Uttar Pradesh had less than a fifth of villages covered by the program in 1992, and this rose to a third by 1998 — still substantially lagging much of the rest of the country. The other three poor Northern states are more on par with the country averages in terms of ICDS coverage — though given their high levels of malnutrition they should in fact have above average coverage.

The overall distribution of the ICDS program coverage across states is also regressive when compared with the states' economic level, as measured by State Domestic Product per capita (Figure 2). The picture is even more regressive when we look at inter-state differentials in government budgetary allocations for the ICDS program per malnourished child (Table 3, col 2). Even allowing for some differences in the purchasing power of a rupee in different states, the contrasts are sharp. Except for Orissa, the poor Northern states receive by far the lowest budgetary allocations in the country. For example, Bihar (the poorest state) receives only Rs 25 per malnourished child, while Punjab (the richest state) receives Rs.334. The Northeastern states are especially well funded, and some of them receive a hundred times as much per malnourished child as Bihar.[26]

To make matters worse, Bihar and Uttar Pradesh do not spend all the money allocated to them. In line with their history of poor governance, they spent only 76% and 65% of their allocations respectively. Almost all the other states use up their full allocations. Thus

---

25 By the time of the 2001 Census, Uttar Pradesh, Madhya Pradesh, and Bihar had some additional states carved out of them: Uttaranchal, Chhattisgarh, and Jharkhand, respectively. For the current analysis, the old state definitions are used here.

26 The Northeastern states also receive a block grant from the central government which helps cover the state portion of the ICDS budget (V. Selvaraju, personal communication to Yi-Kyoung Lee).

children across the poor Northern states with high levels of malnutrition suffer multiple disadvantages: (1) ICDS coverage is low, because central government budgetary allocations per malnourished child are much lower than the rest of the country — and (2) if they live in the vast populous states of Bihar or Uttar Pradesh, their state government does not even use the budgets allocated for them. Rajasthan, Madhya Pradesh and Orissa use their allocations, but they too receive very little relative to their needs.

Descriptive Results: Program Placement across Villages

The village-level data confirm that placement is regressive across states, with villages in richer states having a higher incidence of placement — but also indicate that it is less regressive within a given state. The top panel of Figure 3a is constructed based on the wealth ranking among all villages in India, and shows that richer Indian villages have a higher probability of being covered by the program than poorer villages. For example, only half of the villages from the lowest two deciles of all-India wealth distribution had ICDS program in place in 1998 — while the program covered about 80 percent of the richest villages in India.

The placement of the program is less regressive if one analyses the bottom panel of Figure 3a, which is based on intra-state village wealth rankings. The difference in the program coverage between the poorest and the wealthiest villages within the states is much smaller – about 60 percent of the poor villages in every state was covered by ICDS programs compared with 70 percent of wealthiest villages. Moreover, the placement became more regressive between 1992 and 1998.

To obtain a regional breakdown, we look at placement among villages within a given cluster of states (Figure 3b). In the poorest Northern states, placement amongst villages was neutral in most wealth percentiles in 1992, except for the disproportionate allocation to the wealthiest villages. By 1998, this had become more steadily regressive across wealth percentiles, with about 45% coverage in the poorest villages, compared with 60% in the richest ones. In the rich Northern states (also the wealthiest states of the country), the distribution was clearly progressive in 1992, and fairly neutral across wealth percentiles in 1998. In the Southern states, the distribution was fairly neutral in 1992 and became more regressive by 1998: with around 62% of the poorest villages covered compared with 85% of the richer ones. In the Northeastern states, the distribution was fairly neutral across wealth percentiles in 1992, but became clearly regressive by 1998: with around 60% coverage of the poorest villages and nearly 80% coverage of the wealthiest ones.

Descriptive Results: Growth of Program Coverage

States with the lowest coverage of the ICDS program in 1992 showed the highest rates of expansion of coverage between 1992 and 1998 (Table 2). This applies to several of the poor Northern states, where the average annual growth of coverage within a state was above 11% (Figure 2a.1). Coverage was already relatively high in 1992 in the richer Northern states as well as the Southern states, and coverage in these states grew at an

average annual rate of 3% and 1.5% respectively. This progressive trend is also reflected in the much more rapid growth of the program in the poorest villages of the country during the period 1992-98 (Figure 4a, top panel).

Within a given state, the picture is more mixed. Looking at the entire sample (Figure 4a bottom panel) the growth of program coverage was quite regressive: with less than 30% growth for villages in the lowest three wealth percentiles compared with 40% growth for the wealthiest villages. Disaggregating the results by region (Figure 4b), we find that in the poor Northern states the growth was somewhat regressive across most of the village wealth percentiles, except that the wealthiest villages showed lower growth than the others. The trend was clearly progressive in the richer Northern states, with 7% growth in the poorest villages compared with about 4% in the wealthier percentiles. It was regressive in the Southern states, where the poorest villages showed almost 2% *decline* in coverage while villages in the fortieth wealth percentile and above showed about 2% growth. The Northeastern states showed a mildly regressive trend, with 2-3% growth amongst the poorer villages and 4% in the richest villages.

Modeling of Program Placement in a Multivariate Framework

The observed presence of the ICDS program in a village could be interpreted as a result of two processes: program placement and program retention. The official policy of the Government of India is to place the ICDS program in poorer administrative blocks and villages, with a preference for larger villages where an ICDS center can have a larger catchment population to serve. However, a number of factors could in practice modify the application of these placement criteria, such as politicians' desire to corner benefits for their own electorate at the cost of more deserving candidates; and officials' desire to select villages which are easily accessible and have good infrastructure conditions to work in.

A village's ability to retain the program depends on its ability to create good conditions for its functioning. There are many ways in which the levels of local cooperation are critical to making it possible for the anganwadi worker (AWW) to function. A good space has to be made available for the center. It also helps if the community is willing to help the anganwadi worker overcome difficulties encountered: does she have adequate access to water supplies? how best to help her reach the more difficult households, or organize events such as rounding up children for immunization drives? Anganwadi workers operate under difficult conditions, far from any access to their superiors, so communities, which are better at offering such support, are more likely to be able to retain the program. The probability of program retention is likely to be indicated by the presence of other development programs in the village, which implies that there is a network of formal agents in place to provide occasional support to the AWW, and also that the village is able to retain development programs in general. Community capacity for collective action is also indicated by the presence of cooperatives and women's associations.

The effect of various village characteristics on a village's probability of having the ICDS program could be modeled in the standard probit framework. The dependent variable in our empirical specification is a binary indicator of whether there is an ICDS center in a village. The set of explanatory variables in this specification includes the village's demographic characteristics, wealth, distance from towns and transport connections, state of infrastructure, and the presence of other development programs and community associations.

We model the probability that a village is selected into the ICDS program as a function of a large set of variables that include village-level aggregates on demographic, and socio economic conditions, infrastructure, and presence of other development programs. The results of this estimation are shown in Table 4. The table presents two specifications of the model – with and without state dummies. The results of specification with the state dummies show that, within a given state, villages with larger populations and villages that are electrified are significantly more likely to have the ICDS program. For both the survey years, poor villages, i.e., villages with a lower average household wealth index, have a significantly higher probability of attracting ICDS program than rich villages. By contrast, the effect of village wealth in the specification with no state dummies is insignificant for NFHS-1, and *positive* and significant for NFHS-2. The estimations without the control for the state-specific characteristics demonstrate a neutral (in 1992) and pro-rich (1998) bias in placement, while the ICDS placement mechanism becomes strongly progressive when state dummies are introduced. Thus, while the program is more likely to be allocated to the richer states, within a state the ICDS programs were allocated to the poorest villages.

Another important determinant of a village's having the program is the presence of community associations and other development programs. Villages that have fair price shops, other development programs, and women's associations (Mahila Mandals) have a higher probability of being selected into the program. At the same time, such characteristics as the village's distance to the district centers, accessibility, and the average level of women's education are not significantly related to the probability of placement in either year.

These results confirm the results from the descriptive analysis, that program placement is regressive between states: richer states are more likely to receive the program. However, they show more clearly than the descriptive results that placement is progressive within a given state. Our results support the view that program placement follows the official policy of placing the program in villages in poorer administrative blocks, with a preference for larger villages. If politicians are modifying the application of these guidelines to meet electoral pressures, this is not to an extent that is perceptible in the data. A village's probability of having the ICDS program is greater if it is poorer and has a larger population to serve. It is also greater if it has other development programs and community (women's) associations in place, possibly partly because this indicates the village's ability to attract as well as to retain development programs. There also seems little evidence that program placement is geared towards officials' convenience, as the

village's connection to transport networks or distance from the district center does not increase its likelihood of being selected.

6. Evaluation of Outcomes: Impact of the ICDS program

We turn now to evaluating whether children living in villages with the ICDS program have significantly different anthropometric outcomes than those living in village without the program. First, we examine the descriptive statistics, and then move on to modeling the impact using propensity score matching. The results are shown separately for the 1992 –3 and 1998-99 rounds of the NFHS survey.

Descriptive Statistics

Comparing the unconditional distributions of child anthropometric indicators between the villages with and without the ICDS program, the program seems to have had little impact on child nutrition outcomes. Figure 5 shows that the distribution of child anthropometric measurements is very similar among children living in villages served by the program, and those living in villages without the program. For example, the average HAZ for the children in the villages without the program was close to –2.0 and around –1.70 for the villages with ICDS in 1992. By 1998 this indicator did not change for the children living in villages not covered by ICDS and declined to –1.80 for the children form ICDS-covered villages.

