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ECONOMIC RESEARCH
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Washington, D.C.

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Los Angeles • London • New Delhi • Singapore • Washington DC

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NATIONAL COUNCIL OF APPLIED ECONOMIC RESEARCH (NCAER)
and
BROOKINGS INSTITUTION

First published in 2015 by

SAGE Publications India Pvt Ltd
B1/I-1 Mohan Cooperative Industrial Area
Mathura Road, New Delhi 110 044, India
www.sagepub.in

SAGE Publications Inc
2455 Teller Road
Thousand Oaks, California 91320, USA

SAGE Publications Ltd
1 Oliver's Yard, 55 City Road
London EC1Y 1SP, United Kingdom

SAGE Publications Asia-Pacific Pte Ltd
3 Church Street
#10-04 Samsung Hub
Singapore 049483

Library of Congress Serial Publication Data applied for

NOT FOR COMMERCIAL USE

ISSN: 0973-4805
ISBN: 978-93-515-0575-4 (PB)

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Published by Vivek Mehra for SAGE Publications India Pvt Ltd, typeset in 10.5/13 pt Times by RECTO Graphics, Delhi, and printed at Saurabh Printers Pvt Ltd, New Delhi.

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Enhancing Nutrition Security via India's National Food Security Act: Using an Axe Instead of a Scalpel?§

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ABSTRACT In September 2013, India passed a historic National Food Security Act (NFSA). This paper examines the potential impact of the two central pillars of this act—expansion of the Public Distribution System (PDS) and strengthening of the Integrated Child Development Schemes (ICDS)—on child nutrition. Using new data from the India Human Development Survey of 2011–12, this paper shows that access to subsidized grains via PDS is not related to improved child nutrition, and while ICDS seems to be related to lower child undernutrition, it has a limited reach in spite of the universalization of the program. The paper suggests that a tiered strategy in dealing with child undernutrition that starts with the identification of undernourished children and districts and follows through with different strategies for dealing with severe, acute malnutrition, followed by a focus on moderate malnutrition, could be more effective than the existing focus on cereal distribution rooted in the NFSA.

Keywords: *Malnutrition, Child health, Food Security, Public Distribution System (PDS), Integrated Child Development Scheme (ICDS)*

JEL Classification: *I12, I15, I38, O15*

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§This paper uses data from the NCAER/Maryland India Human Development Survey, which was funded by grants *R01HD041455* and *R01HD061048* from the US National Institutes of Health and a supplementary grant from the Ford Foundation. Data management was funded by the UK Government as part of its *Knowledge Partnership Programme* and analysis was carried out with the aid of a grant from the International Development Research Centre, Ottawa, Canada. We gratefully acknowledge research assistance from Jaya Koti. This work benefitted from discussions with participants at a NCAER/IDS Conference on *Undernutrition in India and Public Policy* in Manesar in June 2014.

1. Introduction

National Food Security Act (NFSA) passed in September 2013 is one of the largest safety net programs in the world. This Act legislates the availability of 5 kg of cereals per person per month at prices ranging from ₹1 to ₹3 per kg to about 67 percent of India's population. It also contains provisions for nutritional supplementation for young children as well as pregnant and lactating mothers via the Integrated Child Development Scheme (ICDS) and through maternity benefit of ₹10,000 for all new mothers.[1] The maternity benefits are not yet implemented due to a court challenge but the other two programs involve expansion/restructuring of currently existing programs. The financial cost of this extremely ambitious program is difficult to estimate but some estimates peg it at ₹44,000–₹76,000 crore (Mishra 2013) above and beyond the costs already being incurred for various food security programs.

This act has emerged in response to a strong advocacy following the observation that economic growth has not kept pace with reduction in hunger and malnutrition in India. In 2013, India ranked 63rd out of 120 in the Global Hunger Index. This index is based on proportion of people who do not get sufficient calories, proportion of children who are underweight, and mortality rate for children under five (von Grebmer et al. 2013). Much of this low ranking is driven by very high proportion of underweight children in India. National Family Health Survey (NFHS) of 2005–06 shows that 43 percent of children under five are underweight compared to WHO global standards and 48 percent are too short for their age (have moderate to severe stunting).

Research on the consequences of undernutrition notes substantial economic costs associated with poor learning outcomes and productivity (Spears 2012, 2013). By some estimates, the economic burden of malnutrition is expected to be between 0.8 percent and 2.5 percent of the GDP (Crosby et al. 2013). One can easily quibble about the size of these estimates but these eye-catching numbers have given considerable impetus to the advocacy for reducing malnutrition and placed it at the forefront of the national political agenda. For example, the election manifesto of the Bharatiya Janata Party prioritizes a focus on undernutrition in a mission mode.

While a nutrition advocacy has fueled the demand for NFSA, whether the NFSA will meet the nutritional needs of the nation remains far from clear.

1. For the text of the Act, see http://indiacode.nic.in/acts-in-pdf/202013.pdf (accessed April 30,2015).

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In order to assess its potential implications, we must address the following questions:

1. What are the determinants of undernutrition in India and does NFSA appropriately target them?
2. How successful are the two mechanisms at the core of NFSA—PDS and ICDS—in targeting undernutrition? Are there any unanticipated effects?
3. What is the likelihood that the massive expansion of programs envisioned by NFSA can be carried out within the present administrative framework?
4. Should we be looking at any other policy options?

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2. Current Status of Undernutrition in India

Given the policy activism surrounding food and hunger, it is surprising that India has so little recent data on nutritional status. Generally, malnutrition is measured by collecting data on height and weight for children and adults. Based on these, anthropometric indices are calculated reflecting standardized scores for weight-for-age or height-for-age comparing the index individual with a reference standard. [2] For adults the body-mass-index is usually used. Children with weight-for-age index of that is two standard deviations or more below the median of the reference population are generally considered underweight, while those below three standard deviations are considered severely underweight. Similarly, children with height-for-age of below two standard deviations are considered stunted and those below three standard deviations are considered severely stunted.

2.1. Sources of Nutrition Data in India

Getting national data on child anthropometry is quite difficult because not only does it involve measuring children, it also involves collecting accurate data on their age since children grow rapidly and a few months' difference

2. Whether use of global standards is appropriate in India is subject to considerable debate, see Panagariya (2013) and articles in response to this including Deaton et al. (2013) and Desai and Thorat (2013). Since a fourth of the WHO sample from which these standards were derived consists of Indian children, and these standards have been officially adopted by Indian Academy of Pediatrics as well as over 150 countries worldwide, we do not focus on this debate in this paper.

in age could make a large impact on their placement on the growth chart. We have three major sources of data on nutrition:

1. NFHS of about 100,000 women conducted in 1992–93, 1998–99, and 2005–06 are the most frequently used sources of nutrition data. This survey was organized by the International Institute of Population Sciences which also conducted the District Level Health Survey (DLHS-II) of 2002–04 of about 200,000 households. DLHS-IV of 2011–12 was carried out for only selected states but offers the latest data on undernutrition with large samples.
2. Periodic surveys conducted by National Nutrition Monitoring Board (NNMB) covering anthropometric outcomes and dietary intake for rural areas of 10 states in 1975–79, 1988–90, 1996–97, and 2011–12. The sample size for these surveys is about 24,000 households. NNMB also carries several other special purpose surveys including those in tribal areas.
3. Some of the special surveys with anthropometric data include the HUNGaMA survey of 2011–12 in rural areas of 100 poorest districts of seven states carried out by the Nandi Foundation for over 100,000 children and India Human Development Surveys (IHDS) (2004–05 and 2011–12) of about 42,000 households.

Sadly, none of the large nationally representative surveys are recent. But Figure 1 based on NFHS, NNMB, and IHDS surveys paints a picture of modest decline in proportion of children underweight during an era when poverty dropped sharply. The HUNGaMA survey suggests a sharper decline when compared the DLHS-II survey for the same districts using the same reference standards (from 53 percent children being underweight in DLHS of 2002–04 to 42 percent underweight in HUNGaMA survey of 2011–12 but these comparisons are somewhat difficult due to different survey design and focus on 100 poorest districts.

No other national data are currently available. The Annual Health Survey (still being processed) collects anthropometric data for nine focus states in north-central India, while the DLHS-IV collects data in the rest of the India and fact sheets form DLHS-IV for selected states are just being put in the public domain.

2.2. State of Undernutrition in India

The IHDS of 2011–12 on which most of the discussion in this paper is based, is the only source of national data on anthropometry as well as dietary

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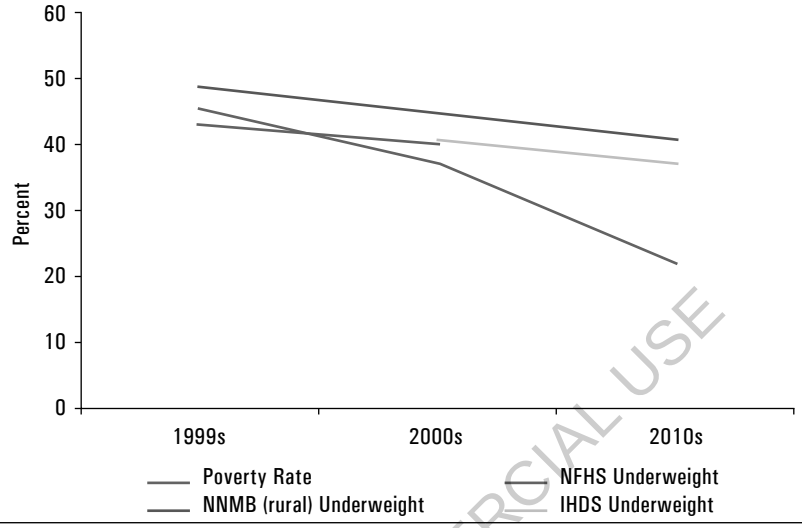
FIGURE 1. Decline in Percentage of Children under Five being Underweight Has Not Kept Pace with Poverty Decline



Source: NFHS-III report, NNMB report, authors' calculation IHDS.

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intake/expenditure and utilization of large public programs like ICDS and PDS. Thus, it is important to evaluate the quality of this survey before drawing any conclusions from it.

Table 1 compares the point estimates of underweight for children under five from various other surveys with the IHDS-II results. These results appear to be more or less in line with each other and point to about 37 percent of the children being underweight in India circa 2011–12. Figure 1 plots fertility decline from various surveys over the past 20 years, along with the decline in poverty. This figure suggests a continuation of the prior trend of a relatively slow decline in underweight children of less than 1 percentage point per year, a stark contrast to the rapid decline in poverty.

We do not focus on children's height-for-age in this paper because collection of height data is far more error prone than collection of weight data, particularly for children under one who must be measured lying down.[3] However, all multivariate analyses presented in this paper are repeated with stunting (height-for-age being less than two SD below reference median) and show similar results.

3. Underweight rates for IHDS-I are similar to NFHS, stunting rates are considerably higher suggesting greater measurement error in height than in weight. Our personal observations in the field support this.

TABLE 1. Point Estimates of Underweight Circa 2010 for IHDS-II in Comparison with NNMB, HUNGaMA, and DLHS-IV

IHDS-II Sample	*IHDS-II (2011–12)*	*HUNGaMA (2010–11) Rural—100 poorest districts in 7 Central States*	*NNMB Rural—10 large states (South + WB + Orissa + UP)*	*DLHS4*
Nationwide				
Rural	40%			
Urban	29%			
All	37%			
Rural—HUNGaMA states	43%	42%		
Rural NNMB states	41%		43%	
States				
Maharashtra	39.1			38.7
Himachal Pradesh	26.6			28.5
Karnataka	32.6			29.7
Punjab	21.4			25.5
West Bengal	32.1			37.4

Source: (a) Published reports of HUNGaMA, NNMB and DLHS-IV Fact Sheets.
(b) IHDS-II authors' calculations.

