Generating Further Reductions of Child Malnutrition in India’s BIMARU States: What are the Options Now?

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Introduction

India's efforts to address malnutrition have been significant and noteworthy. India's Integrated Child Development Program (ICDS) is the largest child nutrition-related program in the world. The prevalence of malnutrition in India dropped more than 20% since 1960, contributing to significant decreases in infant and child mortality.\(^1\)

Despite these advances, child malnutrition continues to represent an enormous problem in India, and most particularly in four key states of the country which contribute over 40% of that malnutrition. This paper, drawing heavily on data collected from intensive efforts to upgrade nutrition services in these states, particularly in Bihar, considers the primary constraints inhibiting improved nutrition in these states, and examines means of addressing them.

Malnutrition in India

In 2005, a mere 10 years from the target date of the Millennium Development Goals, roughly half of India's children are still underweight.\(^2\) India, in fact, accounts for fully 40% of all the underweight children worldwide (although it encompasses fewer than 20% of the world's child population), representing the highest concentration of child underweight internationally. Despite the gains noted above, India continues to bear a formidable burden of malnutrition and its effects – increased burden of disease, compromised human development, and limited productivity – all of which hinder economic growth and perpetuate poverty.

The second target of the first Millennium Development Goal aims to halve the prevalence of underweight preschool children between 1990 and 2015.\(^3\) While India demonstrated an overall reduction in underweight of nearly 2% per year from the mid-1970s to
1990 (underweight dropped from 78% in 1977 to 54% in 1990), the rate fell to less than 1% per year in the 1990s. Assuming that underweight has dropped slightly below the 47% reported in 1999, the MDG target of 27.4% can only be met with annual reductions of more than 1%. In order to achieve this goal, however, India must address the complex dimensions of malnutrition with a particular focus on the most salient determinants, the neediest states, and the most vulnerable populations.

Malnutrition in India is characterized by pervasive protein-energy malnutrition as well as less recognized, but critically important and even more pervasive, micronutrient deficiencies. These further contribute to deleterious developmental effects of malnutrition, limiting intellectual, physical, and mental growth, often with irreversible consequences. Iodine deficiency is endemic in 85% of districts, 57% of preschool children experience sub-clinical vitamin A deficiency (the highest prevalence of VAD in the world), and three quarters of all children suffer from anemia (greater prevalence than both Bangladesh and Pakistan).

Despite steady economic growth, sufficient national food production, adequate water supply, and a long-standing national child development program (ICDS), India experiences higher rates of underweight as well as slower progress in reducing child malnutrition than countries with similar growth and socioeconomic and geographical characteristics. India’s prevalence of underweight and wasting is nearly double that of sub-Saharan Africa, and prevalence of stunting is also markedly higher.

This phenomenon, known as the “Asian Enigma,” (from a classic article by Ramalingaswami, Rohde and Jonsson), but more accurately the “South Asian Enigma,” ascribes the regional anomaly – higher malnutrition prevalence in South Asia than in sub-Saharan Africa – to other underlying factors. Three explanations have emerged from this discussion. The first, citing low birth weight (less than 2.5 kgs) as the single best predictor of undernutrition, notes that LBW prevalence in India, estimated at 30% (a figure which has remained fairly constant over the past 25 years), is roughly twice that of sub-Saharan Africa. Second, poor hygiene and
sanitation, associated with high population density, contribute to infections that accelerate undernutrition. Finally, the status of women plays a critical role in child malnutrition. Low status and limited decision-making power for women appears to have a more deleterious effect on nutritional outcomes in India than in Africa. That is to say, “the particular ways in which women in South Asia are disempowered cuts to the heart of their ability to nurture their children.”

Not included in the original article, but also a likely explanation for some of the differences seen in nutritional status between South Asia and sub-Saharan Africa are micronutrient deficiencies. For example, nearly 70% of children under-5 in India suffer from vitamin A deficiency compared to 40% in Sub-Saharan Africa.

The BIMARU States

In addition to entrenched conditions which perpetuate malnutrition, significant and growing inequalities within India, across regional and socioeconomic groups, further exacerbate the situation and inhibit substantial reductions in malnutrition. The prevalence of underweight is particularly high in the northern states of Bihar, Madhya Pradesh, Uttar Pradesh, and Rajasthan, known by the acronym, BIMARU. Heavily populated and characterized by strikingly high malnutrition rates, these states together account for 43% of all underweight children in India. (Interestingly a high proportion of that malnutrition is concentrated in a select number of districts.) The only other state with more than 50% of its children underweight is Orissa. Moreover, in these high prevalence states underweight is falling more slowly than in better developed, low prevalence states. In addition to disparities in overall prevalence of underweight, children in BIMARU states suffer disproportionately from anemia and girls demonstrate declining nutritional status compared to boys. Economic status is also a factor in underweight prevalence.
The BIMARU states lag behind the rest of India in a broad range of social indicators (see Table 1). All have significantly higher infant and under-5 mortality rates (up to double the rates of Indian averages). Life expectancy and literacy and immunization rates are lower as is access to sanitary facilities and medical services. Infant feeding practices are the poorest in India. Apropos of the “South Asian Enigma” discussion above, women in the BIMARU states are consistently less involved in decisions regarding their own health care than is the case in India as a whole. Given these broad-ranging disparities in development and resources (both human and infrastructural), the high rates of malnutrition in the BIMARU states are not surprising.

*The Punjab Analogy*

It is interesting to note that malnutrition rates and some of the underlying determinants of malnutrition in rural Punjab in 1971 (in areas not yet affected by the Green Revolution) are remarkably similar to those in present day Bihar – and in some cases worse. The prevalence of underweight was similar – roughly 60% compared with 54% in Bihar. Maternal literacy in Punjab was 22.6% compared with roughly 30% in Bihar. Complementary food for infants in Punjab was introduced on average at 10.6 months, compared with 9 months in Bihar. And immunization rates and safe water supply were at least as low and sporadic as the BIMARU states today. Additionally, Punjab in 1971 faced gender discrimination far worse than that experienced today in the BIMARU states (87.5% of severely malnourished children aged 6-24 months were girls).