Modeling the Impact of the ICDS Program on Child Nutritional Status

To assess the impact of the ICDS program on children health, we compare health outcomes for the children in the beneficiary villages with those of children from a comparison group of villages.

The official guidelines require that the program be allocated to administrative blocks and villages in India based on the extent of poverty or its correlates, and the size of the village. Therefore, villages are chosen by project managers based on characteristics, both observable and unobservable, which could be correlated with the expected outcomes of a program. Because of such possible non-random placement, a simple comparison of outcomes between children in the villages that benefit from the program and children living in the villages without the program would not measure correctly the impact of an intervention.

If selection of a village into a program is based purely on observable characteristics, we can use a propensity-score matching (PSM) method to remove the selection bias due to differences between villages with and without projects (Rubin, 1973). Using the PSM method, children in the villages with the program (the "treated" group) are matched with the children in the villages without the program (the "control" group) on the basis of the propensity score. This score could is a composite index of that child's observed characteristics that include his/her own characteristics, and the characteristics of the household and the village he lives in.

To measure the difference in nutritional outcomes between the children from the villages with and without the program, we use the standard estimator of the average treatment on the treated defined as: $E(z_1 - z_0 | s=1)$, where z_1 is a particular health outcome (z-scores) for the child in the treatment and z_0 is a z-score for a child in the control group, and s is the binary indicator equals to 1 if the child resides in the village with the program and 0 otherwise. We can also define the average effect conditional on some set of child's characteristics **x** as: $E(z_1 - z_0 | s=1, \mathbf{x})$. Matching estimators require that conditional on a vector of observed characteristics, **x,** (z_1 and z_0) are independent of s.

For some children in our sample we may not find a set of observed characteristics for which the above conditions hold. This is the problem of *no common support*. If there are groups of children for whom the support of $\boldsymbol{x}$ does not overlap, then there may be a fraction of children for which no match could be found in the data. According to studies by Heckman, Ichimura and Todd (1997, 1998), matching on the *no common support* region is the primary cause of a bias in a matching estimator. In this study we calculate the nutritional outcomes only for the children on a common support.

Using the probit estimations we construct the propensity scores for each child in our sample. For each child in the treatment group we find, among the children in the control group, a pair with characteristics that are similar along many dimensions, including the child's characteristics (age, birth order and gender); mother's characteristics (age, education, caste, religion); household wealth; and village characteristics (population, electrification, drainage, road connection, primary health centre, women's association, controlled-price shops, and development programs such as the IRDP, EGS and NREP for income-generation).

The results, shown in Table 5, indicate little overall effect of the ICDS program on nutritional outcomes. Unmatched differences demonstrate positive and highly significant effects of the program on all three nutrition indicators, for boys, and to a lesser degree for girls. However, looking at the effect after propensity score matching, we find that the only significant effect of the program was a positive effect on boys' stunting in the data from the 1992 survey, but not in 1998. For girls, the effect was not significant. We disaggregated the results to see whether there are significant effects at regional levels, but found none except a significant *negative* impact in the poor Northern states, and in the Northeastern states. There, children living in an ICDS village had a higher probability of being underweight in the 1998 survey. As discussed above, despite our effort to match children along a wide range of dimensions, these results may still be influenced by unobservable underlying factors.

Other studies also indicate that the program has little impact on child nutritional status. A national study (NIPCCD, 1992) found the prevalence of underweight children aged 0-3 to be 29.2% where the program was in place, compared with 32.3% elsewhere. Amongst children aged 3-6, the figures were 25.3% and 30.2% respectively. Given the sample sizes of the control and treatment groups both these differences are statistically insignificant. Also using national data, Deolalikar (2004) found that the presence of an ICDS center is associated with a 5% reduction in the probability of being underweight for

boys, but not for girls. Using data from a sub-group of states, Bredenkamp (2004) found that the presence of a center has no significant effect.

The main limitation of our analysis is that it is based on data from the cross-sectional surveys, where the households and children cannot be matched across surveys. Thus, we are unable to identify the unobserved factors both on the household and village level that could influence simultaneously the placement and the outcomes of the program. Some time-invariant unobserved characteristics of the village that correlate with ICDS program outcomes might also correlate with program placement. This correlation can introduce bias in the estimation of project impact. For example, an active community group might lobby the village authorities to be more active in attracting the program, and, at the same time, stronger community support could positively affect health outcomes of the children. In this case, the effectiveness of the ICDS will be overestimated if the evaluation procedure does not take into account the differences in community activity between treated and control villages.

Another form of bias can arise from time-variant unobservable characteristics correlated with the program placement and the outcomes of the intervention[27]. In particular, program placement mechanism could be based on unobserved community characteristics that are correlated with changes in the expected program outcomes. If, for example, the program were placed in a village based on the expected changes in the health status of the children (e.g., an anticipated food shortage), the evaluation procedure would underestimate the effectiveness in the program.

Impact evaluation of the program is hampered by the lack of panel data on children (or villages) receiving the program. Many studies, including those summarized above, have tried to evaluate the program, but have made relatively little effort to overcome this constraint. We tried to do so by applying the propensity score matching technique on a total sample of about 49,000 and 33,000 children respectively in the 1992 and 1998 surveys, in an attempt to control for various factors that could bias the estimates of the effects of the ICDS programs. But even this did not overcome the inadequacies in the data: the results of our PSM estimation indicate the possibility of strong unobservable factors that determine children's anthropometric status. The available data does not allow us to control for these factors.

7. Discussion

In this study we assess the effectiveness of the ICDS program. This program seeks to provide nutrition supplementation and pre-school education, as well as a range of other basic nutrition and health services to young children, pregnant women and lactating mothers. It is perhaps the largest program of the kind in the world, and has expanded rapidly in recent years in terms of coverage and budgetary outlays.

27 This problem is thought to be severe for the programs in poor areas if the deficient state of children's health in the initial period not only attracts the program, but also reduces future growth (Jalan and Ravallion, 2003).

We describe the distribution and trends in child malnutrition, and then examine two issues: (1) the factors associated with greater likelihood of a village being selected for ICDS program placement, and (2) an impact evaluation of one of the (more expensive) aspects of the program, that is the impact of the nutritional supplementation on child nutrition outcomes. The analysis is based on the DHS data, which has information on child anthropometry as well as much information on the child, the mother, the household, and the village: including whether an ICDS program was in place in the village. This permits us to compare child nutritional outcomes between "treatment" and "control" populations, after matching for various characteristics of these populations.

Overall levels of child malnutrition have fallen only slowly during the 1990s, although this was a decade of fairly rapid growth in all sectors of the economy. We find that the main gains in nutrition status have been amongst the upper socioeconomic groups: among the children of educated mothers, wealthier households, and the upper castes. Girls have gained less than boys. Girls' nutrition status has actually worsened amongst the lower socioeconomic groups: uneducated mothers, the poorest tertile of households and tribal populations. This could be because they have less access to prenatal sex-selection technology than higher socioeconomic status groups, but are reducing fertility and therefore parents focus their efforts more on their sons.

Program placement is clearly regressive across states. The states with the greatest need for the program — the low-income Northern states with high levels of child malnutrition and nearly half India's population — have the lowest program coverage, and the lowest budgetary allocations from the central government. To make things worse, two of these states (Bihar and Uttar Pradesh) do not even spend the full funds allocated for this, highlighting issues of poor governance. By contrast, most states spend their allocations. One redeeming finding is that the *growth* of program coverage during the period 1992-98 has been more rapid in states with the lowest levels of coverage in 1992.

Program placement within a state is more progressive, as we find when we model the probability of a village having the ICDS program. Placement appears to follow the government guidelines of selecting villages from poorer administrative blocks, with a larger catchment population to serve. Villages which already have other development programs in place, or have community associations, are also more likely to have the program. Infrastructure such as electricity raises the probability of placement, but not distance to district headquarters or access to transport. The application of official guidelines seems to be a stronger determinant of outcomes than considerations of cultivating particular electorates or personal convenience.

There is little evidence of ICDS program impact on overall child nutrition status. However, these results need to be interpreted with caution. As we indicated above, using cross-sectional data can lead to various kinds of biases in estimations of the effectiveness of the program. To evaluate program impact, one would ideally have data for the same children (or villages) from at least two points in time: preferably before and after the program. Unfortunately, such data are rare outside of small-scale intervention studies. It would be useful if such data collection could be carried out in the ICDS program itself, as

this would help clarify many questions that are left unanswered in this paper. Our results indicate that the impact of the program is determined to a large degree by unobserved factors, and that any evaluation that does not control for such factors would produce bias results. Special survey instruments and availability of panel data are necessary for rigorous impact evaluation of the ICDS program.

Yet there is reason to believe that the ICDS program has not been very effective. This is indicated not only by the scant evidence of reduced levels of malnutrition, as discussed above. Many studies have highlighted problems with program implementation, such as inadequate training and supervision of field-level staff, problems of leakage and erratic provision of supplies, and lack of community participation. They also point out the need to target the most malnourished children, and reach them at the young ages optimal for increasing growth. We also argue for the adoption of more cost-effective approaches to reducing malnutrition, shifting from the heavy emphasis on supplementary feeding which has been found to be ineffective in many large-scale programs. This includes showing mothers how to feed their children more effectively from their own resources, as well as how to improve domestic and environmental hygiene, thereby reducing exposure to the diseases, which erode their children's nutritional status.