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3. Determinants of Undernutrition

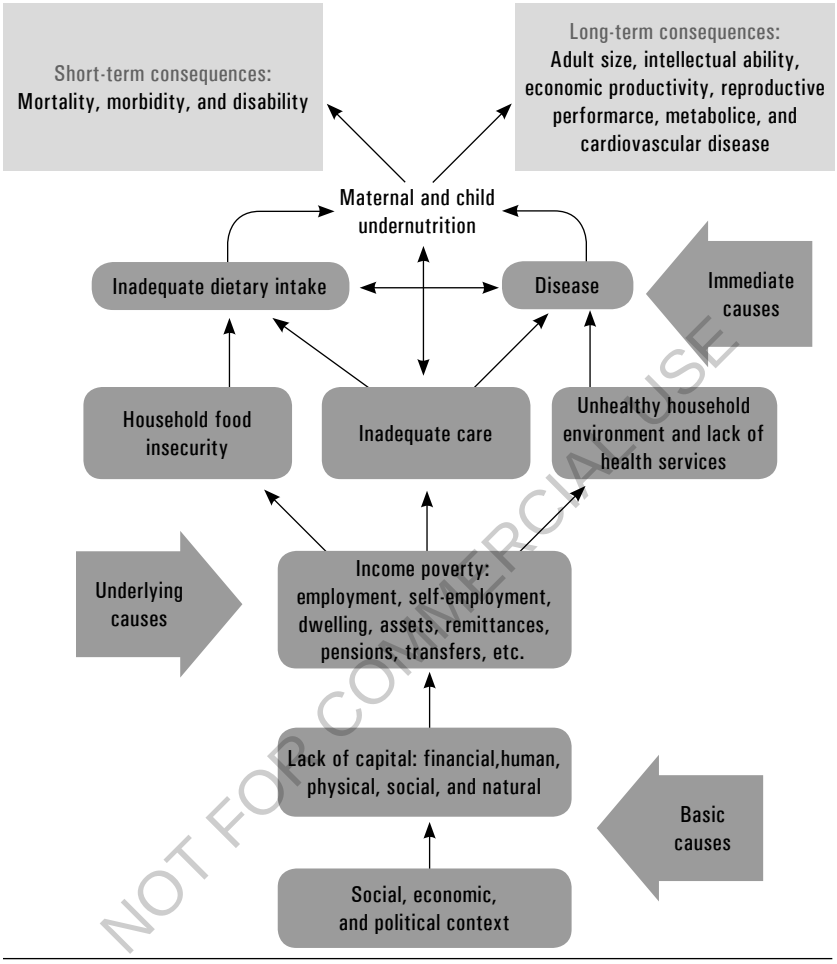
Since 1990s, research on undernutrition has been guided by the framework proposed by UNICEF (United Nations Children's Fund 1990). A modified version of this framework from the Lancet series on undernutrition is reproduced below in Figure 2 (Black et al. 2008).

While this framework identifies disease and diet as two proximate causes of undernutrition, it has done a disservice to the field by not distinguishing between different components of diet—specifically, caloric intake and dietary composition. Although dietary diversity and micronutrient deficiency is well recognized as a source of undernutrition, much of the attention in the policy arena remains directed to caloric deficiency resulting in advocacy for eradicating hunger (Sheeran 2008) and has provided justification for the NFSA. Further, we review evidence for three major sets of determinants for child undernutrition.

3.1. Disease Climate and Undernutrition

Prevalence of gastrointestinal diseases has been long recognized as a key determinant of poor nutritional outcomes (see India Policy Forum paper by Spears 2013). While the pathways are diverse, several deserve particular

FIGURE 2. Modified UNICEF Framework on Undernutrition



Source: Black et al. (2008).

attention. Increased prevalence of diarrhea is associated with loss of appetite and inadequate dietary intake; it is also associated with increased loss of water and electrolytes leading to direct loss of nutrients as well as decreased absorption of nutrients (Dangour, Watson, Cumming, Boisson, Che, Velleman, Cavill, Allen and Uauy 2013).

Studies linking water, sanitation, and hygiene (WASH) to diarrheal prevalence seem to find a generally positive relationship between improvements

in WASH and disease prevalence (Clasen Thomas et al. 2006; Clasen Thomas et al. 2010; Ejemot-Nwadiaro Regina et al. 2008) and WASH and nutritional outcomes (Dangour et al. 2013). Hookworm infection from the soil contaminated with feces affects small intestine and is associated with iron deficiency and appetite loss. This evidence is somewhat tentative and direct effects are relatively small,[4] but improving disease climate offers an interesting opportunity for multiplicative effect of other socioeconomic interventions.

Past research in India has documented a large role of geography in shaping disease prevalence, mortality, and access to health care (Deolalikar 2005; Desai et al. 2010). However, with declining disease prevalence, the role of geography is receding and that of food intake is likely to increase.

As disease prevalence declines, the role of food intake becomes more important (Desai and Thorat 2013). As Table 2 based on NFHS documents, over time the differences between the rich and the poor on nutritional outcomes have grown, documenting rising role of household incomes in shaping nutritional outcomes.

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3.2. Food Intake and Undernutrition

When UNICEF began its campaign for child survival and development in early 1980s, it began with the poorest and most marginalized children at its center. This led to the famous GOBI (Growth monitoring, oral rehydration, breastfeeding, and immunization) framework that has influenced the discourse around health and undernutrition over the past three decades. Hunger or caloric deficiency has been the center of this discussion. As research on famines, war, and other emergency situations documents, crises situations frequently lead to a vast proportion of individuals, particularly children, being malnourished (von Grebmer et al. 2013). This would lead us to assume that in stable economies as incomes grow, poverty will be vanquished and along with it undernutrition.

However, although income growth leads to decline in poverty, its impact on undernutrition tends to far smaller. Ruel and Alderman (2013, p. 538) note that, "Country fixed-effects regressions show that a 10 percent increase in gross domestic production (GDP) per person predicts a 5.9 percent (95 percent CI 4·1–7·6) reduction in stunting and an 11 percent (8·6–13·4) decrease in the World Bank's poverty measure of individuals living on

4. But a randomized experiment in toilet construction in Maharashtra shows a relatively large effect on nutrition; see Hammer and Spears (2013).

TABLE 2. Changes in Proportion Stunted and Underweight between 1992–93 and 2005–06 by Wealth Quintile

	1st quintile		*2nd quintile*		*3rd quintile*		*4th quintile*		*Top quintile*	
Age	*1992–93*	*2005–06*	*1992–93*	*2005–06*	*1992–93*	*2005–06*	*1992–93*	*2005–06*	*1992–93*	*2005–06*
					Proportion Stunted (%)					
< 12	32	24	28	22	25	19	22	14	15	10
13–23	65	65	64	56	59	54	52	46	38	28
24–35	71	59	69	53	62	41	57	34	40	18
36–48	75	62	74	54	72	50	63	41	45	24
All Ages	**60**	**53**	**59**	**47**	**55**	**42**	**48**	**34**	**35**	**21**
					Proportion Underweight (%)					
< 12	39	35	36	30	32	22	25	17	18	11
13–23	73	74	73	62	70	57	57	47	42	31
24–35	70	70	72	64	68	52	59	46	42	30
36–48	66	65	67	56	63	52	54	44	40	29
All Ages	**62**	**61**	**61**	**54**	**58**	**46**	**49**	**39**	**35**	**26**

Source: Desai and Thorat (2013).

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$1·25 per person, per day." The same review also observes that the relationship for India is even weaker than that observed globally.

Declining caloric consumption in India adds to this puzzle. Although incomes have risen sharply in India, per capita caloric consumption has steadily fallen from 2,150 calories per person per day in 1993–94 to 2,020 in 2009–10 in rural areas and from 2,071 to 1,946 in urban areas (National Sample Survey Organisation 2012). Similar decline is observed in the data collected by the National Nutrition Monitoring Bureau (National Nutrition Monitoring Bureau 2012). This decline in caloric consumption has added urgency to the advocacy for reducing hunger in India.

However, it seems somewhat implausible that as incomes grow and poverty declines, hunger levels rise instead of declining. While rising inequality or higher health care, transportation and other expenditures could account for this, one would expect that food consumption is at the core of the household expenditure strategy and would receive priority. Are there any other explanations for this observed trend? Measurement errors in the National Sample Survey (NSS) survey could account for this, particularly since converting data collected in kilograms and rupees to calories requires substantial approximation. This has become a bigger problem over time since more and more information for consumption expenditure seems to be provided in rupees rather than in quantities, increasing errors in conversion. However, there may also be a deeper issue. Disaggregated analysis seems to show that much of the decline in caloric consumption has taken place in higher income strata (Deaton and Drèze 2009) and may well be associated with a decline in energy-intensive work. Moreover, over time household structure has also changed resulting in changes in caloric needs. NSS results for 2009–10 have adjusted the caloric intake for energy needs of different age groups and the results, presented in Figure 3a and 3b, suggest an increase in caloric intake in urban areas between 2004–05 and 2009–10 for all income groups, but a decline in caloric intake for households at higher consumption levels in rural areas. Without doing this adjustment for age/activity level, bottom 20 percent of the households seem unable to meet FAO revised norms for 1,800 calories per day, with the adjustment, all consumption classes seem to meet these norms on average (National Sample Survey Organisation 2012). Given the growth of non-farm work in rural India, decline in energy needs among the rural rich seems a plausible explanation.

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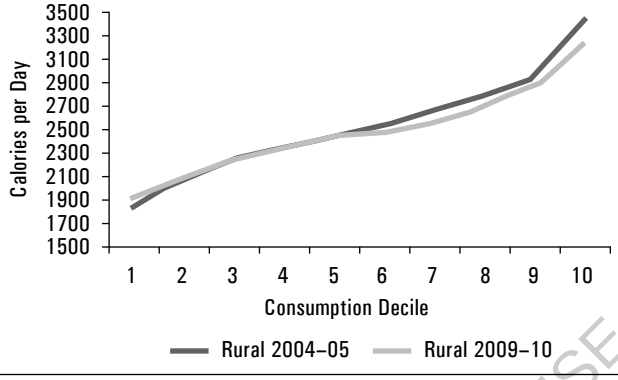
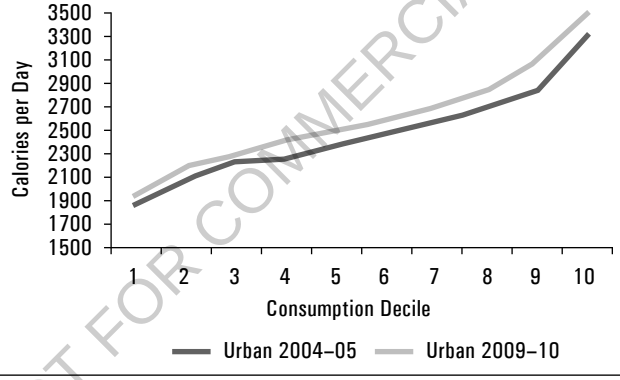
FIGURE 3A. Calories Intake per Adult Equivalent, Rural



Source: National Sample Survey Report 513, 2012.

FIGURE 3B. Calories Intake per Adult Equivalent, Urban



Source: National Sample Survey Report 513, 2012.

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3.3. Food Composition and Undernutrition

As economies grow and starvation levels recede, we would expect to see caloric intake increase. However, composition of food continues to remain a bottleneck for improved nutritional status. A large number of studies have documented the importance of micronutrients like iron, vitamin A, zinc, and calcium in shaping maternal health, child birth weight, and child undernutrition (Bhutta et al. 2013; Black et al. 2013). This issue is particularly relevant in India since studies have documented high prevalence of anemia in Indian mothers and children that seems persistent in spite of economic growth.

NFHS of 2005–06 records 56 percent of the women as being anemic up from 52 percent in 1998–99. A similar increase in anemia is observed among children with about 78 percent being at least mildly anemic (hemoglobin level of <10 g/dl) in 2005–06 compared to 74 percent in 1998–99.

This increase in anemia among Indian population is puzzling given the increase in incomes. Food diversity including consumption of milk, vegetables, fruits, and pulses is important to a balanced diet and micronutrient intake. Analysis of NFHS-III data shows that children who received diets that consisted of at least four food groups had far lower likelihood of being underweight or stunted than those that did not (Menon et al. 2015).[5] However, NFHS-III notes that only 49 percent of the women consume milk daily while that number is even smaller for fruits, only 13 percent.