Thirty years later, following a period of rapid and participatory economic growth (with both landed and landless households more than doubling real income), and with broad-based and effective health and education services, malnutrition in Punjab fell to 14.9% – with malnutrition among girls falling from 68.6% to 17.5%. The combined effect of real income and service delivery gains over the 30 year period led to a nearly four-fold increase in maternal literacy (now 84.8%), a virtual disappearance of superstition-based understanding of the source
of malnutrition,\textsuperscript{17} and a mean age of introduction of complementary food of 7.2 months (down from 10.6 months).\textsuperscript{18}

Economic gains comparable to those achieved in Punjab are unlikely in the BIMARU states (even the most optimistic estimates of economic growth in these states would be inadequate to permit substantial nutritional gains\textsuperscript{19}). However, the challenge posed by these improvements in Punjab is finding that combination of programmatic interventions not significantly dependent on improved socio-economic status, which is, nonetheless, capable of reducing malnutrition significantly, even if not quite as radically. With evidence that even without rapid economic growth, major increases are possible in maternal literacy, immunization coverage, and safe water supply as well as in such practices as timely introduction of complementary food, prospects for reducing malnutrition in the BIMARU states may be more promising than sometimes assumed.

\textit{The ICDS Program}

Underlying all nutrition programming is India’s flagship child development and nutrition intervention, the Integrated Child Development Services (ICDS). While ICDS has achieved considerable geographical coverage over its 30 year lifespan (in 2004, 93% of their own targeted areas had operational ICDS presence\textsuperscript{20}), still less than half of India’s child population is covered.\textsuperscript{21} Given its limited coverage, the ICDS impact on child malnutrition, particularly in the high prevalence states, has been disappointing.

This underperformance can be attributed to a fundamental mismatch between the causes of undernutrition and ICDS response. The most egregious design flaw is the inadequate focus on children age 0-3, the critical “window of opportunity,” when nutritional stunting can be prevented, and the period during which malnutrition takes its greatest toll on cognitive as well as physical development. Additionally, ICDS places little attention on sanitation, an integral factor in the interplay between disease and malnutrition. Finally, ICDS has neglected care and feeding
practices which have been found to be more important determinants of malnutrition in India than food scarcity. 22

Although ICDS has been criticized for its considerable expenditure on food supplements, these criticisms inadequately take into account the often important role of these supplements in attracting food-insecure families to the program in the first place. The more serious issues may be the targeting of that food (at present most goes to older pre-school children rather than under-twos and pregnant women) and its micronutrient content.

Although ICDS is national in scope, its coverage and support is uneven, often to the disadvantage of the poorest states. Expenditure on ICDS in the BIMARU states is only 30-50 Rupees per child compared to an average of 200 Rupees nationwide, and population coverage is lower. 23 Coverage rates in the BIMARU states have increased more rapidly during the 1990s. 24 The primary challenge in these critical states at present is to ensure improved quality while continued expansion takes place.

For ICDS to resolve its programmatic mismatches and address the lacunae in its philosophy and coverage, it must embrace the latest thinking in nutrition and update its practices accordingly. This involves stressing interventions that directly address the most significant determinants of malnutrition and concentrate on the neediest areas (especially the worst-off districts within them) and the most vulnerable populations.

*Malnutrition-focused Overlays to ICDS*

In an effort to do just that – to focus increased attention within ICDS programs on women and children in the first three years of life – the Government of India and several state governments, with the assistance of UNICEF and CARE, have been introducing programmatic “overlays” onto ICDS in portions of Bihar, Jharkhand, Madhya Pradesh, West Bengal, and Rajasthan. These “first generation” efforts have been based on a universal understanding that
early initiation of breastfeeding and provision of colostrum, exclusive breastfeeding for six
months, and prolonged breastfeeding, plus the timely introduction of adequate complementary
food (at six months), will significantly improve child survival, reduce child morbidity, and
decrease early childhood malnutrition.

Seeking to promote this agenda through improved delivery systems and community
participation, these programs have made highly valuable contributions over the past five years.
Effective mechanisms and service delivery models have been created, most notably
neighborhood-based volunteers or “Local Resource Groups,” LRGs, in the Dular program in
Bihar and Jharkhand, the involvement of panchayats in West Bengal, the state funding of an
additional AWC worker in Rajasthan, the implementation of growth monitoring for under-twos
in Madhya Pradesh and West Bengal, and the utilization of positive deviance in West Bengal and
Orissa. With these structures in place, some important behavioral change has taken place, most
significantly relating to practices in the first hours and days of life, and in particular hygiene
practices. (In Jharkhand, Dular mothers are 83% more likely to give colostrum to their newborns
than in regular ICDS.)

These initiatives have had significant effects. In Jharkhand, after three years of program
operation, the prevalence of severe underweight in Dular areas is roughly half that in regular
ICDS. In Bihar, the prevalence of underweight among Dular children is now 10 percentage
points lower than in regular ICDS, the prevalence of severe underweight fell by over a third in a
single year, and the prevalence of wasting among young Dular children is less than two-thirds
that of children in the normal ICDS program. Clearly the combination of (1) better managed
programs with motivated volunteers assisting better-trained AWWs and (2) effective counseling,
addressing at least some key aspects of priority nutrition-related messages, has had significant
nutritional impact.

At the same time, the malnutrition problem – even in these upgraded programs –
continues to be unacceptably high. Even in Dular areas in Bihar, fully 55% of children 12-36
months are underweight, while a disturbingly high 67% are stunted. This paper is an attempt to consider what might be called “second generation” inputs into ICDS in an effort to boost that program’s effectiveness in reducing malnutrition (and, in the process, reducing infant and under-5 mortality). Selection of these second generation interventions becomes particularly important at the present time, as a significant geographical expansion of ICDS is likely in presently underserved BIMARU states with World Bank assistance.