In sum, we find limited evidence that the ICDS program is meeting its goals of reducing child malnutrition in India. Some modifications are needed towards this end. Firstly, program coverage and fund allocation needs to be shifted towards states with the highest prevalence of child malnutrition. Secondly, efforts have to be made to ensure that funds are fully utilized in the few states where this is not the case. Thirdly, the impact of the program on recipients can be enhanced by addressing flaws in program design and implementation. With such changes, the substantial resources allocated to the ICDS can be used more effectively for raising future generations of healthy children.

Bibliography

The word "processed" describes informally reproduced works that may not be commonly available through library systems.

Alderman, Harold, Jesko Hentschel, and Ricardo Sabates. 2003. "With the help of one's neighbors: externalities in the production of nutrition in Peru." *Social Science and Medicine* 56: 2019-2031.

Allen, Lindsay H., and Stuart R. Gillespie. 2001. *What Works? A review of the efficacy and effectiveness of nutrition interventions*. Manila: UN Administrative Committee on Coordination Subcommittee on Nutrition, in collaboration with the Asian Development Bank.

Anderson, Mary Ann, James E. Austin, Joe D.Wray, and Marian F. Zeitlin. 1981. *Nutrition Interventions in Developing Countries, Study 1: Supplementary Feeding*. Cambridge MA: Oelgeschlager, Gunn and Hain.

Beaton, George, and Hossein Ghassemi. 1982. "Supplementary feeding programs for young children in developing countries." *American Journal of Clinical Nutrition* 34 (supplement): 864-916.

Behrman, Jere R., and John Hoddinott. 2001. "Program Evaluation with Unobserved Heterogeneity, Selective Implementation and Imperfectly Targeted Beneficiaries: the Mexican *Progresa* impact on child nutrition." Paper presented at the Northeast Universities Development Consortium (NEUDC) Conference, September 28-30, 2001, Boston.

Behrman, Jere R., Harold Alderman, and John Hoddinott. 2004. "Hunger and Malnutrition, Copenhagen Consensus Challenge Paper." (http://www.copenhagenconsensus.com/Files/Filer/CC/Papers/Hunger_and_Malnutrition_070504.pdf)

Berggren G., J. Hebert , and C Waternaux. 1985. "Comparison of Haitian children in a nutrition intervention program with children in the Haitian National Nutrition Survey." *Bulletin of the World Health Organization* 63:1141- 1150.

Bhan, Maharaj Kishan, Rajiv Bahl, and Nita Bhandari. 2001. "Infection: how important are its effects on child nutrition and growth?" In Reynaldo Martorell and Ferdinand Haschke, eds., *Nutrition and Growth.* USA: Nestec Ltd and Lippincoot Williams and Wilkins, (Nestle Nutrition Workshop Series, Pediatric Program, Vol 47). (Note: place of publication not specified in the book)

Black, R. E., K. H. Brown, S. Becker, A R. M. Alim, and I. Huq.1982. "Longitudinal studies of infectious diseases and physical growth of children in rural Bangladesh. II. Incidence of diarrhea and association with known pathogens." *American Journal of Epidemiology* 115:315-324.

Census of India 2001. *Provisional Population Totals, Series 1, India, Paper 1 of 2001*. (http://www.censusindia.net/results/)

Das Gupta, Monica. 1987. "Selective discrimination against female children in rural Punjab, India." *Population and Development Review* 13: 77-100.

Das Gupta, Monica, and P. N. Mari Bhat. 1997. "Fertility Decline and Increased Manifestation of Sex Bias in India." *Population Studies* 51(3): 307-315.

Deolalikar, Anil B. 2004. *Attaining the Millennium Development Goals in India.* World Bank, Human Development Unit, South Asia Region, Washington, D.C. Processed.

Dibley, M. J., J. B. Goldsby, N. W. Staehling, F. L. Trowbridge. 1987a. "Development of normalized curves for the international growth reference: historical and technical considerations." *American Journal of Clinical Nutrition* 46:736-48.

Dibley, M. J., N. Staehling, P. Nieburg, F. L. Trowbridge. 1987b. "Interpretation of Z-score anthropometric indicators derived from the international growth reference." *American Journal of Clinical Nutrition* 46:749-62.

Dyson, Tim, and Mick Moore. 1983. "On kinship structure, female autonomy and demographic behavior in India." *Population and Development Review* 9(1):35-60.

Engle, Patrice L., Purnima Menon, and Lawrence Haddad. 1999. "Care and Nutrition: Concepts and Measurement." *World Development* 27(8):1309-1337.

Esrey, Steven A., James B. Potash, Leslie Roberts, and Clive Shiff. 1990. "Health benefits from improvements in water supply and sanitation: survey and analysis of the literature on selected diseases." USAID, WASH Technical Report No. 66., Washington, D.C.

Filmer, Deon, and Lant Pritchett. 2001. "Estimating Wealth Effects without Expenditure Data --- or Tears: an application to educational enrollments in states of India." *Demography* 38(1):115-32.

Gillespie, Stuart, ed. 1997. *Malnutrition in South Asia: a regional profile*. Kathmandu: UNICEF Regional Office for South Asia.

Gillespie, Stuart, and Lawrence Haddad. 2001. *Attacking the double burden of malnutrition in Asia.* Manila: Asian Development Bank and IFPRI, ADB Nutrition Development Series No 4.

Gillespie, Stuart, Milla McLachlan, and Roger Shrimpton, eds. 2003. *Combating Malnutrition: Time to Act*. Washington, D.C.: The World Bank, Human Development Network, Health Nutrition and Population Series (World Bank-UNICEF Nutrition Assessment).

Gopalan, C. "Growth Charts in Primary Child-Health Care: Time for Reassessment." *Indian Journal of Maternal and Child Health* 3.4 (1992): 98-103.

Government of India, Ministry of Rural Development (no date) http://rural.nic.in/book01-02/ch-2.pdf. See also http://rural.nic.in/book00-01/ch-2.pdf

Government of India, Planning Commission. (no date). Programme Evaluation Office Study No.147 (http://planningcommission.nic.in/reports/peoreport/cmpdmpeo/volume1/147.pdf)

Government of India. circa 2000. *Child Development*. Ministry of Human Resource Development, Department of Women and Child Development (http://wcd.nic.in/)

Government of India. 2002. *The Indian Child: a profile*. Ministry of Human Resource Development, Department of Women and Child Development (http://wcd.nic.in/)

Government of India, Department of Women and Child Development. 2003. *Empirical Analysis of Integrated Child Development, National Family Health Survey.*

Government of India, Ministry of Finance Economic Survey, 2003-04, http://indiabudget.nic.in/es2002-03/chapt2003/tab18.pdf.

Greiner, Theodore, and David F. Pyle. 2000. "Nutrition Assessment — India." Paper presented at the World Bank-UNICEF Joint Nutrition Assessment Workshop, Oct 11-12, 2000.

Heckman, J., Ichimura, H., and P. Todd. 1998. "Matching as an Econometric Evaluation Estimator: Evidence from Evaluating a Job Training Program." *Review of Economic Studies* 64(4): 605-654

Heckman, J., H. Ichimura, J. Smith, and P. Todd. 1998. "Characterizing Selection Bias using Experimental Data." *Econometrica* 66: 1017-1099

International Institute for Population Sciences (IIPS). 1995. *National Family Health Survey – India 1992-93.* Bombay: IIPS. (http://www.nfhsindia.org/india1.html)

International Institute for Population Sciences (IIPS) and ORC Macro. 2000. *National Family Health Survey (NFHS-2), 1998-99. India*, Mumbai: IIPS. (http://www.nfhsindia.org/india2.html)

Jalan, Jyotsna, and Martin Ravallion. 2003. "Does Piped Water Reduce Diarrhea for Children in Rural India?" *Journal of Econometrics* 12(1): 153-73.

Kennedy, Eileen T., and Harold Alderman. 1987. *Comparative analysis of nutritional effectiveness of food subsidies and other food-related interventions.* Washington, D.C.: International Food Policy Research Institute and Joint WHO-UNICEF Nutrition Support Program (ISBN 0-89629-060-3).

King, KW, W. Fougere, A Hilaire, R. E. Webb, W. Berggren, and G. Berggren. 1978. "Preventive and therapeutic benefits in relation to cost: performance over ten years of mothercraft centers in Haiti." *American Journal of Clinical Nutrition* 31:679-690.

Maharatna, Arup. 2000. 'Fertility, Mortality and Gender Bias Among Tribal Population: An Indian Perspective', *Social Science and Medicine* 50(10): 1333-1351.

Martorell, Reynaldo and Ferdinand Haschke, eds. 2001. *Nutrition and Growth*. USA: Nestec Ltd and Lippincoot Williams and Wilkins, (Nestle Nutrition Workshop Series, Pediatric Program, Vol 47). (Note: place of publication not specified in the book.)