What is more curious is the fact that dietary diversity has steadily declined in India (Gaiha, et al. 2013). Gaiha and colleagues use NSS data to show increasing concentration for food expenditure across various food groups using a concentration index similar to Herfindahl that takes into account distribution of expenditure across various food groups. Dietary surveys by National Institute of Nutrition also document a decline in availability of calcium and iron along with protein and energy in the states they have surveyed since 1975 (National Nutrition Monitoring Bureau 2012).

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4. National Food Security Act and Undernutrition

This brief review has examined the determinants of undernutrition and their trends in India. How do we expect NFSA to address these three components? Although NFSA provides a nod to the need for improved water and sanitation systems, policies directed towards stimulating agriculture and providing maternity benefits of ₹10,000 to each pregnant woman, food distribution through the Public Distribution System (PDS) and Integrated Child Development Services (ICDS) are the two pillars of this legislation. This is not surprising given its origin, the Right to Food case filed by the People's Union of Civil Liberties in 2001 and a series of Supreme Court orders directing universalization of ICDS as well as provision of food to the poor.

5. Note, however, that some cross-national analyses have failed to find this to be a statistically significant relationship Jones, Mbuya, Ickes, Heidkamp, Smith, Chasekwa, Menon, Zongrone and Stoltzfus (2014).

The NFSA emerged as a part of the common minimum program of the UPA Government in 2004 and was finally passed as legislation in September 2013. However, given its focus on alleviating hunger and ensuring food distribution, its potential for addressing India's nutritional challenges remains unknown. In this paper, we examine the potential of PDS and ICDS for improving nutritional outcomes of children under age five.

While in principal, both programs should improve nutritional outcomes, empirical studies fail to show a conclusive relationships. Literature on effectiveness of PDS in improving nutrition is not unanimous in its findings. With some exceptions (Kochar 2005), studies that focus on caloric intake find that PDS is effective in increasing caloric intake (Himanshu and Sen 2013; Kaul Forthcoming); in contrast, studies that actually focus on nutritional outcomes show little impact of going from universal PDS to targeted PDS on anthropometric outcomes (Tarozzi 2005). The literature on ICDS is also ambiguous. Some of the earlier studies failed to find a strong relationship between availability of ICDS program and nutritional outcomes (Deolalikar 2005; Lokshin et al. 2005), while more recent studies show that presence of Anganwadi centers (AWCs) through which ICDS operates improve children's nutritional outcomes, although often for selected groups of children (Jain 2013; Kandpal 2011). This suggests that these relationships should be empirically examined and not simply assumed.

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5. India Human Development Survey (IHDS)

Results presented in this paper are based on the analysis of IHDS-II of 2011–12. The IHDS is carried out jointly by the University of Maryland and National Council of Applied Economic Research and is the only nationwide survey to collect data on income, consumption, and nutrition. This is a survey of over 40,000 households. It began in 2004–05 with a sample of 41,554 households and about 83 percent of these households were resurveyed in 2011–12. The IHDS-II sample consists of 42,154 households of which 34,621 households were also surveyed in 2004–05; 5,397 households have separated from the original household (also included in the sample) and live in the sample village or urban area; and, 2,134 households were added to refresh the urban sample where there were greater losses due to non-recontact. The recontact rate is over 90 percent in rural areas and about 72 percent in urban areas. The quality of IHDS-I data is considered to be generally quite high with its results being comparable to Census, NFHS, and NSS, and ASER

survey on variables like poverty rate, school enrollment, and learning outcomes (Desai et al. 2010). Analysis of IHDS-II shows similar concurrence between IHDS-II data and other data sources. The comparison of IHDS-II anthropometric data with other surveys is presented in Table 1.

The IHDS sample is spread over all states and union territories with the exception of Andaman Nicobar and Lakshadweep and covers both urban and rural areas covering 1420 villages and 1042 urban blocks. The IHDS-II contains interviews of a respondent knowledgeable about household income, expenditure, and employment (typically the head of the household), up to two ever-married women ages 15–49, and a youth aged 15–18.

IHDS-II also includes anthropometric measurements for household members including those for 10,715 children for whom both complete date of birth and weight measurements are available. Using these two pieces of information, we have constructed weight-for-age standardized scores for children 0–60 months of age using WHO growth reference standards and STATA's Zanthro routine. Descriptive statistics for moderate and severe underweight for children are presented in Table 3 and show expected correlation between household education and income and child underweight. Children from households that participate in the two programs we are interested in—PDS and ICDS—show higher undernutrition rates, but that is partly due to selectivity into these programs by lower income families. A point to which we return when discussing multivariate analyses.

IHDS-II collected data on both incomes and expenditure. Expenditure data were collected using the short module of about 50 items used by the NSS's Employment/Unemployment survey. While this does not contain the full range of items collected by the consumption expenditure survey of NSS, it is sufficient for our analysis since we focus on consumption of major commodities and food groups. Comparison of quantities consumed per capita from detailed NSS data and IHDS shows fairly similar pattern. For example, cereal consumption per capita in NSS 68th round is 9.4 kg per month in urban areas and 11. 4 kg in rural areas; corresponding figures for IHDS are 9.8 kg and 11.5 kg.

Our focus is on the quantity of cereals, pulses, and milk consumed by PDS and non-PDS households along with whether their consumption included fruits, vegetables, oil/fat, and sweeteners. We also construct an index of dietary variety which is a sum of the number of food groups consumed including cereals, other grains, such as ragi and jowar, pulses, fruits and nuts, vegetables, and milk.

Where quantities consumed are available (e.g., for grains, pulses, and milk), the quantity consumed per household member is adjusted for

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TABLE 3. Percentage of Children Underweight by Location and Household Characteristics

	Weight-for-age	
	(Moderate < 2 SD)	*(Severe underweight < 3 SD)*
All India	**37.4**	**15.8**
States		
J&K, HP, UK	27.6	7.9
Pun, Har, Del	26.3	8.7
UP, Bih, Jhar	40.8	18.5
Raj, Chh, MP	40.9	15.4
North-East, Assam, WB	34.7	18.1
Guj, Maha, Goa	39.1	14.9
AP, Kar, Ker, TN	32.4	13.1
Sector		
Rural	40.1	17.7
Urban	29.0	10.2
Highest HH Education		
Illiterate	46.5	22.9
1–4 std	39.9	19.0
5–9 std	40.6	16.7
10–11 std	35.4	13.3
12th and graduate	34.1	13.4
Postgraduate	24.1	10.2
Caste/Religion		
Forward caste Hindus	26.7	11.7
OBC	38.0	14.7
Dalit	41.6	17.9
Adivasi	49.2	23.4
Muslim	36.0	16.3
Christian, Sikh	23.3	8.8
Income group		
Below 25,000	43.5	18.3
25,001–50,000	43.6	20.3
50,001–75,000	41.6	17.9
75,001–100,000	36.1	13.5
100,001–200,000	31.1	12.2
200,001–300,000	26.6	11.6
300,001–400,000	22.7	8.0
400,001–500,000	22.2	4.8
500,001 and above	16.2	7.2
No. of Adult Equivalent		
1	0.0	0.0
2	19.1	16.8
4	38.3	15.3
8	37.1	16.6
8+	35.3	13.7
Any toilet in the HH		
Yes	29.9	11.6
No	43.1	19.1

(Table 3 Contd)

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(Table 3 Contd)

	Weight-for-age	
	(Moderate < 2 SD)	*(Severe underweight < 3 SD)*
Piped water in HH		
Yes	32.5	11.8
No	39.9	17.9
Sex		
Male	37.3	16.5
Female	37.5	15.1
Child age category		
< 12 months	33.3	16.5
13–24 months	38.9	17.9
25–36 months	36.6	14.0
37–48 months	38.2	15.6
49–60 months	40.6	15.0
Type of PDS card		
APL/No card	35.1	14.6
BPL	40.1	17.7
Antyodaya	46.6	19.0
Purchase from PDS shop by card type		
No PDS Use	35.8	15.0
APL use	32.8	14.3
BPL use	40.2	17.7
Antyodaya use	48.8	19.3
ICDS education particip.		
Yes	39.9	14.7
No	37.0	16.1
ICDS food receipt		
Yes	40.7	15.3
No	35.9	16.2
Sample—children ages 0–60 months	10,521	

Source: Authors' calculations.
Note: SD = standard deviations.

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age/gender composition of household members using a scale used by the NSS (Appendix I). This analysis was repeated with a simple equivalence scale with a child under five counting as half an adult, the conclusions did not change.

6. Propensity Score Matching

In this paper, we undertake three analyses:

1. Do households who access subsidized cereals from PDS shops have a different food basket than those who do not use subsidized cereals?

2. Are children from households that use cereals from PDS shops less likely to be undernourished?
3. Are children who use ICDS services less likely to be malnourished than comparable children who do not use ICDS services?

Since the use of PDS and ICDS is concentrated in lower socioeconomic strata of the society, we employ propensity score matching to compare households and children that are as similar to each other as possible. Propensity score analysis (; Heckman and Navarro-Lozano 2004; Rosenbaum and Rubin 1983) is frequently used in the context of nonrandom treatment assignments in observational studies. The propensity score is expressed as:

$$e(X_i) = pr(Z_i=1 \mid X_i = x_i)$$

where the propensity score for subject i (i = 1… N) is the conditional probability of being assigned to treatment Zi = 1 versus control Zi = 0 given a vector xi of observed covariates.

Conceptually, estimating treatment effect in a quasi-experimental situation is relatively simple involving predicting participation in a treatment using a set of covariates and then matching two respondents with similar propensity scores, one from the treatment group and one from the control group. However, results tend to be sensitive to the quality of matching. In order to maximize the quality of the match, we have used nearest neighbor matching within calipers and following (Austin 2011), set calipers to 0.2 standard deviations of the predicted logit. Since our matching procedure does not allow a comparison case to match with more than one treatment case, it also reduces the number of treated observations that have a valid match, an issue of potential concern. We examine both of these potential sources of bias in a later section.

In this analysis, we match households with each other using the following variables: state of residence, urban/rural residence, highest education level obtained by an adult above 21 in the household, household income and a squared term for income, number of adult equivalents in the households, number of married women in the household as a proxy for household structure as well as time availability, caste/religion categories (forward caste, OBC, Scheduled Caste, Scheduled Tribe, Muslim, other religions), whether household has any toilet and whether it has indoor piped water. For child underweight analyses, we add child and mother characteristics including child's gender, age, a dummy variable for infants, and number of children borne by the mother.

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6.1. Quality of Matching

Table 4 provides an illustrative example of the quality of matching in this analysis. The left-hand side panel shows sample distribution before matching and the right-hand side shows it after matching. For example, before matching 21 percent of the PDS users came from urban areas while 35 percent of the non-PDS sample was urban. After matching this proportion was 24 percent for both. T-test examines the differences in these means. As Table 4 shows, matching substantially reduces the bias on each independent variable. Where statistically significant bias remains for an individual covariate, it is very small in size.

Appendix II contains kernel density plots for the log odds of propensity score for the treatment and comparison sample for each of the four analyses, PDS use at household level, PDS use at child level, and ICDS use at child level. The graphs suggest that matched treatment and comparison cases are very similar on predicted propensity scores. While this close matching eliminates the bias, efficiency of this matching process remains open to question. Our matching technique includes nearest neighbor matching within calipers without replacement. That is, a comparison case will only match a treatment case if predicted propensity score for both falls within a narrow caliper and one comparison case will match one and only one treatment case. For each of the four analyses about 6–28 percent of the sample of treated cases did not match with an appropriate comparison case and the results are based on the remainder. Comparison of unmatched and matched treatment cases for any given dependent variable provides some estimate of differences between these two sets of cases.

As a robustness check, we also carry out household level fixed-effects analysis to see if holding all unobserved household characteristics constant and controlling for variables that vary over time—namely, income and household composition—supports our conclusions based on propensity score matching. While household fixed effects analyses are feasible for food consumption, they are not feasible for nutritional outcomes since households with young children at one point in time may not have young children at the time of the second survey. But fixed effects analyses for food intake provide some robustness check by validating the observations from propensity score matching. Results from these robustness checks and comparison of changes in nutritional outcomes with changes in PDS intake from other data sources such as DLHS-IV are presented in Appendix III.