Conceptual Issues

In thinking through “second generation” inputs, several conceptual issues should be addressed. The first of these is the balance between rehabilitative and preventive approaches to reducing malnutrition. The approach utilized in some ICDS programs in West Bengal and Orissa and which draws on positive deviance techniques, seeks initially to identify children with severe malnutrition and provide them with food supplementation plus intensive daily counseling to mothers for relatively short periods of time. Similar attention then is given later on to moderately malnourished children. These “NERP” (nutrition education and rehabilitation program) sessions are often successful in reducing, sometimes dramatically, the prevalence of malnutrition although evidence on sustainability is mixed. This approach is consistent with thinking among some in ICDS that efforts should first be addressed to severely malnourished children, after which other children can be considered. It is also consistent with training practices common in India which give priority to children whose growth falls “below the solid line” on the growth chart.

The alternative approach, pursued in Dular, is the “preventive” approach which provides counseling to all households with reproductive age women and young children, and which initiates attention to infants in the earliest months in an effort to prevent malnutrition from occurring. The preventive approach, when coupled with growth monitoring, also permits the identification of “growth falterers,” whose problems are easier and less expensive to correct at that point than later, when they become severely malnourished.
Examination of the short and long term impact of these approaches in India will be useful in arriving at a second generation strategy.

A second conceptual issue is the degree to which BCC in such programs should concentrate on exclusive breastfeeding as formally defined (i.e. nothing but breastmilk for six months). As indicated in the Appendix, the benefits of exclusive breastfeeding cannot be denied, particularly in cases where its absence usually involves the feeding of water, which is so often contaminated. At the same time, qualitative data collected in the Dular program indicates that such patterns are deeply entrenched, and that even with intensive counseling, Dular has failed to bring about pure exclusive breastfeeding on any appreciable scale.

If this is the case, it may be useful to distinguish among (a) those households which provide complementary food too early, (b) those which provide it too late, and (c) those which introduce such food in timely fashion but provide water to their children along with breast milk in the early months. Of the three patterns, the first two are likely to be most deleterious. If so, the primary emphasis in counseling might be placed on changing these two patterns while also discouraging the provision of other milk, stressing the importance of boiling all water given to infants, and providing ORS to infants experiencing diarrhea.

Process of Selecting “Second Generation” Inputs into ICDS

In addition to the need for a sharper targeting of interventions in BIMARU states to the neediest districts, as indicated above, part of the second generation approach involves consolidation of those approaches which have worked well in the existing state-level intensified programs in north India – suggesting that cultural acceptability is not likely to be at issue. This means an expansion of the LRG volunteer model into ICDS programs elsewhere, the broader inclusion of growth monitoring and follow-up in such programs, and intensive attention to
colostrum feeding and immediate breastfeeding. (Some of the research support for the second
generation initiatives discussed in this paper is summarized in the Appendix.)

In considering second generation interventions in Dular-type programs, and in BIMARU
states more generally, this paper utilizes three primary sources of information: (1) a
UNICEF/India effort to translate to the India context the Lancet articles on the effects of
alternative interventions in reducing child mortality (referred to hereafter as “UNICEF
Lancet”),27 (2) the 2004 World Bank publication, “Attaining the Millennium Goals in India,”
and specifically those sections pertaining to means of reducing malnutrition (referred to as “Bank
Millennium”),28 and (3) tables 2 to 9 created for this paper.
These tables are based on a survey conducted among “Dular” and control households in July 2005. The households were selected randomly, and anthropometric as well as other nutrition-related and socio-economic information was collected. Details on the survey are provided elsewhere. The Tables indicate the “positive deviance” characteristics of Bihar households, comparing the “positive deviant” children having “normal” nutritional status with households having mildly, moderately or severely malnourished children. Most of these tables have three columns. The first uses the entire sample of children in Bihar (both Dular and regular ICDS). The second looks only at the poorest 50% of households (still both Dular and regular ICDS to permit larger sample size), utilizing as an indicator of economic status a combination of size of landholding and participation in agricultural or other non-formal labor by the head of household. The third column, arguably the most important, looks at the poorest 50% of households only in Dular-assisted areas. This third column, in other words, asks, “What is it that households have been able to do, despite low income but with intensified programmatic assistance, that has resulted in healthy growth and hence ‘normal’ nutritional status?”

A brief summary of these tables: When looking at the Bihar population as a whole, there are several positive deviance characteristics that are income or class dependent. These are summarized in Table 2. Households with “normal” children own nearly five times more land than households with “severes,” are twice as likely to have electricity, are half as likely to live in a poorest quality dwelling, are 60% more likely to have a hand pump, are 3.5 times more likely to have a private toilet, and are 50% less likely to be scheduled caste or scheduled tribe.

Recognizing the dependence of these advantages on income, the more important analysis (tables 3-8) considers positive deviant characteristics much less dependent on resources, and also examines the positive deviant characteristics of poorer households.

These tables indicate that for each of the groupings, children found to be “normal” have had complementary food introduced earlier, have moms who are more likely to use soap after
exposure to feces, have cleaner nails, hands, and mouths, have less diarrhea, and have moms who are more likely to be literate. When total households (column 1) are considered, the feeding of colostrum also emerges as a PD characteristic. Meanwhile, children in Dular households that had contact with an LRG in the course of a month were more likely to be normal than those without contact.