Measham, Anthony R., and Meera Chatterjee. 1999. *Wasting Away: the crisis of malnutrition in South Asia*. Washington, D.C.: The World Bank, Directions in Development Series.

Miller, Barbara. 1981. *The Endangered Sex: neglect of female children in rural North India.* Ithaca: Cornell University Press.

National Council of Applied Economic Research. 2001. *Concurrent Evaluation of the ICDS Programme* (Vols I and II), New Delhi: National Council of Applied Economic Research.

National Institute of Public Cooperation and Child Development (NIPCCD).1992. *National Evaluation of Integrated Child Development Services*, New Delhi: NIPCCD.

Nawani, N.P. 1994. "Indian Experience on Household Food and Nutrition Security." Paper prepared for the Regional Expert Consulation, FAO-UN, Bangkok Thailand, August 1994. (http://www.fao.org/DOCREP/x0172e/x0172e00.htm)

Parikh, Kirit, and R.Radhakrishna, eds. 2002. *India Development Report 2002.* New Delhi: Oxford University Press.

Parliament of India, Rajya Sabha. 2003. Department-related Parliamentary Standing Committee on Human Resource Development 104th Report (April 2003). (http://parliamentofindia.nic.in/rs/book2/reports/HRD/Report140th.htm)

Radhakrishna, R. 2002. "Food and nutrition security." In Kirit S. Parikh and R. Radhakrishna, eds., *India Development Report 2002.* Oxford University Press.

Radhakrishna, R., and K. Subbarao.1997. *India's Public Distribution System : a national and international perspective*. Washington DC: The World Bank Discussion Paper no. 380.

Rosenbaum, P., and D., Rubin. 1983. "The Central Role of the Propensity Score in Observational Studies for Causal Effects." *Biometrika*, Vol. 70: 41-55

Rogers, B.L., and J.Coates. 2001. Food Safety Net Programs and Related Nutrition Intervention Annotated Bibliography (http://www.worldbank.org/wbi/socialprotection/southasia/pdf/readings/day1/rogersbiblio.pdf)

Roy, S.K. 1997. "Complementary Feeding in South Asia." In Stuart Gillespie, ed., *Malnutrition in South Asia : a regional profile.* Kathmandu: UNICEF Regional Office for South Asia.

Rubin, D., (1973) "The Use of Matched Sampling and Regression Adjustment to Remove Bias in Observational Studies." *Biometrics* Vol. 29: 159–183

Scrimshaw, Nevin S., ed. 1995. *Community-based Longitudinal Nutrition and Health Studies: Classical Examples from Guatemala, Haiti and Mexico.* Boston, Mass.: International Foundation for Developing Countries (INFDC). (http://www.unu.edu/unupress/food2/UIN09E/uin09e00.htm#Contents)

Shrimpton, R., C. G. Victora, M. de Onis, R. Costa Lima, M. Blössner, and G. Clugston. 2001."Worldwide timing of growth faltering: implications for nutritional interventions." *Pediatrics* 107(5).

Stifel, David, and Harold Alderman. 2003. "The glass of milk subsidy program and malnutrition in Peru." Policy Research Working Paper No 3089. World Bank, Washington, D.C.

Vasundhara, M.K., and B.N. Harish. "Nutrition and Health Education through ICDS." *Indian Journal of Maternal and Child Health* 4.1 (1993): 25-6.

Whang, In-Joun, 1981. *Management of Rural Change in Korea*. Seoul: Seoul National University Press.

World Bank. 1998. Project Appraisal Document… for a Woman and Child Development Project, Washington DC: The World Bank, South Asia Region, Health, Nutrition and Population Sector Unit.

Table 1. Share of stunted (HAZ < -2) and underweight (WAZ < -2) children[a] by various characteristics

	Boys				Girls			
	1992		1998		1992		1998	
Characteristic	*Mean*	*Std. Err.*	*Mean*	*Std. Err.*	*Mean*	*Std. Err.*	*Mean*	*Std. Err.*
Height-for age								
mother's education								
none	0.546	*0.007*	0.533	*0.006*	0.525	*0.007*	0.564	*0.007*
primary	0.446	*0.013*	0.438	*0.011*	0.445	*0.012*	0.454	*0.011*
secondary	0.314	*0.009*	0.293	*0.007*	0.328	*0.009*	0.316	*0.007*
household's wealth tertile								
poorest	0.567	*0.009*	0.554	*0.009*	0.537	*0.010*	0.579	*0.010*
middle	0.504	*0.009*	0.469	*0.008*	0.489	*0.009*	0.501	*0.008*
richest	0.361	*0.007*	0.340	*0.006*	0.378	*0.008*	0.368	*0.006*
mother's caste								
scheduled caste	0.545	*0.013*	0.505	*0.010*	0.529	*0.014*	0.529	*0.011*
scheduled tribe	0.513	*0.015*	0.523	*0.012*	0.447	*0.015*	0.535	*0.012*
other	0.463	*0.006*	0.408	*0.005*	0.461	*0.006*	0.438	*0.006*
All	0.478	*0.005*	0.438	*0.004*	0.469	*0.005*	0.467	*0.005*
Weight-for age								
mother's education								
none	0.592	*0.006*	0.536	*0.006*	0.587	*0.006*	0.578	*0.007*
primary	0.512	*0.011*	0.488	*0.011*	0.509	*0.010*	0.493	*0.011*
secondary	0.380	*0.008*	0.315	*0.007*	0.350	*0.008*	0.343	*0.007*
household's wealth tertile								
poorest	0.624	*0.008*	0.570	*0.009*	0.593	*0.008*	0.598	*0.010*
middle	0.563	*0.007*	0.491	*0.008*	0.558	*0.007*	0.532	*0.008*
richest	0.409	*0.007*	0.353	*0.006*	0.411	*0.007*	0.386	*0.007*
mother's caste								
scheduled caste	0.568	*0.012*	0.517	*0.010*	0.572	*0.012*	0.548	*0.010*
scheduled tribe	0.590	*0.012*	0.551	*0.012*	0.559	*0.012*	0.574	*0.012*
other	0.520	*0.005*	0.424	*0.005*	0.509	*0.005*	0.459	*0.006*
All	0.532	*0.004*	0.455	*0.004*	0.522	*0.004*	0.489	*0.005*

a. Children aged 0-4 in the 1992 survey, and 0-3 in the 1998 survey.
Source: NFHS I and II.

Table 2. Share of villages which had the ICDS program, by state

State	*1992*	*1998*	*% change 1992-98*
Andhra Pradesh	0.30	0.65	117
Assam	0.39	0.30	-23
Bihar	0.14	0.32	129
Goa	0.85	0.95	12
Gujarat	0.61	0.84	38
Haryana	0.64	0.92	44
Himachal Pradesh	0.39	0.52	33
Jammu	0.44	0.70	59
Karnataka	0.63	0.86	37
Kerala	1.00	0.97	-3
Madhya Pradesh	0.27	0.53	96
Maharashtra	0.66	0.81	23
Manipur	0.60	0.83	38
Meghalaya	0.07	0.22	214
Mizoram	0.97	0.73	-25
Nagaland	0.54	0.84	56
Orissa	0.42	0.47	12
Punjab	0.39	0.70	79
Rajasthan	0.36	0.52	44
Sikkim		0.27	-
Tamil Nadu	0.77	0.43	-44
West Bengal	0.45	0.58	29
Uttar Pradesh	0.20	0.33	65
Delhi	0.53	0.55	4
Arunachal Pradesh	0.65	0.82	26
Tripura	0.76	0.83	9
Total	**0.35**	**0.52**	**49**

Source: NFHS I and II.

Table 3. Allocation of ICDS funds, and % of allocation spent, by state

	% spent from the funds allocated by the GoI to the states for the ICDS program, 1992-2003[a]	*GoI spending on the ICDS program, per underweight child age 0-6 years, 2000/01-2001-02*[b]	*Per capita SDP (average of 1990-91 and 1998-99)*[c]
Bihar	76	25	7440
Madhya Pradesh	102	72	15480
Orissa	99	231	11490
Rajasthan	105	95	17231
Uttar Pradesh	65	60	12570
Gujarat	101	173	25158
Haryana	101	280	27437
Maharashtra	114	154	27968
Punjab	98	334	29361
North (other)			
Himachal Pradesh	96	469	21387
Jammu & Kashmir	116	446	16215
West Bengal	105	174	18713
South (Cluster 3)			
Andhra Pradesh	99	178	18809
Karnataka	100	234	20395
Kerala	99	351	21139
Tamil Nadu	82	357	23154
North-East			
Arunachal Pradesh	95	2689	18360
Assam	100	257	13258
Manipur	95	958	14416
Meghalaya	102	380	16034
Mizoram	101	1766	18335
Nagaland	94	2690	18301
Sikkim	125	1001	18371
Tripura	89	377	15252
India	87	?	

a. Under the budget heading "ICDS (General). Source: Yi-Kyoung Lee and Selvaraju, from Lok Sabha Unstarred Question No 89 dated 18 February 2003, and Rajya Sabha Unstarred Question No. 4417, dated 2 May 2003.

b. Under the budget heading "ICDS (General). Source: Yi-Kyoung Lee and Selvaraju, from Lok Sabha Unstarred Question No. 1241, dated 31 July 2003, and calculated using the number of children aged 0-6 years from the 2001 census * prevalence of more than 2SD underweight from the NHFS2.

c. Source: Government of India, Ministry of Finance Economic Survey, 2003-04, http://indiabudget.nic.in/es2002-03/chapt2003/tab18.pdf. The data are at current prices at the time of the Economic Survey.