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TABLE 4. Distribution of Matched and Unmatched Households—Before and After Propensity Score Matching

	Without adjustment					*With adjustment*				
	Mean			*t-test*		*Mean*			*t-test*	
Variable	*PDS Use*	*No PDS use*	*% bias*	*t*	*p > |t|*	*PDS use*	*No PDS use*	*% bias*	*t*	*p > |t|*
States										
J&K, HP, UK	omitted									
Pun, Har, Del	0.059	0.133	–25.3	–23.65	0	0.080	0.075	1.8	1.44	0.149
UP, Bih, Jhar	0.114	0.166	–15.0	–14.42	0	0.145	0.145	0.1	0.04	0.969
Raj, Chh, MP	0.161	0.175	–3.6	–3.54	0	0.194	0.191	0.8	0.55	0.583
NER, Ass, WB	0.155	0.150	1.4	1.41	0	0.180	0.174	1.8	1.26	0.208
Guj, Maha, Goa	0.085	0.156	–21.8	–20.67	0	0.116	0.112	1.0	0.79	0.431
AP, Kar, Ker, TN	0.372	0.153	51.4	52.77	0	0.215	0.235	–4.7	–3.52	0.000
Sector										
Rural	omitted									
Urban	0.219	0.382	–36.3	–34.80	0	0.239	0.242	–0.5	–0.38	0.704
Highest HH education										
Illiterate	omitted									
1–4 std	0.082	0.047	14.2	14.49	0	0.076	0.076	0.3	0.18	0.858
5–9 std	0.363	0.294	14.7	14.52	0	0.378	0.381	–0.7	–0.47	0.635
10-11 std	0.135	0.150	–4.4	–4.27	0	0.138	0.139	–0.2	–0.16	0.875
12th and some college	0.099	0.154	–16.6	–15.84	0	0.113	0.112	0.3	0.21	0.830
Graduate	0.069	0.229	–46.0	–42.40	0	0.081	0.081	0.0	0.02	0.980

(Table 4 Contd)

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(Table 4 Contd)

	Without adjustment					*With adjustment*				
	Mean			*t-test*		*Mean*			*t-test*	
Variable	*PDS Use*	*No PDS use*	*% bias*	*t*	*p > |t|*	*PDS use*	*No PDS use*	*% bias*	*t*	*p > |t|*
Caste/Religion										
Forward caste Hindus	omitted									
OBC	0.355	0.330	5.4	5.31	0	0.353	0.361	–1.6	–1.17	0.241
Dalit	0.276	0.175	24.3	24.45	0	0.260	0.258	0.5	0.32	0.745
Adivasi	0.129	0.063	22.4	23.06	0	0.114	0.109	1.5	1.01	0.312
Muslim	0.113	0.128	–4.5	–4.38	0	0.123	0.131	–2.4	–1.73	0.084
Christian, Sikh	0.012	0.037	–16.4	–15.02	0	0.016	0.015	0.2	0.22	0.827
Income group										
Below 25,000	omitted									
25,000–50,000	omitted									
50,001–75,000	0.258	0.167	22.3	22.46	0	0.246	0.231	3.8	2.68	0.007
75,001–100,000	0.207	0.149	15.2	15.25	0	0.206	0.190	4.3	3.04	0.002
100,001–200,000	0.125	0.110	4.6	4.51	0	0.127	0.120	2.2	1.59	0.113
200,001–300,000	0.177	0.231	–13.6	–13.12	0	0.190	0.195	–1.2	–0.88	0.381
300,001–400,000	0.035	0.102	–26.7	–24.60	0	0.041	0.052	–4.1	–3.57	0.000
400,001–500,000	0.010	0.047	–22.7	–20.43	0	0.012	0.017	–2.7	–2.78	0.005
500,001 and above	0.004	0.028	–18.7	–16.69	0	0.006	0.006	–0.1	–0.09	0.928
No. of adult equivalent	3.861	3.898	–2.0	–1.96	0	3.895	3.905	–0.5	–0.39	0.697
No. of married females	1.150	1.230	–11.4	–11.11	0	1.167	1.170	–0.4	–0.30	0.761
Any toilet in the HH	0.407	0.629	–45.7	–45.01	0	0.450	0.453	–0.6	–0.41	0.683
Piped water in HH	0.471	0.488	–3.5	–3.39	0.001	0.423	0.428	–1.0	–0.78	0.435

Source: Authors' calculations.

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7. Public Distribution System and Food Consumption

Although a very weak form of PDS existed in India during the second world war, it emerged in the form we now see in 1960s (Kumar 2010) following increased availability of grains via US Government's foreign assistance program known as PL-480 as well as the institution of price support program to stabilize agricultural prices. A large network of PDS shops, also known as Fair Price Shops, was established: local traders were enrolled as owners, and households were issued a PDS card with monthly per capita entitlements of food staples.

The PDS has changed both qualitatively and quantitatively since the 1970s. At first, the PDS was confined to urban areas and regions with food deficits. The main emphasis was on price stabilization. Private trade was considered "exploitative," and the PDS was considered a countervailing power to private trade. Since the early 1980s, the welfare role of the PDS has gained importance. Nevertheless, the PDS was widely criticized for its failure to reach those living below the poverty line for whom the program was intended. Although rural areas were covered in many states in the 1980s, the PDS had an urban bias and large regional inequalities in its operation. An effort was made, therefore, to streamline the PDS by introducing the Targeted PDS (TPDS) in June 1997 (Kumar 2010).

At present, households have access to three types of cards: Above Poverty Line (APL) cards which allow households to buy from the PDS shops at close to market price; Below Poverty Line (BPL) cards which allow for subsidized purchase of rice, wheat, sugar, and kerosene at subsidized prices up to an allocation level fixed by state governments; and Antyodaya Anna Yojana (AAY) cards given to the poorest of the poor which provide a much higher level of subsidy. While this is a centrally sponsored scheme, it is administered by state governments, which are free to add other items to the list and to reduce prices or to increase quantities.

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7.1. Who Uses PDS?

The TPDS scheme has been severely criticized for its inability to identify the poor and for widespread leakages (Dreze and Khera 2010). Its operation has been less effective in poorly governed states than in more efficient states, resulting in low off-take rates. For example, in 2004–05 only 31 percent of the BPL or AAY card holders purchased rice at PDS shop; the corresponding figure was 35 percent for wheat.

However, the program has undergone considerable changes between 2005 and 2011 with proportion of PDS users rising sharply along with a decline in targeting errors (Himanshu and Sen 2013). IHDS I and II show an interesting pattern of change. First, exclusion of very poor households from access to BPL/AAY cards has declined, although some the nonpoor still own BPL/AAY cards. Second, proportion of card holders who buy wheat, rice, or other cereals from fair price shop in the month prior to the survey has increased substantially. Increasing food prices may be at least partially responsible for this.

Table 5 shows descriptive statistics for households with access to various types of cards as well those who purchased food (not counting sugar and kerosene) from fair price shops. The results show some interesting patterns. The PDS has expanded rapidly in the South with state government funds; thus, 57 percent of the Southern households have a BPL card compared to only 30 percent in the central plains, although poverty is far more prevalent in the central states than in South. Beginning from a program that had a marked urban bias, PDS is now increasingly a rural program. Scheduled Castes and Tribes are far more likely to get BPL and AAY cards than others, partly because of the higher rates of poverty among these groups and partly because of identification criteria used at the local levels.

Almost all BPL and AAY card holders seem to purchase food grains from the PDS shops. This is a marked contrast to 2004–05 in IHDS-I where off-take of often quite limited (Desai et al. 2010). About 15 percent of the APL households also purchase food from PDS shops although the price they pay is very close to the market price.

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7.2. Role of PDS in Shaping Food Consumption

In analyzing the role of PDS in shaping food consumption of the households, we combine APL households with non-users. Since our focus is to understand the role of price subsidies on food consumption, it makes sense to exclude APL card holders who must pay near market prices from the treatment sample (but they are included in the comparison group). We also combine BPL and AAY card holders for these analyses given the small number of AAY card holders in our sample, only about 5 percent.

Table 6 shows means for a variety of measures of food consumption for PDS and non-PDS samples, before and after matching. The results from the matched samples show that regardless of PDS use most households consume cereals, pulses, oil/fat, and vegetables in the month prior to the interview. Since these are such staples of Indian diet, everyone consumes at least some

TABLE 5. Distribution of Card Type and PDS Purchase

	Card type			*Use of card*			
	APL/No card	*BPL*	*Antyodaya*	*No use/No card*	*APL and use*	*BPL and use*	*Antyodaya and use*
All India	**58.6**	**36.3**	**5.6**	**47.7**	**15.0**	**32.6**	**5.1**
States							
J&K, HP, UK	68.5	25.1	6.6	28.1	43.1	22.8	6.0
Pun, Har, Del	73.4	18.7	8.2	78.6	3.2	11.7	6.7
UP, Bih, Jhar	62.2	30.1	8.2	64.4	3.5	25.2	7.4
Raj, Chh, MP	60.5	31.1	8.8	58.4	6.8	27.1	8.1
NER, Ass, WB	59.8	36.1	4.8	43.3	20.3	32.5	4.4
Guj, Maha, Goa	72.0	25.4	2.8	60.5	16.2	20.9	2.4
AP, Kar, Ker, TN	40.4	57.5	2.9	16.0	25.7	56.2	2.8
Sector							
Rural	52.9	40.8	7.0	44.3	13.1	36.8	6.4
Urban	71.8	25.9	2.5	55.5	19.6	22.9	2.1
Highest HH education							
Illiterate	41.0	49.7	10.1	37.7	8.0	45.7	9.3
1–4 std	47.8	45.0	7.9	37.6	13.8	41.7	7.5
5–9 std	54.6	39.6	6.4	43.5	15.4	35.6	6.0
10–11 std	61.7	35.1	3.6	47.6	17.8	32.0	2.9
12th and some college	68.6	28.2	3.6	55.2	17.7	24.2	3.1
Graduate	81.1	17.9	1.2	65.8	18.7	14.8	0.8
Caste/Religion							
Forward Cast Hindu	76.1	21.6	2.5	63.0	16.3	18.7	2.0
OBC	56.9	38.2	5.3	45.7	15.1	34.7	4.7
Dalit	46.9	45.1	9.1	38.9	12.6	41.1	8.5

(Table 5 Contd)

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	Card type			*Use of card*			
	APL/No card	*BPL*	*Antyodaya*	*No use/No card*	*APL and use*	*BPL and use*	*Antyodaya and use*
Adivasi	43.1	49.1	8.1	39.7	9.5	43.4	7.7
Muslim	63.0	33.0	4.4	48.8	18.1	29.4	4.0
Christian, Sikh	80.4	18.0	1.9	54.0	29.8	15.0	1.4
Income group							
Below 25,000	48.0	43.7	8.9	41.0	11.7	39.2	8.5
25,001–50,000	49.3	44.1	7.2	42.7	11.1	40.0	6.7
50,001–75,000	52.1	41.9	6.7	42.0	14.2	38.2	6.2
75,001–100,000	55.7	39.4	5.6	43.5	16.4	35.8	4.9
100,001–200,000	67.3	29.9	3.2	50.9	19.8	27.0	2.6
200,001–300,000	80.0	18.5	1.7	63.4	20.4	15.1	1.3
300,001–400,000	85.6	13.5	1.0	72.7	17.4	9.5	0.5
400,001–500,000	90.2	9.2	0.7	73.7	19.0	6.9	0.5
500,001 and above	90.8	8.4	0.9	79.9	14.6	5.3	0.3
No. of Adult Equivalent							
1	47.5	44.5	8.1	38.2	14.3	40.4	7.2
2	56.8	37.4	6.2	43.1	17.3	34.2	5.8
4	60.8	35.1	4.5	47.8	16.7	31.8	4.0
8	57.2	36.8	6.7	49.1	12.7	32.7	6.1
8+	61.6	34.8	5.1	56.4	10.8	29.4	4.8
Any toilet in the HH							
Yes	68.7	28.4	3.1	52.7	19.5	25.3	2.7
No	48.3	44.3	8.2	42.5	10.5	40.1	7.5
Piped water in HH							
Yes	60.4	36.4	3.6	44.8	19.0	33.2	3.3
No	57.2	36.2	7.2	49.9	12.0	32.1	6.5

Source: Authors' calculations.