*Proposed Second Generation Inputs into ICDS*

Based on these sources and the studies listed in the Appendix, the following interventions appear particularly attractive for consideration as “second generation” interventions:

1. **Intensification of successful “first generation” interventions**

   The success of *early breastfeeding-related interventions* (including the feeding of colostrum in the Dular program) in facilitating a significant reduction in severe malnutrition suggests that these interventions should be replicated more broadly in ICDS programs in the BIMARU states. Additionally, “UNICEF Lancet” ranks these interventions first in terms of their potential effect in preventing under-5 mortality, finding a potential 15% reduction in mortality from these interventions (see discussion of exclusive breastfeeding under “Conceptual Issues” above). The expansion of *growth monitoring for children 6 – 24 months*, successfully utilized in the MP, Maharashtra and West Bengal ICDS overlays, and, in fact already an accepted, if underpracticed, activity of ICDS, would permit cadres such as the LRG volunteers in Bihar to identify young children at greatest risk (severes and growth falterers) for intensive follow-up. Additionally, in Maharashtra, a sharp re-orientation of AWW priorities to include the weighing of under-twos and counseling on feeding and other care behaviors in eight districts has resulted in significant reductions in the prevalence of moderate and severe malnutrition.
2. **Micronutrients**

The “Copenhagen Consensus” exercise, designed to set priorities among a series of proposals to confront major global challenges (among them communicable disease control and reduced hunger and malnutrition), identified micronutrient interventions as second only to those addressing HIV/AIDS. Similarly, in the “UNICEF Lancet” exercise, both vitamin A and zinc supplementation rank high in their potential effects on under-five mortality. ICDS, at extremely low cost and with little additional effort on the part of AWWs, could further strengthen VAC supplementation for young children, facilitate the provision of iron/folate (and perhaps eventually multi-micronutrient) supplements for pregnant women, and deliver a “Sprinkles”-like supplement for young children.

Sprinkles, which permits the addition of essential micronutrients to home-prepared complementary food, is now sufficiently inexpensive that it can be provided free to parents of under-two children at a tiny percentage of total ICDS food costs. (As few as 60 packets per child per year may be adequate to protect against the primary micronutrient deficiencies.)

3. **Timely introduction of adequate complementary food**

This intervention, one of the top four cited in “UNICEF Lancet” as a means of reducing child mortality (with a potential reduction potential of 4% a year) and an important practice associated with improved nutritional status in Punjab, was also a primary PD practice of poor households with normal children in Dular areas. As indicated in Table 5, Column 3, normal children from poor Dular households received complementary food at 7.18 months, as opposed to 9.27 for poor households with severely malnourished children, and compared with 9.04 months for Dular children as a whole.

An important issue to be resolved is whether messages relating to the timely introduction of complementary food should include a primary stress on the qualitative adequacy of this food, or, if a Sprinkles-type product is to be introduced in ICDS projects, messages in the short run
can concentrate instead on timeliness and amount of food to be given. In addition to getting valuable micronutrients to huge numbers of at-risk Indian children, the very availability of these Sprinkles might have the effect of increasing the timely introduction of complementary foods per se (i.e. with the foods perceived as a vehicle for getting these valuable ingredients to the infants). Additionally, because most young children are fed from the mother’s plate, the provision of a small bowl for the child’s food could facilitate the use of Sprinkles and the introduction of complementary food in general. At a minimum, Sprinkles-type products may be able to “buy time” while messages which focus initially on quantity and energy shift over time to diversity and quality.

4. Improving Pregnancy Outcomes and Birthweights

The “Bank Millenium” report indicates that children under the age of 3 are nearly twice as likely to be malnourished if the child’s birthweight was <2500 gms as opposed to those with birthweights >3000 gms. As indicated in the Appendix, the potential of pregnancy-related interventions to increase birthweight relates importantly to the pre-pregnancy status of the mother and to her energy intake. (This is demonstrated most dramatically in cited data from the Gambia and from Bangladesh.) The finding has relevance for efforts to improve child nutrition (significantly affected by birthweights) in the BIMARU states where both maternal nutritional status and pregnancy intakes are particularly low.

In Bihar, just under 40% of reproductive age women have BMIs <18.5. Data from the Bangladesh Integrated Nutrition Project (BINP) with comparable BMI figures, found that the supplementation of these women (who also had significantly lower SES than higher BMI women) resulted in greater pregnancy weight gains and birthweights than higher BMI unsupplemented women. Additionally, recognizing that supplementation has its greatest effects in pre-harvest “hunger” seasons, operations research might usefully be undertaken on the effectiveness of seasonal food supplementation through ICDS for low BMI women in BIMARU.
states (comparable to efforts to assure ORS availability during the rainy season with higher diarrhea prevalence). Operations research carried out as part of BINP found that given the common practice of “eating down” during pregnancy, food supplements provided to eligible women generally were additive to food consumed at home rather than substituting for it.

Recognizing that pregnancy weight gain monitoring is often useful in identifying pregnant women at risk of delivering a low birthweight infant, there also might be value in adding pregnancy weight gain monitoring (with follow-up of women gaining less than 1 kg per month) to child growth monitoring. This is not at all an unmanageable task, given an estimated 12 women pregnant at any point in time in an AWC coverage area.

Additionally, recognizing (1) that birthweights from first pregnancies tend to be lower than average, and (2) that pregnancy outcomes are at least as dependent on pre-pregnancy nutritional status as on nutrition during pregnancy, attention to adolescent girls is not misplaced as an ICDS priority. In some areas, Kishori Shakti Yojana groups have been formed in which adolescent girls receive some combination of weekly iron-folate supplementation and deworming, health education, functional literacy, and vocational training.

Finally, it would be valuable to assess the effectiveness of pregnancy-related efforts by assessing birthweights on a regular basis. Recognizing the logistical difficulties of doing this in the near future through home visits with accurate weighing scales, it has been proposed that testing be carried out to determine the feasibility of measuring head circumference or other potentially attractive proxies for birthweight requiring only a tape measure.