Table 4. Probit results of village participation in ICDS

	No state dummies				*State dummies*			
	1992		*1998*		*1992*		*1998*	
	coef.	std. err.	coef.	std. err.	coef.	std. err.	coef.	std. err.
Demographic characteristics of the village								
village population (log)	0.179***	*0.035*	0.147***	*0.030*	0.153***	*0.042*	0.187***	*0.035*
share of children (age<16)	0.804	*0.916*	-1.969**	*0.869*	1.522	*0.997*	-0.991	*0.974*
share of girls (age<5)	0.370	*1.562*	1.225	*0.934*	1.132	*1.653*	1.004	*1.023*
share of women (age 16+)	2.688*	*1.388*	-2.092*	*1.152*	3.544**	*1.528*	-1.387	*1.256*
share of elderly (age 60+)	-2.144*	*1.210*	0.332	*0.560*	-1.185	*1.392*	0.179	*0.633*
% of mothers – primary education	0.133	*0.200*	0.078	*0.163*	-0.075	*0.234*	0.145	*0.187*
% of mothers - secondary+ education	0.365*	*0.195*	0.177	*0.140*	0.257	*0.226*	0.250	*0.163*
Wealth and infrastructure of the village								
Average household wealth (assets) index	-0.001	*0.003*	0.005*	*0.003*	-0.009**	*0.004*	-0.007**	*0.003*
Distance to the Tehsil/district headquarters	0.002	*0.002*	0.003***	*0.001*	0.001	*0.002*	0.002	*0.001*
Distance to the nearest railway station	0.002***	*0.001*	0.003***	*0.001*	0.001	*0.001*	0.002*	*0.001*
Village is connected to all-weather road	-0.019	*0.075*			-0.101	*0.081*		
Distance to all-weather road			-0.005	*0.003*			-0.004	*0.003*
Village is electrified	0.604***	*0.100*	0.489***	*0.084*	0.427***	*0.112*	0.263***	*0.095*
No drainage	-0.182**	*0.072*	0.055	*0.063*	-0.095	*0.081*	0.003	*0.071*
Primary Health Center (PHC) in the village	0.216*	*0.131*	0.050	*0.099*	0.169	*0.142*	0.087	*0.110*
Natural calamity last 2 years	-0.055	*0.071*			-0.074	*0.077*		
Community activities and development programs in the village								
Cooperative society	0.228***	*0.078*	0.155*	*0.081*	0.242***	*0.085*	0.127	*0.089*
Fair price shop	0.201***	*0.077*	0.238***	*0.065*	0.163*	*0.091*	0.270***	*0.073*
Mahila Mandal	0.278***	*0.075*	0.337***	*0.073*	0.297***	*0.084*	0.307***	*0.083*
IRDP	-0.041	*0.077*	0.211***	*0.067*	-0.094	*0.084*	0.190**	*0.075*
NREP	-0.115	*0.086*	-0.078	*0.104*	-0.145	*0.096*	-0.089	*0.111*
TRYSEM	0.129	*0.092*	0.060	*0.088*	0.108	*0.094*	-0.018	*0.095*
EGS	0.099	*0.092*	-0.023	*0.120*	0.305***	*0.108*	-0.040	*0.128*
DWACRA			0.287***	*0.087*			0.343***	*0.098*
IAY			0.195***	*0.066*			0.358***	*0.077*
SGNY			0.089	*0.114*			-0.089	*0.139*
Constant	-3.147***	*0.779*	-0.860	*0.626*	-3.732***	*0.873*	-1.756**	*0.725*
R2 (pseudo)	0.134		0.183		0.148		0.251	
Observations	1613		2137		1565		2137	

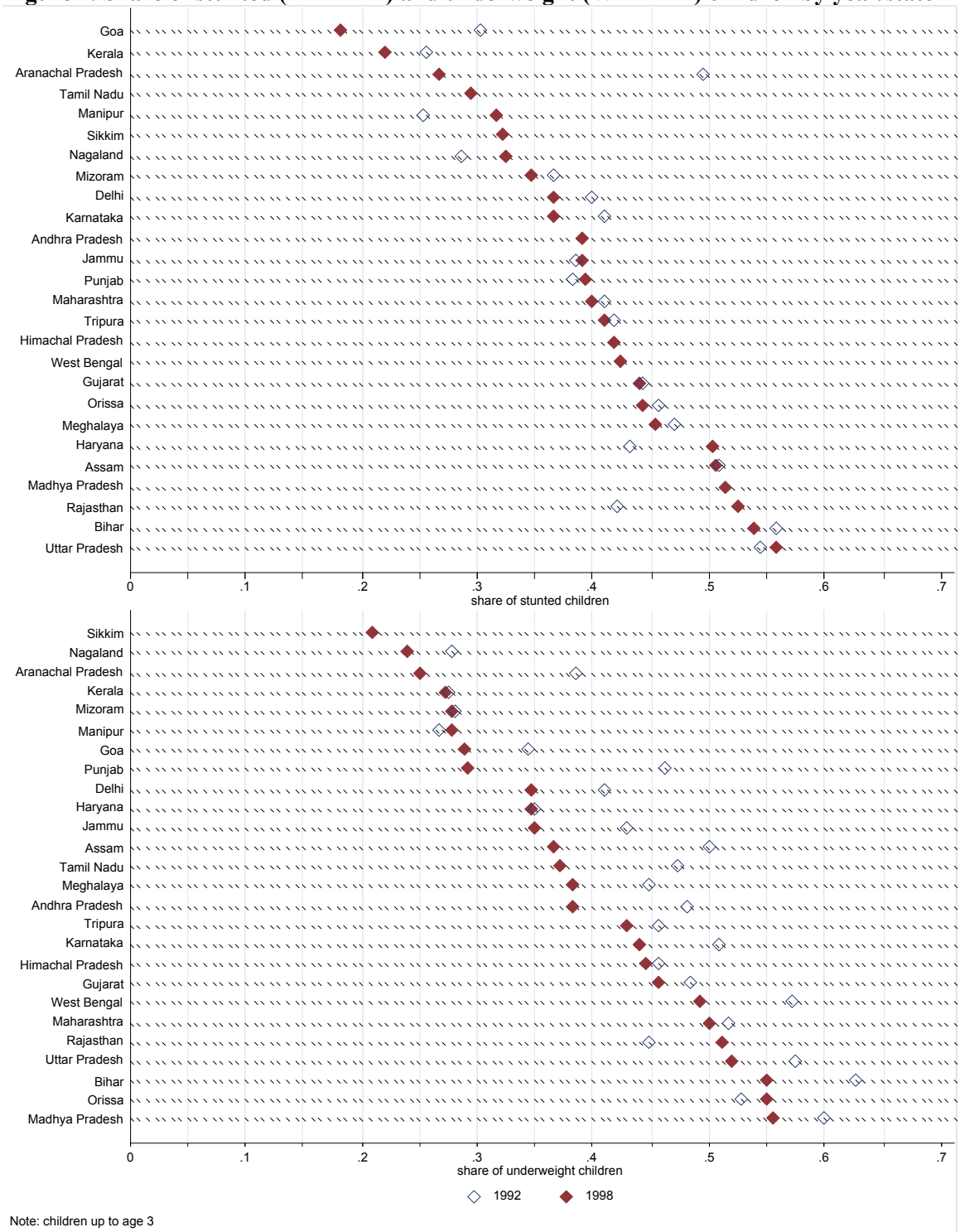
Note: Standard errors in parentheses; the coefficients on state dummies are not reported
* significant at 10%; ** significant at 5%; *** significant at 1%
Source: NFHS I and II.

Table 5. The estimated effect of the ICDS program on z-scores of children using the child-level data, with and without propensity score matching, 1992 and 1998