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TABLE 6. Food Intake Comparisons for Unmatched and Matched PDS Users and Non-Users from Propensity Score Matching

	PDS users	*Non-users*	*Difference*	*S.E.*	*T-stat*
Any cereal					
Unmatched	0.996	0.994	0.002	0.001	2.86
Matched	0.996	0.991	0.006	0.001	5.05
Any other food grain					
Unmatched	0.322	0.274	0.048	0.005	10.38
Matched	0.279	0.273	0.006	0.006	1.00
Any pulses					
Unmatched	0.981	0.986	–0.005	0.001	–4.18
Matched	0.978	0.984	–0.006	0.002	–2.98
Any oil/ghee					
Unmatched	0.996	0.992	0.004	0.001	5.19
Matched	0.997	0.992	0.005	0.001	4.83
Any vegetables					
Unmatched	0.993	0.986	0.006	0.001	5.86
Matched	0.992	0.986	0.006	0.001	4.16
Any fruits					
Unmatched	0.670	0.743	–0.074	0.005	–16.14
Matched	0.636	0.677	–0.041	0.006	–6.38
Any meat					
Unmatched	0.737	0.590	0.147	0.005	30.44
Matched	0.686	0.679	0.008	0.006	1.19
Any sweetener					
Unmatched	0.984	0.981	0.003	0.001	1.95
Matched	0.982	0.970	0.012	0.002	5.72
Any eggs					
Unmatched	0.550	0.453	0.097	0.005	19.07
Matched	0.482	0.496	–0.013	0.007	–1.94
Any milk					
Unmatched	0.816	0.893	–0.077	0.003	–22.36
Matched	0.805	0.820	–0.014	0.005	–2.74
Quantity cereal (Kg/adult equiv)					
Unmatched	15.356	13.865	1.491	0.071	20.90
Matched	15.432	14.610	0.822	0.102	8.08
Quantity milk (ltr/adult equiv)					
Unmatched	2.830	5.958	–3.128	0.077	–40.73
Matched	3.223	4.009	–0.786	0.087	–9.08
Quantity pulses (kg/adult equiv)					
Unmatched	0.232	0.259	–0.027	0.008	–3.47
Matched	0.213	0.241	–0.028	0.009	–3.13
Quantity sugar (kg/adult equiv)					
Unmatched	1.149	1.469	–0.321	0.011	–27.94
Matched	1.225	1.265	–0.041	0.015	–2.79
Food/nonfood ratio					
Unmatched	0.518	0.485	0.034	0.002	20.68
Matched	0.520	0.523	–0.003	0.002	–1.26
Variety – No. of food groups					
Unmatched	9.312	9.176	0.135	0.015	8.85
Matched	9.079	9.130	–0.051	0.021	–2.45
Unmatched households	14,924	27,217			
Matched households	10,909	10,909			

Source: Authors' calculations.

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of each item. However, when it comes to milk and fruits, the PDS sample is a little less likely to consume both of these items. Our index of dietary variety which is a sum of the number of food groups consumed including cereals, other grains like ragi and jowar, pulses, fruits and nuts, vegetables, and milk is 5.69 for PDS users and 5.71 for non-users. While this is a very small difference, given the number of staples everyone consumes (e.g., cereals, oil, and vegetables), this small difference really taps into consumption of fruits and milk and has an impact on nutritional outcome, mediating some of the adverse relationship between PDS use and nutrition.

When we examine quantities consumed, we find that PDS users are substantially more likely to consume cereals. On an adult equivalent level, PDS users consume 20 kg cereals per month compared to 18 kg for non-users. In contrast, PDS users only consume 4.3 l of milk per adult equivalent compared to 5.3 for non-users.

This suggests that PDS users seem to skew their consumption towards items they are able to purchase cheaply, namely cereals, while reducing consumption of other items like fruits and milk. It is difficult to figure out how to interpret this observation. If Indian undernutrition is due to caloric deficiency, higher consumption of calorie dense foods like cereals could be a good way of addressing undernutrition. In that case, by making cereals cheaper, the policy is doing exactly what it is supposed to do. In contrast, if caloric insufficiency is not the bottleneck and if cheaper cereals lead people to switch away from milk and fruits and thereby reduce dietary diversity, it could potentially have a negative impact on nutritional outcomes. This is an issue to which we turn in the next section.

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8. Public Distribution System and Child Nutrition

In this section, we examine underweight statistics for households that purchased grains from PDS shops in the month prior to the survey and those that did not, following the matching strategy used above. Here our sample consists of over 10,000 children ages 0–60 months for whom we have data on weight as well as a valid date of birth.

We present results for three outcome variables, standardized score on weight-for-age, whether the child's weight-for-age is two standard deviation or more below the median of WHO reference population (moderate to severe undernutrition) and, whether it is 3 or more standard deviations below median (severe undernutrition).

The results presented in Table 7 indicate that children from PDS-using households have a slightly lower z score and are more likely to be underweight than non-PDS using households. However, these differences are not statistically significant. Since PDS use is concentrated in low-income households, it is not surprising that the differences between unmatched samples are very large. But even when we match the samples on a variety of variables such as income, caste, residence, and household composition, PDS sample appears not to benefit from PDS usage and is more or less on par with non-PDS households on anthropometric outcomes.

This could simply be due to poor quality of matching or sensitivity of different matching techniques; we found that different model specifications changed the size and significance of this difference. However, we did not find that any change in specification reversed the sign and make PDS users *less* malnourished than comparable non-users.

It seems counterintuitive that a policy designed to increase foods security would not lead to improvement in nutritional outcomes and may mildly be associated with poorer outcomes. Do we have any reason to believe that PDS could make the undernutrition problem worse than it is? As we note above, reduction in dietary diversity seems to accompany PDS use, skewing consumption towards cereals rather than fruits and milk.

These results imply that if food subsidy for cereals is the only weapon in our arsenal, it is unlikely to reduce child undernutrition. If a significant proportion of Indian population suffered from starvation, the response to increased cereal consumption would be far greater. However, starvation has been declining in India, making dietary diversity a greater challenge than simple caloric intake.

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TABLE 7. Comparison of Weight-for-age and Underweight for PDS Users and Non-users

	PDS users	*Non-users*	*Difference*	*S.E.*	*T-stat*
Z score for weight-for-age					
Unmatched	–1.621	–1.385	–0.236	0.033	–7.24
Matched	–1.594	–1.527	–0.067	0.042	–1.62
Moderate underweight (< 2 SD)					
Unmatched	0.402	0.334	0.068	0.010	6.71
Matched	0.394	0.374	0.020	0.013	1.48
Severe underweight (< 3 SD)					
Unmatched	0.164	0.126	0.038	0.007	5.22
Matched	0.156	0.146	0.010	0.010	1.05
Unmatched children 0–60 months	3,157	7,364			
Matched children	2,607	2,607			

Source: Authors' calculations.

9. ICDS and Child Undernutrition

The second pillar of NFSA, ICDS, was set up in 1975. Early in its history, this program was geared towards children under five from BPL households. However, following an order of the Supreme Court, it has now been universalized. It operates community-based AWCs operated by an Anganwadi worker, who is now supposed to receive help from a helper. ICDS program is supposed to provide the following services:

1. Supplementary nutrition to children below six, pregnant and lactating mothers, and adolescent girls
2. Immunization to children under six and pregnant women
3. Health checkup to children under six and pregnant and lactating mothers
4. Referral to children under six, pregnant and lactating mothers
5. Health and nutrition education to women ages 15–45 and adolescent girls.

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As on January 31, 2013, 13,31,076 AWCs are operational across 35 States/UTs, covering 93 million beneficiaries under supplementary nutrition and 35 million three to six years children under pre-school component were operational, at least on paper (Saxena 2014).

On paper this program has tremendous potential for redressing maternal and child undernutrition. However, its evaluations present mixed evidence. Several studies using data from 1990s have found little impact of the presence of AWC on child nutritional outcomes (Deolalikar 2005; Lokshin et al. 2005). In contrast, studies using more recent data (i.e. circa 2005) have found statistically significant but small positive effect of presence of AWC's (Kandpal 2011) and of daily supplementary feeding (Jain 2013) on child nutrition. Since most evaluations rely on data from NFHS of 1998–99 and 2005–06, few evaluations have been undertaken since the program was universalized.

Table 8 shows distribution of ICDS usage by household and child characteristics for the two major components, use of ICDS education program (typically, targeted at children 3 and above) and supplementary food distribution program. Children attending educational program at the ICDS centers (Anganwadis) also receive meals. For these analyses, we restrict our sample to youngest children born in the prior five years since ICDS data in our survey are only collected for the last birth.

TABLE 8. Use of ICDS Services for Youngest Child under Five

	ICDS education benefits	*ICDS food benefits*
All India	**20.3**	**39.0**
States		
J&K, HP, UK	19.0	41.0
Pun, Har, Del	10.0	21.2
UP, Bih, Jhar	10.4	21.8
Raj, Chh, MP	15.8	43.0
NER, Ass, WB	27.7	63.1
Guj, Maha, Goa	33.5	51.1
AP, Kar, Ker, TN	34.9	48.2
Sector		
Rural	21.6	42.9
Urban	16.6	26.9
Highest HH education		
Illiterate	19.0	34.3
1–4 std	23.1	46.4
5–9 std	21.2	44.8
10–11 std	25.5	42.7
12th and graduate	17.6	31.5
Postgraduate	16.1	28.7
Caste/religion		
Forward caste Hindus	19.0	32.0
OBC	18.8	36.1
Dalit	20.1	42.3
Adivasi	32.6	61.0
Muslim	19.9	37.6
Christian, Sikh	13.6	25.4
Income group		
Below 25,000	23.5	45.8
25,001–50,000	23.1	42.9
50,001–75,000	19.5	41.2
75,001–100,000	20.4	38.2
100,001–200,000	18.8	34.3
200,001–300,000	15.6	29.6
300,001–400,000	18.7	34.7
400,001–500,000	16.6	22.8
500,001 and above	9.0	24.8
No. of adult equivalent		
1	0.0	0.0
2	8.0	30.1
4	22.4	40.9
8	18.4	37.4
8+	21.3	37.9
Any toilet in the HH		
Yes	21.3	42.2
No	19.2	34.9
Piped water in HH		
Yes	18.4	38.3
No	23.9	40.2

(Table 8 Contd)

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(Table 8 Contd)

	ICDS education benefits	*ICDS food benefits*
Sex		
Male	21.0	38.8
Female	19.6	39.2
Child age category		
< 12 months	9.3	31.1
13–24 months	16.7	40.9
25–36 months	24.5	40.4
37–48 months	30.0	44.2
49–60 months	33.2	43.8

Source: Authors' calculations.

Table 9 shows results from propensity score matching for children who received pre-school education (and hot meals) with those who did not. Table 10 performs similar analysis for the use of supplementary nutrition program. The results show that both of these interventions are associated with higher weight-for-age and lower underweight for participants. These differences are statistically significant in one-tail test at 0.05 level in some of the regressions. Participation in pre-school program is associated with lower probability of being underweight in matched samples; participation in food supplementation program improves the z score of weight-for-height and reduces moderate underweight but not severe underweight.

Before matching, the sample children who do not receive pre-school or food supplementation are more likely to have lower z score and higher

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TABLE 9. Comparison of Weight-for-Age and Underweight for ICDS Educational Service Users and Non-Users

	ICDS educational program users	*Non-users*	*Difference*	*S.E.*	*T-stat*
Z score for weight-for-age					
Unmatched	–1.558	–1.397	–0.161	0.044	–3.70
Matched	–1.527	–1.601	0.074	0.057	1.31
Moderate underweight (< 2 SD)					
Unmatched	0.385	0.341	0.044	0.013	3.31
Matched	0.376	0.398	–0.022	0.018	–1.23
Severe underweight (< 3 SD)					
Unmatched	0.147	0.138	0.009	0.010	0.98
Matched	0.147	0.171	–0.024	0.013	–1.84
Unmatched children 0–60 months	1,631	6,233			
Matched children	1,514	1,514			

Source: Authors' calculations.