5. **Sanitation and hygiene practices to reduce childhood diarrhea**

Sanitation has been identified by “Bank Millennium” as the intervention with the greatest potential to reduce underweight in the poorer states of India. This is not surprising recognizing that young children in BIMARU states have higher rates of diarrheal infection than children elsewhere in India, that children who have had experienced even one episode of diarrhea are
15% more likely to be malnourished, and that Indian children in households with access to a
toilet are 8.6% less likely to be underweight. Information presented in the Appendix underlines
the major effect of diarrhea on nutritional status noting that from one-fourth to one-third of
growth failure can be attributed to diarrheal infection with a portion of that growth failure
attributable to decreased energy intake during bouts of infection. (Qualitative data collected from
Dular areas suggests that most doctors counsel a reduction of feeding and a cessation of
breastfeeding during diarrhea.)

Despite the enormous proven value of ORS in preventing the dehydration associated
with diarrheal infection, ORS packets have not been regularly available through ICDS, even in
some of the intensified programs in BIMARU states. Data collected from the Dular program
indicates that home recipes for ORS generally deviate substantially from what should be
provided. ORS availability should be assured, particularly during the rainy season associated with
higher diarrhea prevalence.

Other evidence from Dular suggests that, even in the absence of sanitation infrastructure,
relevant counseling can make a difference. Although programs such as Dular have successfully
disseminated messages on the importance of washing with soap, particularly after defecation,
after contact with infant stools, and before food preparation, fewer than 20% of women in Dular
program areas utilize soap for these purposes. (In the absence of soap, the most common
cleansing material is mud which may well increase rather than decrease pathogen exposure.)
Table 7 Columns 7-9 indicate that the use of soap after exposure to feces is a major PD
characteristic among “normals” in poor Dular households. Other identified positive deviant
characteristics of poor Dular households are observed cleanliness of the nails, hands, and
mouths of young children (see Table 8c). The expense of soap is the most common explanation
for lack of use. Once again, the regular provision of soap to these households would represent a
tiny percentage of ICDS costs.
6. **Improved Female Education**

Although a “tier” removed in malnutrition causality, female education and literacy have a consistently major effect on the more immediate determinants of malnutrition, and on the improved practices indicated above. The “Bank Millennium” report cites maternal literacy as the largest potential contributor to reducing malnutrition in the poorer states. Maternal literacy also emerges as a major positive deviance characteristic of “normals” in poor Dular households, with maternal literacy in these households fully seven times higher than among the mothers of low income “severes” (see Table 9 Column 3).

**Conclusions**

This paper considers alternative “second generation” inputs designed to expedite the reduction of malnutrition among children under age 3 in BIMARU states. It documents the significant impact of “overlays” to ICDS in such states as Bihar and Jharkhand, resulting from enhanced delivery capacity with the use of neighborhood volunteers, and, utilizing these volunteers, bringing about important behavioral change. Despite these gains, however, malnutrition prevalence continues to be high, even in areas where such overlays are in place.

Using established sources as well as newly analyzed data from the Dular program in Bihar, the paper suggests that substantial further impact is possible (1) by replicating these outreach innovations with neighborhood volunteers throughout BIMARU states, (2) by replicating successful growth monitoring for under 3s and BCC relating to early breastfeeding practices, and (3) by providing intensive efforts to bring about important changes in factors contributing to malnutrition. Among these changes are (a) timely introduction of complementary food, (b) reinforced micronutrient supplementation efforts, (c) improved birthweights through attention to pregnant women, and (d) reduced diarrheal infection through improved sanitation and hygiene practices. These outcomes can be further strengthened by improved female education and maternal literacy.
UNICEF staff in New Delhi have made the astute observation that the longer term sustainability of programs like Dular may require something more tangible than simply good BCC. Beyond longer term efforts to improve counseling and community outreach, the data underscore the high priority which should be given to the ready availability of ORS (particularly in the rainy season) and the provision of soap and Sprinkles. These “tangibles” can both increase program sustainability and enhance the above-mentioned strategies.

The paper suggests that even without major income increases, programmatic action focusing on these activities can significantly reduce the prevalence of young child malnutrition in the BIMARU states.
### Table 1: Social Indicators for BIMARU States

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Bihar</th>
<th>MP</th>
<th>UP</th>
<th>Rajasthan</th>
<th>India</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant mortality (per 1000 live births)</td>
<td>72.9</td>
<td>86.1</td>
<td>86.7</td>
<td>80.4</td>
<td>63</td>
</tr>
<tr>
<td>Under 5 mortality (per 1000)</td>
<td>105.1</td>
<td>137.6</td>
<td>122.5</td>
<td>114.9</td>
<td>87</td>
</tr>
<tr>
<td>Children 0-36 mos. underweight for age (&lt;-2 SD)</td>
<td>54.4%</td>
<td>55.1%</td>
<td>51.7%</td>
<td>50.6%</td>
<td>47%</td>
</tr>
<tr>
<td>Children 0-36 mos. stunted for age (&lt;-2 SD)</td>
<td>53.7%</td>
<td>51%</td>
<td>55.5%</td>
<td>52%</td>
<td>45.5%</td>
</tr>
<tr>
<td>Children 0-36 mos. wasted for age (&lt;-2 SD)</td>
<td>21%</td>
<td>19.8%</td>
<td>11.1%</td>
<td>11.7%</td>
<td>15.5%</td>
</tr>
<tr>
<td>Children 12-35 mos. with all vaccinations</td>
<td>11%</td>
<td>22.4%</td>
<td>21.2%</td>
<td>17.3%</td>
<td>42%</td>
</tr>
<tr>
<td>Mothers receiving at least one antenatal checkup</td>
<td>36.3%</td>
<td>61%</td>
<td>34.6%</td>
<td>47.5%</td>
<td>65.4%</td>
</tr>
<tr>
<td>Women involved in decisions about their own healthcare</td>
<td>47.1%</td>
<td>36.6%</td>
<td>44.8%</td>
<td>40.6%</td>
<td>51.6%</td>
</tr>
<tr>
<td>Women illiterate</td>
<td>76.6%</td>
<td>68.5%</td>
<td>70.2%</td>
<td>75.5%</td>
<td>58.2%</td>
</tr>
<tr>
<td>Households with no latrine or toilet facilities</td>
<td>83.2%</td>
<td>77.8%</td>
<td>73.3%</td>
<td>71.8%</td>
<td>64%</td>
</tr>
<tr>
<td>Households with pucca house (brick or block)</td>
<td>15.5%</td>
<td>19.2%</td>
<td>24.8%</td>
<td>41.4%</td>
<td>32%</td>
</tr>
</tbody>
</table>