			Unmatched				*Matched*	
z-score	treated	controls	difference	std. err.	treated	controls	difference	std. err.
India: all children								
haz								
1992	-1.844	-2.149	0.305***	*0.026*	-1.877	-1.933	0.056	*0.055*
1998	-1.787	-1.981	0.194***	*0.027*	-1.807	-1.832	0.024	*0.056*
waz								
1992	-1.894	-2.089	0.195***	*0.017*	-1.917	-1.873	-0.044	*0.038*
1998	-1.771	-1.881	0.110***	*0.021*	-1.789	-1.788	0.001	*0.047*
India : Boys								
haz								
1992	-1.808	-2.203	0.396***	*0.036*	-1.823	-1.974	0.151**	*0.076*
1998	-1.762	-1.992	0.230***	*0.037*	-1.777	-1.872	0.095	*0.073*
waz								
1992	-1.867	-2.122	0.255***	*0.023*	-1.885	-1.897	0.012	*0.054*
1998	-1.754	-1.864	0.111***	*0.029*	-1.767	-1.804	0.037	*0.071*
India : Girls								
haz								
1992	-1.881	-2.092	0.211***	*0.038*	-1.925	-1.935	0.010	*0.081*
1998	-1.816	-1.970	0.154***	*0.039*	-1.859	-1.803	-0.056	*0.095*
waz								
1992	-1.921	-2.053	0.131***	*0.025*	-1.948	-1.948	0.000	*0.055*
1998	-1.790	-1.898	0.108***	*0.032*	-1.827	-1.702	-0.125	*0.092*
North (poor): Uttar Pradesh, Bihar, Rajasthan, Madhya Pradesh, Orissa								
haz								
1992	-2.054	-2.267	0.213***	*0.043*	-2.140	-2.069	-0.071	*0.097*
1998	-2.086	-2.135	0.049	*0.038*	-2.091	-1.962	-0.130	*0.090*
waz								
1992	-2.045	-2.172	0.127***	*0.029*	-2.083	-2.038	-0.045	*0.058*
1998	-2.053	-2.066	0.014	*0.030*	-2.066	-1.891	-0.175***	*0.041*
North (rich) : Punjab, Haryana, Maharashtra, Gujarat								
haz								
1992	-1.888	-1.907	0.019	*0.054*	-1.860	-1.879	0.019	*0.093*
1998	-1.890	-1.750	-0.140	*0.094*	-1.859	-1.997	0.138	*0.131*
waz								
1992	-1.879	-1.999	0.120***	*0.041*	-1.859	-1.855	-0.006	*0.108*
1998	-1.730	-1.681	-0.049	*0.079*	-1.730	-1.823	0.093	*0.176*
South: Andhra Pradesh, Karnataka, Kerala, Tamil Nadu								
haz								
1992	-1.618	-2.122	0.504***	*0.082*	-2.095	-2.222	0.127	*0.132*
1998	-1.437	-1.571	0.133*	*0.079*	-1.488	-1.730	0.242	*0.152*
waz								
1992	-1.852	-2.074	0.222***	*0.043*	-2.103	-2.078	-0.025	*0.174*
1998	-1.636	-1.686	0.050***	*0.064*	-1.677	-1.939	0.262	*0.160*
1998	-0.921	-0.919	-0.002	*0.090*	-0.890	-1.192	0.302	*0.241*
Northeast: Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura								
haz								
1992	-1.795	-1.916	0.121	*0.074*	-1.738	-2.002	0.264	*0.191*
1998	-1.425	-1.860	0.436***	*0.087*	-1.399	-1.289	-0.110	*0.344*
waz								
1992	-1.636	-1.712	0.075	*0.056*	-1.611	-1.559	-0.052	*0.147*
1998	-1.365	-1.300	0.065	*0.067*	-1.373	-0.995	-0.378*	*0.213*

Note: Children aged 0-4 in the 1992 survey, and 0-3 in the 1998 survey. Data for Sikkim were not available for 1992. ***, **, * - significant at 1,5, and 10% level respectively; standard errors are estimated using bootstrapping based on 200 iterations (one-to-one matching).
Source: NFHS I and II.

Figure 1. Share of stunted (HAZ < -2) and underweight (WAZ < -2) children by year/state

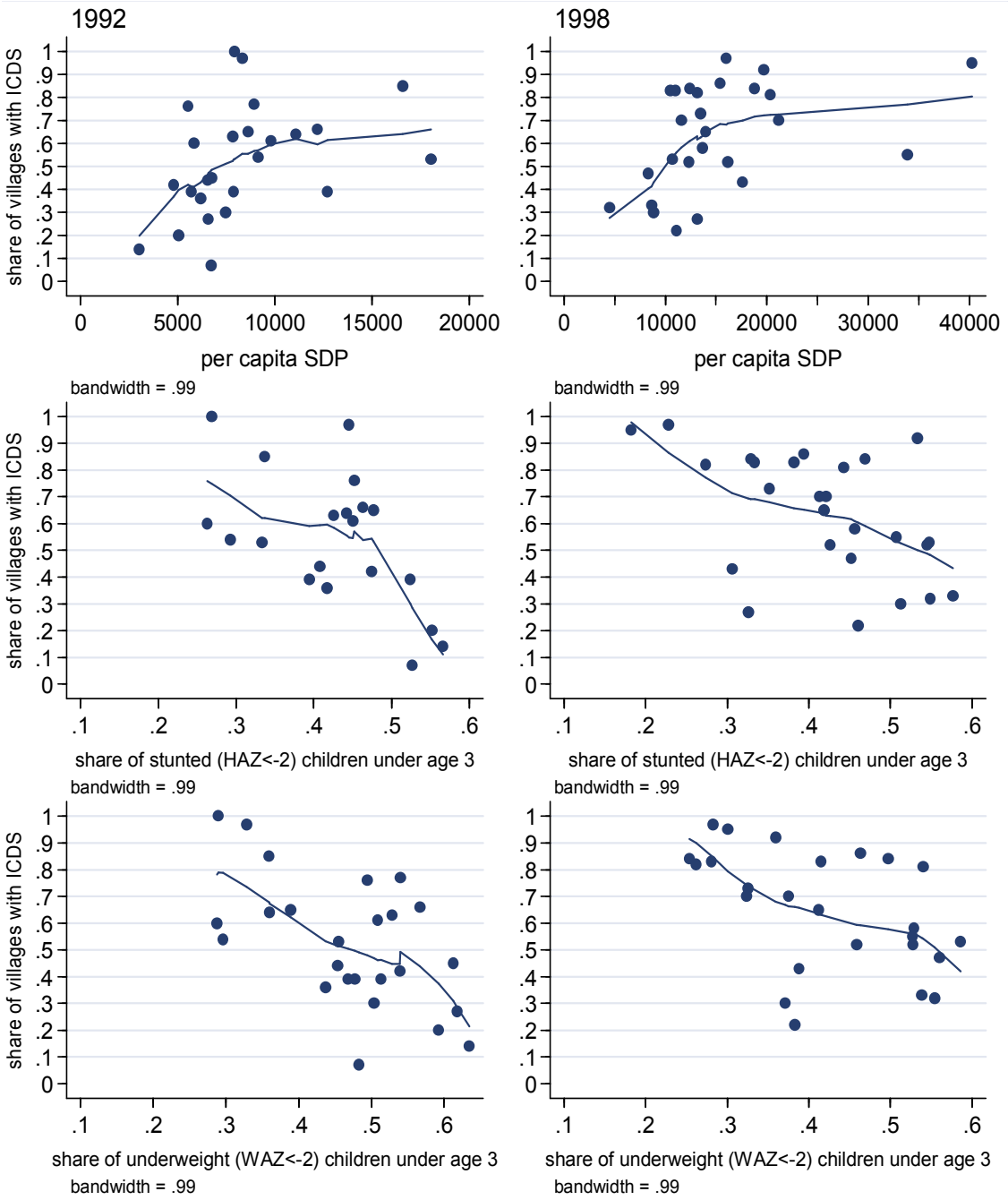


Note: children up to age 3

Source: NFHS I and II.

Figure 2. The relationship between ICDS program participation and states' economic and malnutrition levels

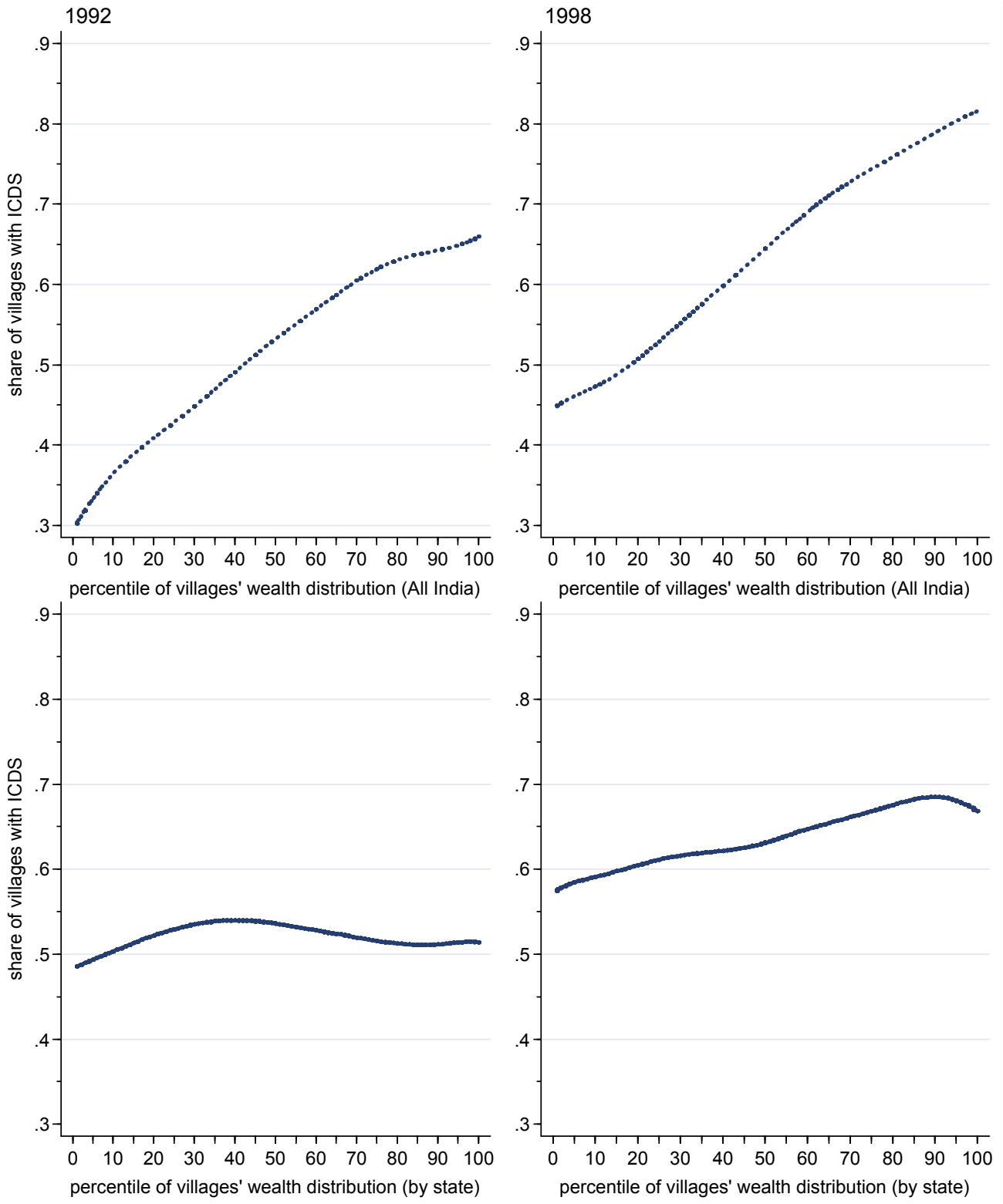
(State Domestic Product per capita,[a] and prevalence of stunting and underweight amongst children)