TABLE 10. Comparison of Weight-for-Age and Underweight for ICDS Supplemental Food Service Users and Non-Users

	ICDS food supplement users	*Non-users*	*Difference*	*S.E.*	*T-stat*
Z score for weight-for-age					
Unmatched	–1.564	–1.347	–0.218	0.036	–6.01
Matched	–1.510	–1.425	–0.085	0.047	–1.81
Moderate underweight (< 2 SD)					
Unmatched	0.388	0.326	0.062	0.011	5.66
Matched	0.376	0.352	0.024	0.014	1.72
Severe underweight (< 3 SD)					
Unmatched	0.145	0.136	0.009	0.008	1.10
Matched	0.144	0.152	–0.007	0.010	–0.71
Unmatched children 0–60 months	3,078	4,788			
Matched children	2,295	2,295			

Source: Authors' calculations.

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proportion are underweight. But in the matched sample, the pre-school education group has higher z score and lower likelihood of being underweight. This difference is greatest for severe underweight (<3 SD) making it statistically significant. Since some of the most disadvantaged cases in the ICDS sample were not matched by an appropriate control (as seen by improved weight for the matched treatment sample vis-à-vis unmatched treatment sample), this may play a role but this selection bias is less important than the fact that matched non-users are substantially different from unmatched non-users.

Although these two components ICDS seem to be useful in reducing the prevalence of severe undernutrition, their reach remains limited. Only 20 percent of all children under five and 30 percent of children between three and five years of age avail of it. This observation is in keeping with the process evaluations of ICDS program which appear to range from cautiously optimistic to negative (Agnihotri 2014, Saxena 2014, and The Planning Commission 2011). Part of this ambivalence lies in the fact that Anganwadis function well in some states and not in others. Use of ICDS services has grown substantially between 2004–05 and 2011–12. The IHDS-I found only 22 percent of the women took any advantage of ICDS services for their last birth; this proportion has grown to 54 percent after universalization. However, when we look at the details of the services provided, they seem to be quite limited. For the last child born (within the prior five years) among IHDS respondents, respondent report availing of ICDS services with the following frequency:

1. Percent of mothers who received any services (56 percent)
2. Percent of children who received any immunization from/via ICDS workers (47 percent)
3. Percent children who received any health check from Anganwadi (28 percent)
4. Percent children who receive any growth monitoring (38 percent)
5. Percent children who receive pre-school education (21 percent)
6. Percent children who receive take home food rations (39 percent ever, 14 percent in prior month)

Nutrition services—take home food ration and pre-school programs that provide hot meals—seem to have a particularly poor reach. This mismatch between program objectives and service coverage may be due to a variety of reasons. First, the Anganwadi worker faces tremendous demands on her time. A survey of Anganwadi workers notes that they spend as much time in record keeping and maintaining a register as they do in delivering pre-school education (The Planning Commission 2011), moreover they are responsible for helping out in a variety of other government programs that also place demands on their time (e.g., carry out Socioeconomic Census). Second, funds and supplies are sporadically received in some states. Spot surveys of Anganwadis by NCAER on behalf of the Planning Commission note delays in receipt of funds to purchase take home rations, mismatch between funds and prevailing local prices, lack of utensils, absence of helpers (The Planning Commission 2011), and a host of other management and process-related challenges that limit effective functioning of ICDS programs.

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10. The NFSA: An Axe or a Scalpel

The results presented previously suggest two things: (a) Access to PDS in the five years prior to the IHDS-II survey does not seem to be associated with better nutritional outcomes for children; and (b) Access to educational programs and associated meals for pre-school children is associated with somewhat lower undernutrition, although the reach of these programs is far from universal.

These are sobering observations since PDS and ICDS form the backbone of NFSA. ICDS is already supposed to be universal and NFSA adds specific details regarding its scope and functioning but does not demand major overhaul. The coverage of PDS is expanded substantially and is expected to cover at least 67 percent of the population.

Research on targeting shows that past efforts at targeting PDS and other programs have been rife with errors of inclusion and exclusion (Dreze and Khera 2010, Sahu and Mahamallik 2011) and hence, expansion of the target population may do a better job of catching the excluded poor. A number of studies have noted the importance of PDS in reducing poverty by effectively increasing consumption expenditure (Dreze and Khera 2013, Himanshu and Sen 2013). Both of these are plausible arguments in favor of expansion of the target population, or even universalization of benefits. However persuasive these arguments are, they may not be a solution to nutrition challenge given the relationship between a cereal-focused PDS system and decrease in dietary diversity we have observed previously.

What about transforming foods subsidies into cash transfers? NFSA allows for this possibility and this is something that has gained considerable currency following some of the Latin American experiments. A recent experiment with unconditional cash transfers by SEWA and UNICEF suggests substantial nutritional improvements for households receiving cash transfers (Sewa Bharat 2013); another study by SEWA also notes a great preference on the part of households for receiving cash rather than in-kind benefits (Sewa Bharat 2009). Unfortunately, these studies do not present data on changes in household consumption basket for the same households following cash transfers. Without conducting more research into changes in household consumption basket with income growth, we remain cautious about this potential solution, particularly since income elasticity for decline in malnutrition is only about 0.5 (Haddad et al. 2003).

There are a number of reasons for the modest correlation between income growth and nutritional improvements. First, as we discussed previously, caloric availability at a household level may not be the primary bottleneck at the present level of economic development in India. Indeed, a large number of children suffering from undernourishment live in households where adults have sufficient calories available to them (National Nutrition Monitoring Bureau 2012). Second, improvement in nutrition requires reduction in diseases and studies show that a substantial proportion of positive impact of income on nutrition actually comes from improvement in infrastructure (Alderman 2005); however, infrastructure access depends on both household income and supply of services such as water and sewage connections (Desai et al. 2010). Consequently, higher income does not always translate into better nutrition.

Increasing pessimism about nutritional consequences of both conditional and unconditional cash transfer programs gives us food for thought.

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Conditional cash transfer programs have been implemented in many parts of the world but most of the empirical evidence comes from Latin America. These programs assumed that transfers given to women will lead to greater investments in child-related consumption and thereby reduce undernutrition. Unconditional cash transfers are more popular outside of Latin America. However, a recent review notes that both conditional and unconditional transfers have only a modest impact on undernutrition. Ruel and Alderman (2013, p. 542) note that, "A forest plot analysis of 15 programs, combining conditional cash transfers and unconditional cash transfers, shows an average effect of 0·04 in height-for-age z score, an effect size that is neither statistically significant nor biologically meaningful; similarly, no significant effect was identified for conditional cash transfers only."

11. Outcome Focused Nutrition Strategy

Advocacy for food security in India has focused on the process of ensuring hunger elimination. Given the inadequacy of this approach as discussed earlier, what are the alternatives that we should consider? In Figure 4, we describe a tiered approach to this issue that focuses on improvement in nutritional status as the ultimate outcome.

11.1. Focus on Pregnant Mothers and Young Children

While undernutrition is a problem that afflicts the whole population, it is far easier to tackle in vitro and before age two than at a later stage (Alderman 2012). Thus, focusing on pregnant women and young children is the first step towards developing an effective nutrition strategy.

11.2. Identify the Undernourished

Undernutrition is a stealth enemy, particularly during childhood. Parents often do not realize that their children are undernourished until they suffer from severe malnutrition. Thus identifying children and populations at risk is of utmost importance. Moreover, without accurate statistics on undernutrition, it is impossible to detect whether our strategies to combat undernutrition are working or not.

We need data at three levels:

1. At national and state levels, we need statistics on undernutrition—height-for-age and weight-for-age as well as hemoglobin

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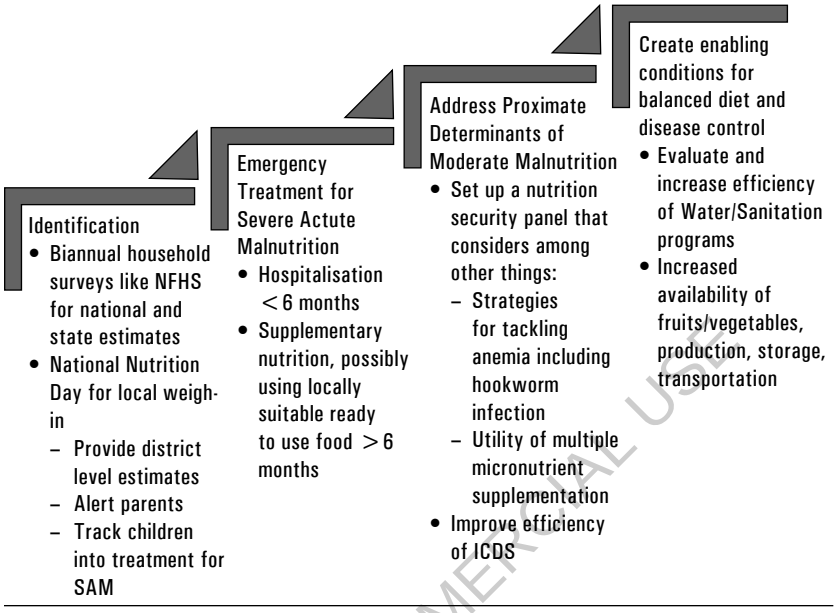
FIGURE 4. A Tiered Approach to Reducing Undernutrition



Source: Authors' creation.

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levels—coupled with information on program utilization and income to examine the effectiveness of our public policies. This must be done by a credible agency and with a strong government buy-in to be useful in policy design and evaluation. An NFHS-III like survey with some additional information in program utilization for about 120,000 children would provide good national and state level estimates. Government must make a commitment to ensure that this survey is conducted every two years. Burdening this survey with requirements to provide district level estimates may not be wise.

2. Collection of nutrition data at a district level to allow us to develop district-specific strategy for combating undernutrition and strategically prioritizing programs based on levels of undernutrition. Instead of engaging in a separate data collection, it would be possible to aggregate data in Step 3, to provide district level estimates.
3 Identifying individual children as being undernourished and degree of malnutrition so that the parents can be alerted and appropriate services can be provided. Like Polio days, setting aside two National Nutrition Days per year when every child below five is weighed and measured could be a way to empower parents with the required

information and to provide data for district-level planning. Linking these data to child's (or parents') Aadhar number can help organize a database when children's growth can be carefully monitored information can be provided to parents. A focus on awareness campaign that helps parents identify undernutrition in their children and strategies to address them could be extremely fruitful.

Evaluations of ICDS note that although the ICDS program is supposed to carry out growth monitoring, few Anganwadi workers have appropriate charts or training in undertaking this effort. A national campaign where children suffering from undernutrition can be identified and tracked into appropriate remedial programs will be very useful. It will be easy to set up a system for weighing and measuring at central locations like panchayat bhawan and railway stations and if coupled with a small computer and printer, it will be feasible to provide parents with printout of their children's height and weight in relation to other children of the same age. While this will not be a representative sample, it will be useful for identifying districts as high, moderate or low malnutrition districts. These nutrition days could also be used to provide treatments like vitamin A supplementation, deworming, etc. However, we should refrain from overburdening them because a review of child health days by UNICEF notes that these days could be effective provided the number of interventions did not exceed five (UNICEF 2011).

11.3. Address Severe Acute Malnutrition Immediately

Children who are three or more standard deviation below the reference median on height-for-age or weight-for-age are defined as suffering from severe acute malnutrition (SAM). International standards suggest that treatment in an inpatient facility should be considered for these children; however, since nearly a fifth of the Indian children are classified in this category, the consensus statement by Indian Academy of Pediatricians suggests hospitalization for children under six months and home-based therapy with either locally prepared foods or ready to use therapeutic foods (RUTF) for older children (Dalwai et al. 2013).

RUTF is energy dense, micronutrient-enhanced pastes used in therapeutic feeding. These soft foods are a homogenous mix of lipid rich foods, typically made out of peanuts, oil, sugar, milk powder and vitamin, and mineral supplements. Since they are energy dense and do not require addition of

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water, they have a long shelf life and can be safely used. While RUTF have been strongly recommended by international organizations like WHO and UNICEF they have been highly controversial in India. UNICEF's program in Madhya Pradesh that used commercial RUTF preparations was under severe attack by the Right to Food Campaign for promoting commercial interests in spite of its success in reducing mortality and increasing weight for a significant proportion of the participants. Over time, emergence of locally made RUTF has calmed these troubled waters as has cautious endorsement by the Indian Academy of Pediatrics (Dalwai et al. 2013). Concerns with poor nutritional content of hot meals like khichri prepared in Anganwadi also suggests a need to look for alternatives. Our results suggest that Anganwadi pre-school education programs which generally serve hot cooked meals may also be associated with lower SAM, albeit the effect is relatively small. This suggests that developing clear guidelines for treating SAM is a priority for developing a workable nutrition policy.