### Table 2: Income or Class-dependent PD Characteristics of Total HHs

<table>
<thead>
<tr>
<th>Malnutrition Level</th>
<th>Land holdings (in acres)</th>
<th>Poorest quality dwelling</th>
<th>Electricity in dwelling</th>
<th>Personal hand pump</th>
<th>Private Toilet</th>
<th>SC/ST</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>3.604</td>
<td>12.4%</td>
<td>25.4%</td>
<td>58.9%</td>
<td>34.5%</td>
<td>42.6%</td>
</tr>
<tr>
<td>Severe</td>
<td>0.749</td>
<td>24.6%</td>
<td>12.8%</td>
<td>35.3%</td>
<td>9.6%</td>
<td>63.0%</td>
</tr>
<tr>
<td>P Value</td>
<td>P&lt;.001</td>
<td>P=.002</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
</tr>
</tbody>
</table>

### Table 3: % Mothers who reported contact with the LRG's in previous month

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>All Dular HHs</th>
<th>Just Dular Poorest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>39.8%</td>
<td>40.6%</td>
</tr>
<tr>
<td>Mild</td>
<td>37.1%</td>
<td>33.3%</td>
</tr>
<tr>
<td>Moderate</td>
<td>38.4%</td>
<td>37.3%</td>
</tr>
<tr>
<td>Severe</td>
<td>31.5%</td>
<td>33.8%</td>
</tr>
<tr>
<td>P Value</td>
<td>P=.470</td>
<td>P=.853</td>
</tr>
</tbody>
</table>

### Table 4: % Women reporting Colostrum was given

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Total HH</th>
<th>Poorest 50% of HH</th>
<th>Poorest 50% of Dular HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>77.4%</td>
<td>66.7%</td>
<td>75.0%</td>
</tr>
<tr>
<td>Mild</td>
<td>77.6%</td>
<td>77.3%</td>
<td>88.0%</td>
</tr>
<tr>
<td>Moderate</td>
<td>72.2%</td>
<td>67.8%</td>
<td>80.4%</td>
</tr>
<tr>
<td>Severe</td>
<td>68.5%</td>
<td>67.9%</td>
<td>75.3%</td>
</tr>
<tr>
<td>P Value</td>
<td>P=.016</td>
<td>P=.136</td>
<td>P=.143</td>
</tr>
</tbody>
</table>
Table 5: Mean age solid foods were started (in months)

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Total HH</th>
<th>Poorest 50% of HH</th>
<th>Poorest 50% of Dular HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>8.92</td>
<td>8.91</td>
<td>*7.18</td>
</tr>
<tr>
<td>Mild</td>
<td>8.99</td>
<td>8.83</td>
<td>9.37</td>
</tr>
<tr>
<td>Moderate</td>
<td>9.04</td>
<td>9.03</td>
<td>8.95</td>
</tr>
<tr>
<td>Severe</td>
<td>9.33</td>
<td>9.32</td>
<td>9.27</td>
</tr>
<tr>
<td>P Value</td>
<td>P&lt;.001</td>
<td>P=.267</td>
<td>P=.179</td>
</tr>
</tbody>
</table>

*Although not statistically significant, it is of great practical importance.

Table 6: In the previous 2 weeks % children with reported diarrhea

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Total HH</th>
<th>Poorest 50% of HH</th>
<th>Poorest 50% of Dular HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>52.7%</td>
<td>56.8%</td>
<td>54.8%</td>
</tr>
<tr>
<td>Mild</td>
<td>60.9%</td>
<td>60.2%</td>
<td>59.8%</td>
</tr>
<tr>
<td>Moderate</td>
<td>63.4%</td>
<td>63.9%</td>
<td>63.6%</td>
</tr>
<tr>
<td>Severe</td>
<td>69.0%</td>
<td>69.8%</td>
<td>69.2%</td>
</tr>
<tr>
<td>P Value</td>
<td>P=.001</td>
<td>P=.131</td>
<td>P=.462</td>
</tr>
</tbody>
</table>

Table 7 % of Mothers who use soap to wash hands after defecation:

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>After she defecates</th>
<th>After Assists child to defecate</th>
<th>After Child Defecates</th>
<th>After she defecates</th>
<th>After Assists child to defecate</th>
<th>After Child Defecates</th>
<th>After she defecates</th>
<th>After Assists child to defecate</th>
<th>After Child Defecates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>44.0%</td>
<td>40.2%</td>
<td>32.0%</td>
<td>22.2%</td>
<td>22.2%</td>
<td>19.6%</td>
<td>25.0%</td>
<td>28.1%</td>
<td>25.9%</td>
</tr>
<tr>
<td>Mild</td>
<td>36.4%</td>
<td>36.7%</td>
<td>33.3%</td>
<td>16.5%</td>
<td>17.7%</td>
<td>12.7%</td>
<td>23.8%</td>
<td>25.0%</td>
<td>18.4%</td>
</tr>
<tr>
<td>Moderate</td>
<td>29.7%</td>
<td>28.7%</td>
<td>27.4%</td>
<td>14.5%</td>
<td>15.0%</td>
<td>14.0%</td>
<td>22.3%</td>
<td>21.4%</td>
<td>21.6%</td>
</tr>
<tr>
<td>Severe</td>
<td>16.4%</td>
<td>18.2%</td>
<td>16.2%</td>
<td>6.2%</td>
<td>6.6%</td>
<td>7.3%</td>
<td>11.8%</td>
<td>11.8%</td>
<td>15.7%</td>
</tr>
<tr>
<td>P Value</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
<td>P=.014</td>
<td>P=.032</td>
<td>P=.015</td>
<td>P=.202</td>
<td>P=.444</td>
<td>P=.603</td>
</tr>
</tbody>
</table>
Table 8a: Observed Information on Cleanliness of Child: % Clean in Total HH