a. The State Domestic Product per capita are for the years 1993-94, and 1998-99, to correspond roughly to the two survey years.

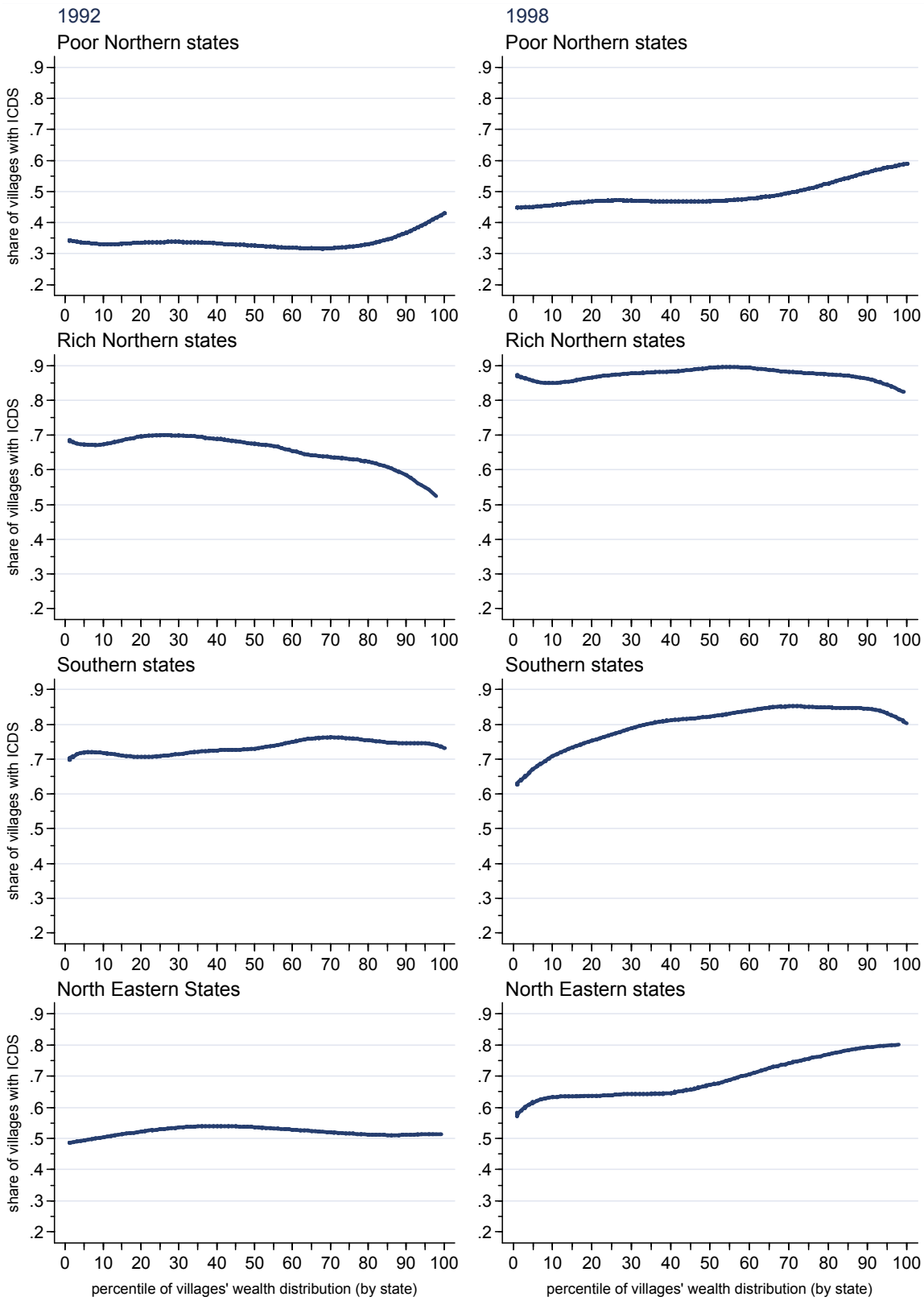
Source: NFHS I and II, State Domestic Product data from the Government of India, *Economic Survey* 2003-04.

Figure 3a. The relationship between village's wealth and ICDS program participation



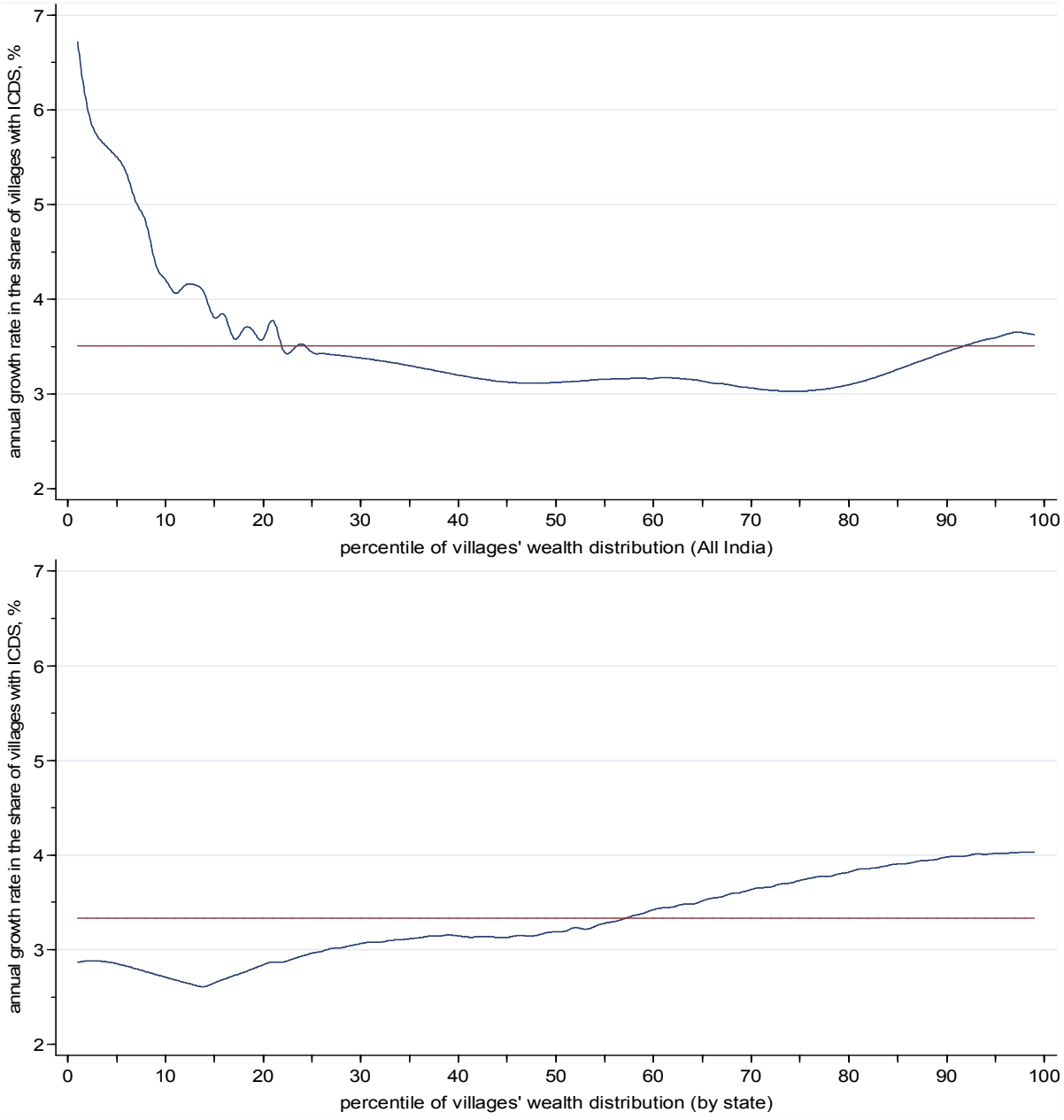
Source: NFHS I and II

Figure 3b. The relationship between village's wealth and ICDS program participation, by cluster of states