11.4. Address Proximate Determinants of Moderate Malnutrition

Moderate undernutrition—children between 2 and 3 standard deviations below the reference median—form the bulk of the undernourished children in India. A number of current strategies are of relevance to this population. The ICDS program includes many of these on paper including food supplementation in ICDS centers, take home rations, Vitamin A, and Iron supplements.

However, the Anganwadi worker rarely has time to pay attention to things like provision of deworming and iron supplement tablets. Thus, restricting the program to ensure accountability and implementation of existing strategies could yield rich benefits. In particular, deworming to treat hookworm infection and provision of iron supplements should be done for all children regardless of whether they attend other Anganwadi programs. While few studies document the prevalence of hookworm infection in India, a trial carried out in New Delhi slums documents 69 percent children in pre-school programs suffered from anemia and 30 percent had worm infestation. Simultaneous treatment of worms and iron supplement improved weight-for-age z scores by 0.31, a large and significant impact (Bobonis et al. 2006).

As we discussed previously, lack of dietary diversity and faulty infant and young child feeding practices are also implicated in increased prevalence of undernutrition (Menon et al. 2015). Providing parents with information about their children's nutrition status through national nutrition days proposed above could be an important tool in directing parental attention to

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this issue. Moreover, micronutrient deficiencies can also be handled through food fortification.

Finally, improving nutrition of pregnant mothers as well as reducing anemia during pregnancy could help reduce low birthweight among babies (Bhutta et al. 2013). NFHS-III shows that 32 percent of the pregnant women suffered from moderate to severe anemia (International Institute for Population Sciences and Macro International 2007). Only 23 percent women took iron folic acid supplement for at least 90 days during their last pregnancy and only 4 percent took any treatment for worms. Since iron deficiency is associated with hookworm infection, it is difficult to eliminate anemia without treating intestinal parasites. Several other interventions for pregnant mothers are increasingly being recommended such as multiple micronutrient supplements (Bhutta et al. 2013) but their efficacy is not yet fully understood and more research is needed in this area. These are some of the topics that deserve attention as we begin to think about restructuring the ICDS program to make it more effective.

11.5. Create Enabling Conditions for Balanced Diet and Disease Control

As we move past the immediate concerns, creating an environment in which nutritional improvements become rooted requires attention to creating enabling conditions for balanced diet and disease control. While access to food through the PDS will play a role in increasing caloric availability, increasing access to fruits, vegetables, and milk is even more important in creating a balanced diet. Agricultural price stabilization in India has involved rapidly increasing procurement prices for wheat and rice but little attention has been directed towards increasing production of diverse food crops. Improving dietary diversity may require increased production, storage and marketing systems, and taming food price inflation.

While the national attention has been directed towards reducing open defecation, very little attention has been directed towards whether the sanitation programs build toilets that are actually sanitary and are associated with decreased disease prevalence. Most of the toilets constructed under Nirmal Bharat Abhiyan are single pit toilets and we know little about their construction quality and whether they are properly installed. Research on water treatment programs and health outcomes shows that in spite of treatment at the source, considerable contamination takes place as water moves from the treatment plant to the distribution points as well as within the household (Clasen Thomas et al. 2006). Thus, along with campaigns to

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increase acceptability of toilets, it is also important to study the effectiveness of the types of the toilets that are being constructed.

The previous discussion of policies to reduce undernutrition has focused on supplementary feeding of energy dense foods for severe malnutrition and increased dietary diversity for moderate malnutrition. Neither of these involve the central component of NFSA—provision of practically free cereals to 67 percent of the Indian population via PDS. We do not dispute that the new and expanded PDS will provide income supplementation to a large proportion of Indian households via food subsidies as argued by Himanshu and Sen (2013). However, this may not be effective in eliminating undernutrition. In contrast, if ICDS can be restructured and its governance structure can be improved, it could be an effective weapon against undernutrition.

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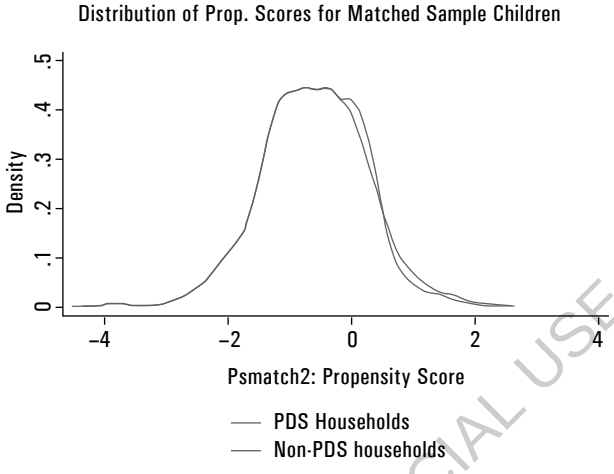
APPENDICES

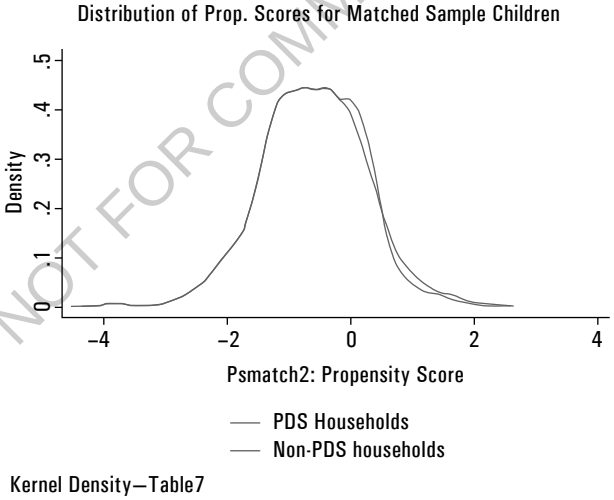
APPENDIX I. Conversion Factor for Adult Equivalence Scale

Completed years	*Male*	*Female*
< 1	0.43	0.43
1–3	0.54	0.54
4–6	0.72	0.72
7–9	0.87	0.87
10–12	1.03	0.93
13–15	0.97	0.80
16–19	1.02	0.75
20–39	1.00	1.71
40–49	0.95	0.68
50–59	0.90	0.64
60–69	0.80	0.51
70+	0,70	0.50

Source: National Sample Survey Report 513 2012, p. 13.

APPENDIX II. Distribution of Propensity Scores for Matched Sample Units





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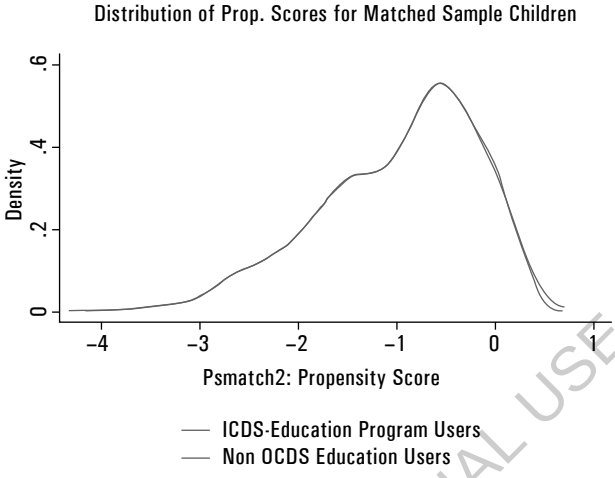
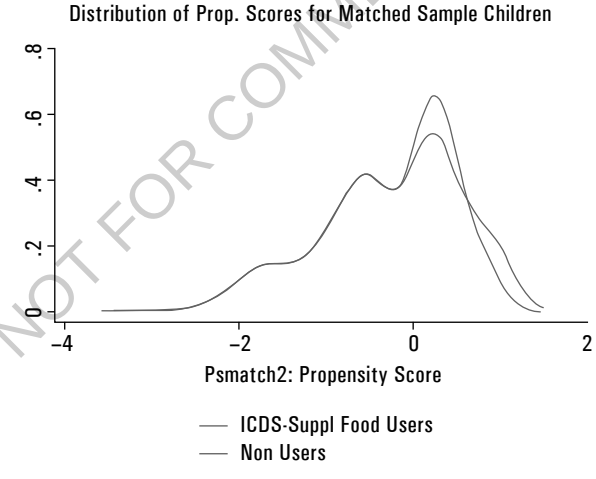


Kernel Density—Table 9



Kernel = epanechnikov, bandwidth = 0.1488

Source: Authors' calculations.

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Appendix III. Absence of Relationship between PDS and Nutrition: Real or a Statistical Artifact?

TABLE A3.1. Percentage of Children Under Age Five Years Classified as Malnourished According to Indices of Nutritional Status: Height-for-Age and Weight-for-Age, by State

	% Households using PDS			*% Children underweight*				
	NSS 2004–05	*NSS 2011–12*	*Percentage point improvement in PDS use*	*IHDS-I (2004–05)*	*IHDS-II (2011–12)*	*Percentage point decline in underweight*	*NFHS-3 (2005–06)*	*DLHS-4 (2012–13)*
Gujarat	25.5	22.7	**–2.8**	49.9	37.5	**12.4**	44.6	
Delhi	5.7	12.3	**6.6**	48.5	31.9	**16.6**	26.1	
Maharashtra	22.1	33.1	**11.0**	38.2	39.1	**–0.9**	37.0	38.7
Haryana	4.3	16.2	**11.9**	29.6	28.5	**1.0**	39.6	36.2
Karnataka	50	63.1	**13.1**	34.7	32.6	**2.2**	37.6	29.7
Tamil Nadu	72.7	87.1	**14.4**	32.5	29.7	**2.9**	29.8	32.5
Rajasthan	10.2	25.4	**15.2**	33.5	34.4	**–0.9**	39.9	
Madhya Pradesh	20.8	36.6	**15.8**	50.9	49.5	**1.4**	60.0	
Andhra Pradesh	58.5	76.1	**17.6**	33.4	40.1	**–6.7**	32.5	28.1
Punjab	0.5	19.8	**19.3**	20.1	21.4	**–1.3**	24.9	25.2
Uttar Pradesh	5.7	25.4	**19.7**	45.0	39.6	**5.4**	42.4	
Jharkhand	5.5	29.6	**24.1**	48.8	51.5	**–2.7**	56.5	
West Bengal	13.2	44.6	**31.4**	47.5	32.1	**15.4**	38.7	37.4
Chhattisgarh	24.2	57.5	**33.3**	27.6	38.7	**–11.1**	47.1	
Himachal Pradesh	51.6	89.5	**37.9**	28.4	26.6	**1.8**	36.5	28.5
Jammu & Kashmir	39.5	79.6	**40.1**	10.9	18.2	**–7.3**	25.6	
Bihar	1.9	42.7	**40.8**	54.8	41.4	**13.4**	55.9	
Kerala	39.7	81.9	**42.2**	24.5	23.2	**1.2**	22.9	20.9
Assam	8.4	52.7	**44.3**	50.3	46.6	**3.7**	36.4	
Orissa	18.6	63.3	**44.7**	44.0	39.3	**4.8**	40.7	
Uttarakhand	21.0	69.0	**48.0**	45.6	32.8	**12.8**	38.0	
All India	22.4	44.5	**22.1**	**41.9**	**37.4**	**4.5**	**42.5**	

Source: NFHS and DLHS-IV data from published reports; NSS PDS use data from Himanshu and Sen (2013), IHDS underweight, authors' calculations.

Note: IHDS state samples are very small and hence results should be treated with great caution. IHDS 1 sample for underweight is only 5.630 children ages 0–5 and IHDS 2 sample is 10555.

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Readers may be rightly concerned that the observed lack of improvement in nutrition in families who use the PDS and those who do not may be due to unobserved factors since PDS users are poorer than non-users. While we do our best to match households with and without access to PDS, our matching procedures could be imperfect. Underlying this uneasiness is a

fundamental puzzle; if undernutrition is due to hunger, how can access to subsidized cereals fail to reduce it?