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Nails</th>
<th>Hands</th>
<th>Mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>54.1%</td>
<td>80.9%</td>
<td>85.2%</td>
</tr>
<tr>
<td>Mild</td>
<td>40.1%</td>
<td>67.5%</td>
<td>74.8%</td>
</tr>
<tr>
<td>Moderate</td>
<td>33.9%</td>
<td>60.1%</td>
<td>68.3%</td>
</tr>
<tr>
<td>Severe</td>
<td>24.9%</td>
<td>44.3%</td>
<td>57.2%</td>
</tr>
<tr>
<td>P Value</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
</tr>
</tbody>
</table>

Table 8b: Observed Information on Cleanliness Child: % Clean in Poorest 50% of HH

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Nails</th>
<th>Hands</th>
<th>Mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>46.0%</td>
<td>65.1%</td>
<td>76.2%</td>
</tr>
<tr>
<td>Mild</td>
<td>31.3%</td>
<td>55.8%</td>
<td>63.8%</td>
</tr>
<tr>
<td>Moderate</td>
<td>25.8%</td>
<td>47.2%</td>
<td>57.7%</td>
</tr>
<tr>
<td>Severe</td>
<td>19.9%</td>
<td>36.4%</td>
<td>50.8%</td>
</tr>
<tr>
<td>P Value</td>
<td>P&lt;.001</td>
<td>P&lt;.001</td>
<td>P=.001</td>
</tr>
</tbody>
</table>

Table 8c: Observed Information on Cleanliness of Child: % Clean in Poorest 50% of Dular HH

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Nails</th>
<th>Hands</th>
<th>Mouth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>53.1%</td>
<td>71.9%</td>
<td>78.1%</td>
</tr>
<tr>
<td>Mild</td>
<td>32.5%</td>
<td>60.2%</td>
<td>65.1%</td>
</tr>
<tr>
<td>Moderate</td>
<td>34.0%</td>
<td>59.2%</td>
<td>65.0%</td>
</tr>
<tr>
<td>Severe</td>
<td>25.9%</td>
<td>37.6%</td>
<td>51.8%</td>
</tr>
<tr>
<td>P Value</td>
<td>P=.050</td>
<td>P=.001</td>
<td>P=.045</td>
</tr>
</tbody>
</table>

Table 9: Maternal Literacy

<table>
<thead>
<tr>
<th>Malnutrition level</th>
<th>Total HH</th>
<th>Poorest 50% of HH</th>
<th>Poorest 50% of Dular HH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>49.28%</td>
<td>20.34%</td>
<td>25.00%</td>
</tr>
<tr>
<td>Mild</td>
<td>37.50%</td>
<td>12.90%</td>
<td>20.24%</td>
</tr>
<tr>
<td>Moderate</td>
<td>29.86%</td>
<td>11.30%</td>
<td>16.50%</td>
</tr>
<tr>
<td>Severe</td>
<td>13.79%</td>
<td>5.04%</td>
<td>3.53%</td>
</tr>
<tr>
<td>P Value</td>
<td>P&lt;.001</td>
<td>P=.002</td>
<td>P=.003</td>
</tr>
</tbody>
</table>
Appendix: Research-based Justifications for Proposed “Second Generation” Initiatives from Selected Studies

Exclusive Breastfeeding:

Infants in Dhaka slums without the benefit of exclusive breastfeeding had a 2.23 fold higher risk of infant death, and 2.40 and 3.94 fold higher risk of death due to ARI and diarrheal infection respectively.37

In Belarus, prolonged and exclusively breastfed infants exhibited better weight gain than children not exclusively breastfed for the first three months of life, after which the difference declined slowly, disappearing by 12 months.38

Research in the Philippines found that exclusive breastfeeding and sanitation form a set of sequential barriers protecting infants from diarrheal pathogens. Exclusive breastfeeding is likely to be particularly important if sanitation is not in place. Even small amounts of contaminated water consumed by exclusively breastfed infants nearly doubles the risk of diarrhea.39

In poor populations in Honduras for infants with birthweights > 2500 gms, when breastfeeding is exclusive for 4-6 months, continues from 6 to 12 months, and is accompanied by generally adequate complementary foods, growth faltering does not occur before 9 months of age.40

In rural Haryana state, India, exclusive breastfeeding up to six months using existing primary health-care services led to significantly reduced diarrheal prevalence and did not precipitate growth faltering, with these results holding also for low birthweight infants.41

Because resistance to exclusive breastfeeding is considerable in many developing areas – with ingrained traditions of feeding some combination of water, milk from animals, tea, or sweeteners – and, accordingly, the cost of changing those patterns is particularly high, the cost-effectiveness of exclusive breastfeeding in these areas may be lower than for other interventions.