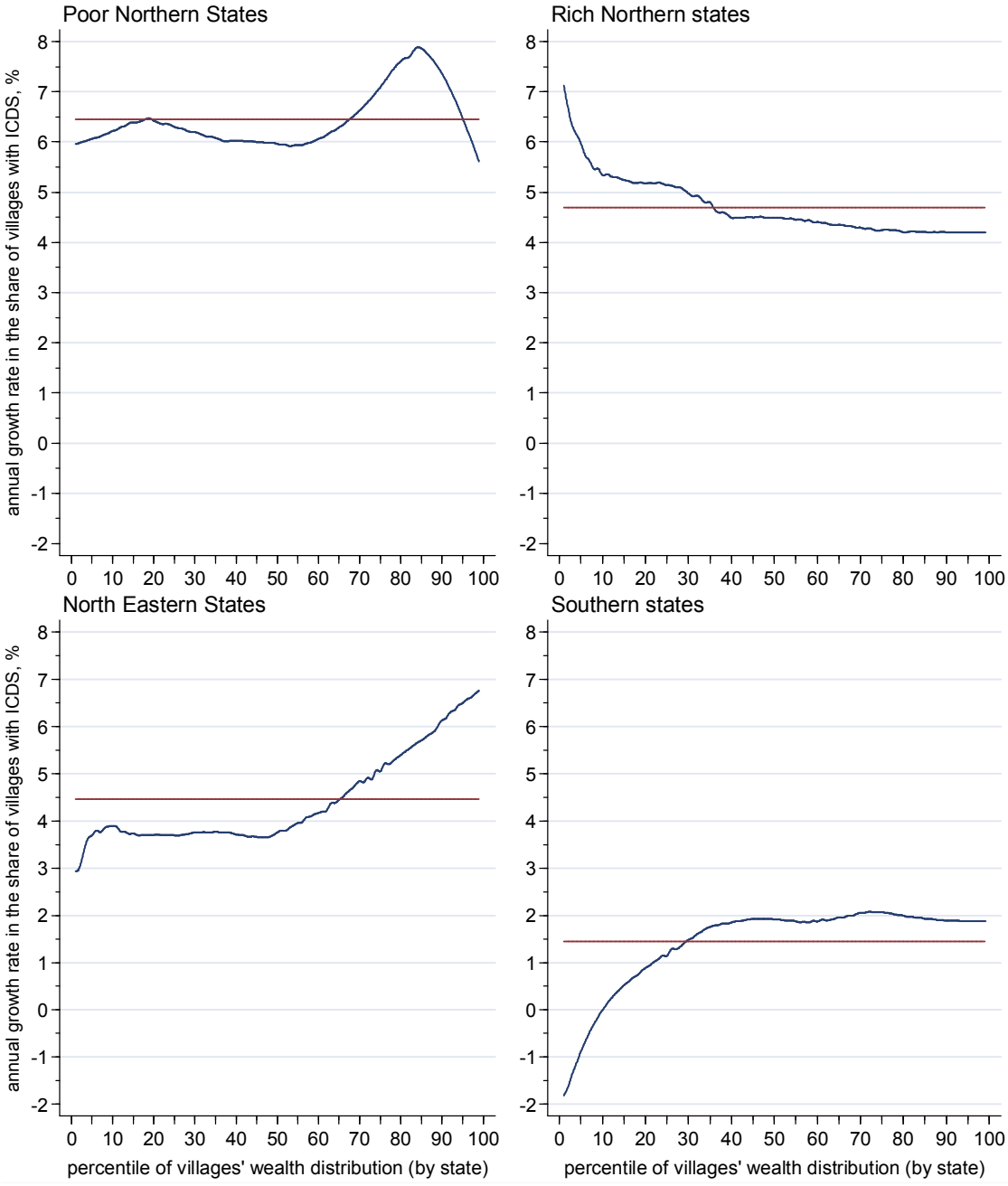
Source: NFHS I and II

Figure 4a. Growth incidence curve for the share of villages with ICDS program, 1992-1998



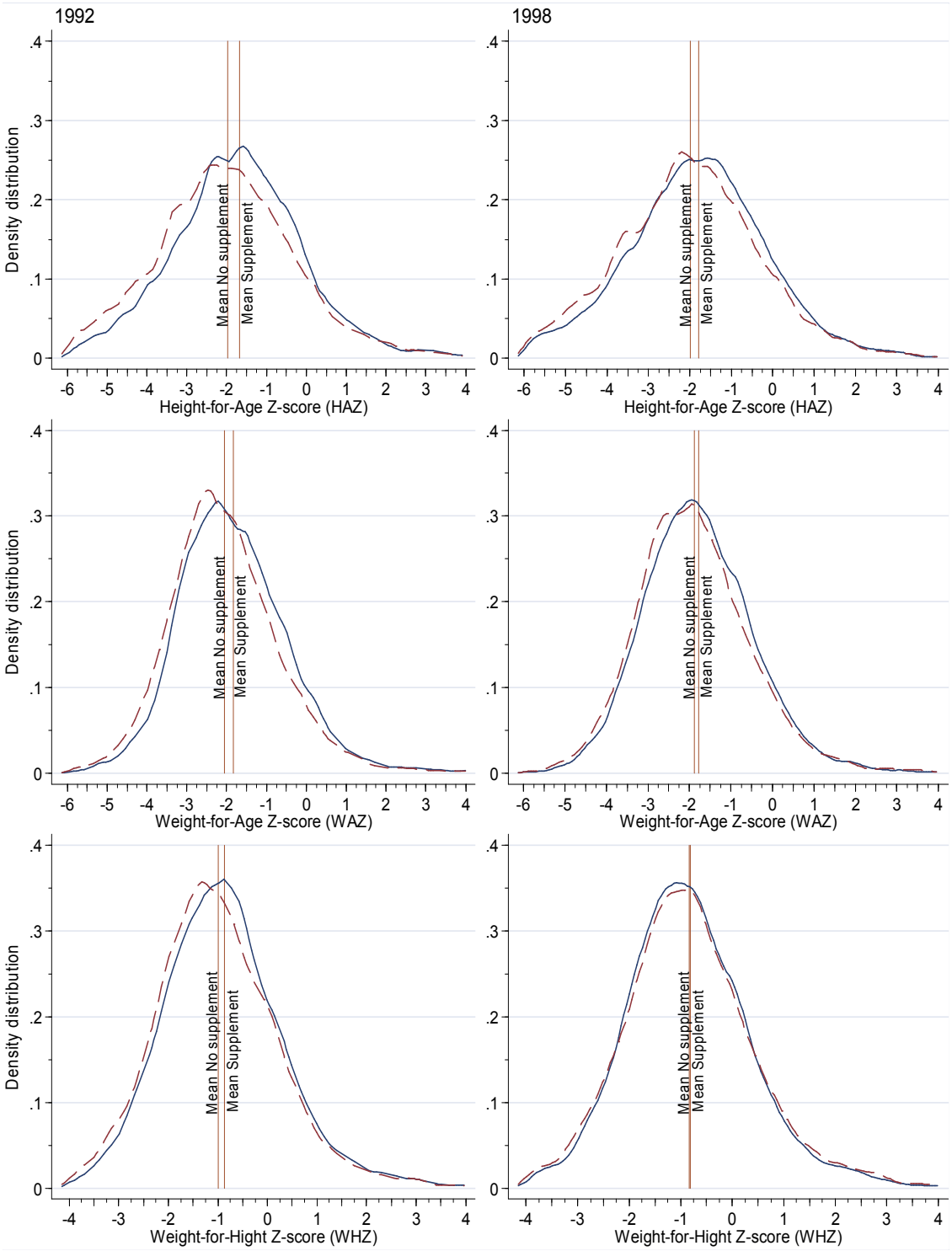
Source: NFHS I and II

Figure 4b. Growth incidence curve for the share of villages with ICDS program, 1992-1998



Source: NFHS I and II.

Figure 5. Kernel densities of HAZ, WAZ and WHZ – with and without ICDS program, 1992 and 1998 (all children under age 3)



Source: NFHS I and II.

Appendix

Table A1. Sample sizes of 1992/93 and 1998/99 DFHS

Type of file	N of obs.		N of HAZ obs.		N of WAZ obs.		N of WHZ obs.	
	1992	*1998*	*1992*	*1998*	*1992*	*1998*	*1992*	*1998*
household file	88,562	92,486						
women file	89,777	89,199						
village file	2,128	2,576						
children file	48,959	33,026	26,892	24,989	35,745	24,989	27,029	25,126
village + children files (merged)	34,926	24,493	18,540	18,218	25,111	18,218	18,638	18,318
% of the initial children file	*0.713*	*0.742*	*0.689*	*0.729*	*0.703*	*0.729*	*0.690*	*0.729*

Note: The number of WAZ observations in 1992 exceeds that of HAZ and WHZ because the measurement of height was not performed in five states.

hsladovich
E:\PS\PS Document Library (2001-2004)\Working Papers\Das Gupta\wps.Das Gupta.Lokshin.Ivaschendo.India.Oct14.2004.submission.doc
October 13, 2004 6:45 PM