However, judging by the historical experience of Indian states, this is precisely what seems to be happening. Growth in PDS usage seems to be unrelated to the decline in undernutrition. As NSS data document, the use of PDS expanded dramatically between 2004–05 and 2011–12 (Himanshu and Sen 2013), however, decline in undernutrition has been far more modest. Although nationwide undernutrition data from recent surveys are not yet available, Appendix Table 1 based on DLHS of 2012–13 and NFHS-III of 2005–06 for selected states shows that there is little relationship between growth of PDS use and decline in underweight. Underweight rate has hardly budged in Kerala and Tamil Nadu in spite of a massive expansion of PDS, while that in Karnataka has declined substantially in spite of a more modest improvement in PDS coverage. Beginning from nearly identical levels of undernutrition in 2005–06 and in spite of similar expansion in PDS use, Himachal Pradesh experienced substantial decline in underweight while West Bengal did not.

IHDS surveys provide national information but do not have very large samples at a state level. Nonetheless, IHDS results also do not show a great deal of relationship between state-level expansion of PDS coverage and decline in underweight. Nationally, PDS use with BPL/Antyodaya prices grew from 21 percent to 37 percent between the two waves while percent underweight declined only from 22 percent to 37 percent.

What can explain this lack of concordance? As this paper argues, access to PDS has a direct impact on availability of cereals but does not have a substantial positive impact on consumption of other food groups. Households do not seem to invest money saved in cereal purchase to improve their consumption of other micro-nutrient rich foods. In this Appendix, we present data on changes in food intake using a fixed effects regression using panel data from 2004–05 to 2011–12. This analysis holds unobserved household characteristics constant and controls for time varying factors such as PDS use, survey period, income, squared term for income, and household size.

The results in Appendix Table 3.2 shows that within this fixed-effects framework, PDS use with BPL/AAY card is associated with greater amount of cereal consumption—by about 840 grams/month per adult—but it does not substantially affect consumption of other items. Part of it may be because savings from consumption of subsidized cereals appear to be invested in other expenditures, possibly important expenditures like schooling and medical care but away from food. Holding constant income and household size, the share of food in total expenditure is lower by about two percentage points

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TABLE A3.2. Results from Household Level Fixed Effects Regressions for IHDS-I and IHDS-II Household Consumption Expenditure

Dependent Variable	*Coefficient*	*S.E.*	*T-Statistic*
Cereals per adult equiv (kg/mo)	0.841	0.080	10.48
Milk per adult equiv (ltr/mo)	–0.012	0.077	–0.15
Pulses per adult equiv (kg/mo)	0.030	0.023	1.3
Sugar/jaggery per adult equiv (kg/mo)	0.043	0.014	2.98
Share of food in total consumption	–0.025	0.002	–11.95

Source: Authors' calculations.

Note: Household level fixed effects regression for households surveyed in both rounds of the IHDS survey (N = 34643 in IHDS-I).

in PDS using households. It is important to note that food patterns and habits are slow to change and here we are comparing households with themselves at two points in time so should not expect to see very large effects.

But these two observations, changes and lack thereof in state-level undernutrition rates during an era of PDS expansion and household level changes reflected in cereal consumption with PDS use, suggest that we should be cautious about our expectation that increased cereal supply via PDS expansion would lead to substantial decline in undernutrition.

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Comments and Discussion

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Let me begin with two things. First, it is a great data. This is evident in the type of questions that the authors have put up in the beginning of the paper which suggest that those questions can be answered. This, in turn, means this dataset is rich and that, in itself, is of great service to everyone. Second, the study suggests some immediate policy directions and the paper then digs deeper into these issues. In particular, they try to connect the PDS with nutrition outcomes and opens up a discussion on cash transfers versus PDS. Having experimented with my colleagues on substituting cash for BPL cards, the discussion in the paper, on this subject, is of obvious interest to me (see Gangopadhyay et al. 2014).

An important finding at the end of this study, and something that corroborates what other researchers presented in an earlier NCAER conference on nutrition, is that there does not seem to be any direct correlation between income and nutrition. So, in some sense the lack of nutrition was not only restricted to poor households or not restricted in any systematic way to poor households. So, when we are talking about policy on nutrition: Is PDS the one to focus on?

The logic of the presentation in the paper seems to suggest that awareness campaigns and extension services could be very important for an effective nutrition policy. This cannot be a simple policy declaration but needs reaching out to individual households. The ICDS thus becomes the effective tool on which to focus.

The paper mentions three factors that may determine the levels of nutrition in a child—food intake, food diversity, and general health (morbidity due to lack of hygiene). The paper matches households who use the PDS with those that do not. Among other things, they use availability of toilets and piped drinking water (as proxies for hygiene) to match households and find that there is no statistically significant difference in the mean nutrition levels (as measured by underweight statistics) of those that use PDS and those that do not. However, they also find that the food diversity of non-PDS users is more than that of PDS users.

Given that much of PDS-use depends on the quality of service (timing of available supplies) this part could have been refined a bit by checking

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whether, or not, all those who use PDS exhaust their full quotas. In other words, are the nutritional outcomes different for those using their quotas versus those that are not. If PDS does help in nourishing children, one would expect some negative impact if households are unable to get their full quota or the desired supply. This becomes especially important to do because the authors do state that some BPL card holders do not use the ration shops.

A conclusion that I draw from the paper is that the PDS may be a very costly way (given the leakages and the costs of the Food Corporation of India) to be used as an instrument for tackling child malnutrition. One has to reach out more to households, may be through a greater focus on ICDS.

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Rinku Murgai

The World Bank

This paper focuses on the impacts of the PDS and ICDS programs on food consumption and child nutrition. Given the high levels of malnutrition in India (debates on measurement notwithstanding) and the amount of public resources devoted to these programs, the paper addresses important questions. By using the 2011–12 round of the India Human Development Survey, the authors bring new data to bear on these issues.

In summary, the paper examines the impact of PDS on the types of foods that households consume, focusing in particular on cereal consumption. It also assesses the impact of the programs on child nutrition. Taken at face value, the results show that PDS increases cereal and vegetable consumption, but reduces milk and sugar consumption. It decreases the diversity of food consumed in the household. By some measures—moderately undernourished, underweight households—child nutrition worsens. ICDS is found to reduce the incidence of severe malnutrition (underweight), suggesting that ICDS may hold promise. The sizes of the impacts are pretty small and PDS is having unintended negative effects and should be scaled down. Especially, the PDS results are provocative enough that it would be good to think little harder about the methodology before we go much further with them.

On methods, the first comment is on what we mean by PDS use because the empirical approach compares households that used PDS shops in the month preceding the survey and compares those to a matched sample of households that did not use PDS shops in the same time period. The validity and interpretation of PDS use as a measure of program access depends on the underlying model of why PDS would matter. For example, if the

existence of a PDS shop reduces the risk in access to grains, the appropriate indicator would be availability of a functioning shop as opposed to PDS use. Alternatively, the correct measure may be having a ration card if it in fact were the case that the only households that did draw from PDS shops were those that actually had a card. I do not know what the data say on that and it would be interesting to see more data on it. So, I think a little bit more on exploring what the right measure of PDS use is would be helpful.

Second, I would like to see more information on the matching procedure to find comparison samples for the programs. The matched sample is a very small sub-sample of PDS users which is worrisome. More generally, it would be useful to present results from the participation regression. Drawing on recent literature, that regression is missing potentially key variables such as birth order of the child, access to PDS shop, etc.

Third, my main question on the method is why the IHDS panel is not being used. The panel will allow corrections for selection on unobservables, and may also permit better understanding of impacts by examining entry or exit from the programs. Overall, much more can be done with the data itself to improve on both the Propensity Score Matching, carrying out robustness checks, and perhaps more credible ways of assessing impacts.

Moving from the results to policy is tricky as evaluations such as these only provide indications of whether or not a scheme works, if impacts are small/zero, we do not know whether it is because of design or implementation issues. To move towards policy, it is important to try to disentangle the two. Examining differences between states in program implementation and impacts may provide a fruitful line of enquiry.

It is important also to think about program design. NSS data show that for the vast majority of households, PDS transfers are infra-marginal. Therefore, the transfers should have an income effect but no substitution effect. Given this, impacts on dietary changes are hard to explain. There may well be some intra-household dynamics at play—e.g., women are more likely to have control over food allocation decisions if the transfers are in kind versus in income—that could explain the dietary impacts. But the evidence is slim, and such or other mechanisms need to be better understood to make a convincing case that the PDS has nutrition impacts.

Finally, in considering policy implications—the second half of this paper—it is useful to weigh the impacts of PDS and ICDS relative to other determinants. For instance, according to recent research poor sanitation is an overwhelmingly important factor explaining differences in child heights between African and Indian kids. What should policy focus on? What are the trade-offs?

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General Discussion

Abhijit Banerjee said that while Sonalde Desai was careful not to insist on causality, the results would be read as causal. So, it is very important to be quite careful in emphasizing the caveats. There is a dataset on malnutrition which was generated from106 districts—the Hungama dataset, by the Nandi Foundation, from which a correlation between there being a PDS shop in a village and the malnutrition rates shows up. Whether that is saying something about causality or about placement of the shops is debatable but it suggests that these shops are placed exactly for very good policy reasons in the places where they are more needed. This is a good reason to use a panel for this kind of analysis. More generally, it reinforces that suspicion that that the PDS is infra-marginal so it should not have any substitution effect. Virtually all studies show that income effects for milk are positive. He did not think that income effects could explain the findings, which could be the emerging from cross-sectional variations across households who accessed PDS.

Karthik Muralidharan thought that the cross-section defeats the purpose of a panel. What should be done is matching on the first round, identify comparable households, and then looking for changes over time either because there was change in access to PDS, the PDS shop opened up nearby or because there is change in access to a card. The initial sample did not have young children and that is why there are matching limitations later but even then, with a demographic pool of young households with women in peak fertility years, in this period of six or seven years should show a difference in fertility between the treatment and control samples. He reiterated that the negative correlation in the cross section was a big concern.

He also reinforced the point that evidence shows PDS grains being intra-marginal, which rules out a substitution effect explaining the findings. Beyond this, he felt that the cross section could be used to differentiate between households in terms of the various constraints they faced and how these influenced their use of PDS. This differentiation, he thought would help to determine whether PDS supplemented access to nutrition.

TN Srinivasan raised concerns that the connection between access to PDS and the nutrition measure, which is the weight-for-age, was tenuous. The PDS is largely for the purchase of cereals and the mechanism that links the purchase of grain to ultimate the weight for age of children within the household is not represented in any way in the econometrics. He was not sure that the exercise suggested by Karthik Muralidharan could be carried out with this dataset.

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He further questioned the nutrition measure itself. Weight-for-age was the consequence of past nutritional intake and may not be amenable to significant change through an intervention like improved PDS access. His final point was related to intra-household allocation of food. There is no way of directly policy intervening at the intra-household decisions if the intra-household allocation is distorted away from children to adults the weight-for-age of children is going to lead to a distorted conclusion.

Dilip Mookherjee reinforced the point that the effects of sanitation and disease can be studied from this dataset and this should be done. That seems to be an important policy question, rather than food or nutrient intake.

Rohini Somanathan suggested that states that have really expanded the PDS are also ones in which milk consumption is very low, which might explain the counterintuitive finding of the study. She also said that a scheme-by-scheme approach could be leading to the wrong conclusions, because it did not measure the entire nutrient intake of the child. What is really needed is to physically measure everything that the child eats and relate this to what schemes are on the ground and seeing whether it makes a difference at the right point in time to their height and weight. One of the nice things about a panel is that by matching households over earlier rounds, the anthropometrics and the food intake can be linked. Then, we might be able to see, e.g., whether they have a mid-day meal or not and impute some benefit to it.

She raised two issues relating on general equilibrium effects. One is competition: households that are not accessing PDS may be getting the same food items cheaper because there is competition from the PDS, which could lead to an underestimation of the effect of the PDS presence. The other thing, related to the point made earlier is all these other schemes coming into the village and their impact.

Sheela Bajaj emphasized that the quality of food, whether distributed through PDS or the Anganwadi scheme, or the mid-day meal, was a very important factor in providing nutritional security to the people who consume it. If this could be brought into the analysis, it could give useful insights for policy.

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