Extended Breastfeeding

Studies in China indicate that breastfeeding for >18 months is associated with significantly higher weight for age and weight for height Z scores, and that breastfeeding for >24 months is associated additionally with greater height for age Z scores.42

Reducing Diarrheal Infection

Analysis of data from Guatemala, West Africa and Bangladesh indicate that from one fourth to one third of observed growth failure in young children is attributable to diarrheal infection.43 44 45 A study in urban West Africa, however, found that these diarrhea-induced growth deficits did not appear in exclusively breastfed infants.46 Data from Peru and from Asian countries also indicate that exclusively breastfed infants have considerably lower risk of diarrhea.47 48

A portion of this growth reduction is attributable to a decrease in energy intake during bouts of diarrhea. Interestingly young Guatemalan children no longer being breastfed reduced energy intake by 30% during acute diarrheal episodes,49 while young Bangladeshi children, still being breastfed, reduced intakes only by 7% suggesting a protective effect of breastfeeding.50

Diarrheal infection also takes a toll on micronutrient status. One study, for example, found a negative balance of zinc during early phases of diarrheal infection.51

At the same time, there is evidence that vitamin A can reduce the severity though not the incidence of diarrheal episodes.52

Finally, and importantly, studies in several countries have demonstrated a 20% reduction in diarrhea incidence with zinc supplementation.53
Timely Introduction of Complementary Food

In a Peruvian periurban area, families receiving BCC through existing health services were more likely to provide nutrient dense complementary food to infants at six months of age, resulting, in turn, in lower rates of stunting than among control children.54

Efficacy studies on the effect of complementary foods in Guatemala, Colombia, Jamaica, Indonesia and Bangladesh on infants 6-12 months of age found energy increases of 65-300 kcal/day resulting in improvements in growth of 0.1 to 0.5 SD (although there is some evidence of these foods replacing some of the energy previously provided by breastmilk.)

Programs studied in 11 countries which have sought to increase the timely introduction of complementary foods, also had to address the problem of inadequate nutrient density. Most programs found mothers willing to introduce complementary foods, although it often has been more difficult to incorporate them into feeding regimens on a regular basis. Primary constraints appear to be limited resources, inadequate time, and fear of diarrhea.

Given the bulk constraints faced by young children, programs which have sought to introduce complementary food adequate in energy and nutrients have frequently recommended an increased number of feedings during the day (3-5). However this may present problems in many areas given the time constraints faced by women, and particularly during peak agricultural sowing and harvesting seasons. Where an increased number of feedings also entails additional cooking (often requiring the hauling of fuel and water), the problem is particularly problematic.55

Some programs, as in Mali and Indonesia also have sought to address the difficulties sometimes faced in feeding older infants, and have, at times, encouraged proactive or responsive feeding involving active encouragement from mothers. In Indonesia, variety in the foods provided also has been encouraged.

BCC programs encouraging timely introduction of complementary food, achieved for example:

• In Colombia, a 30% reduction in food provision < 4 months, and a 70% reduction in the feeding of cow’s milk <4 months;
• In Peru, an 83% increase in appropriate complementary foods fed at least twice daily;
• In Burkina Faso, a 20% increase in timeliness of introduction;
• In Indonesia, for infants 5-8 months of age, increases of 200% in greens consumption, 200% in fish consumption, and 54% in oil consumption.

These changes translated into increased energy intake of 6 to 12 month olds in these programs of 70 to 165 kcal/day, and, in turn into improvements in WAZ of 0.24 to 0.50 and in HAZ of 0.30 to 0.87. Overall, programmatic data from 11 countries found changes in growth rates of –0.04 to +0.87 SD.

Combining efficacy and programmatic data, improved growth rates of 0.10 to 0.50 might be expected from such interventions. A growth improvement of 0.10 SD translate into absolute reductions in the prevalence of malnutrition of 2 to 4%, while an improvement of 0.50 SD translates into malnutrition reductions of 5 to 19% - depending on the prevalence of malnutrition in the population. Finally, using population attributable risk (PAR) introduced for such calculations by Pelletier et al,56 the 0.10 SD to 0.50 SD improvements resulting from improved introduction of complementary food translates into a reduction in the proportion of deaths attributable to malnutrition by 2 to 13%, again depending on the prevalence of malnutrition in the community.57

Improving Birthweights

Low birthweight (LBW) may result from an inadequate rate of fetal growth (intrauterine growth retardation, IUGR), or from inadequate duration of fetal growth (pre-term delivery, PTD) or both. In developing countries where LBW prevalence is high, a greater proportion of LBW is due to IUGR.58 In these countries, pre-pregnancy weight, very young maternal age, and
maternal education are factors associated both with IUGR and PTD, while gestational weight gain, caloric intake (and in some countries malaria and tobacco) are associated with IUGR.\textsuperscript{59}

There is conclusive evidence that (1) higher prepregnancy weight is associated with higher birthweight, (2) increased gestational weight gain is associated with higher birthweight, and (3) optimum birthweight requires a combination of the two.\textsuperscript{60}

Although the relationship of dietary supplementation and other pregnancy interventions to pregnancy outcome indicators is far less linear than is the case with young children (studies have found effects on prepregnancy weight gain, birthweight, child growth, and even the birthweight of the subsequent child, these depending on the degree and length of maternal deprivation, and also have found these associated with the birthweight of the mother herself and of the mother’s mother), the effects are most pronounced in contexts of very low maternal energy intakes, specified in one study as <1750 kcal/day.\textsuperscript{61}

Such low energy intake, often associated with famines, is also found in pre-harvest “hunger” seasons in some countries. One study in Bangladesh found that women conceiving in May or June had significantly lower maternal weight than women conceiving in other months.\textsuperscript{62}

In the well known Guatemalan four-village study, pregnant women consuming an energy-dense supplement (Atole) as opposed to a sweetened clear liquid (Atole), and consuming 20,000 kcals during their pregnancies, delivered infants with birthweights 110 grams higher.\textsuperscript{63}

In the first of two Gambia studies, supplemented women had infants of higher birthweight compared with prior years, but only during the wet (hungry) season.\textsuperscript{64} In the second study, supplements of 1000 kcal per day provided to pregnant women in a context of broader health services resulted in greater pregnancy weight gain, birthweight, infant length, head circumference, and perinatal and infant survival. Gains in birthweight were 94 g during the dry season and 201 g during the wet (hungry) season.

In Thailand, supplements provided to pregnant women in two treatment groups and supplying between 400 and 560 kcal/day resulted in birthweight gains of 236 and 251 grams.\textsuperscript{65}

Data from Dhaka slums indicates that size at birth has an important role in determining growth during infancy. Differences in weight at birth remained relatively constant throughout infancy.\textsuperscript{66}

Ante-natal care has been associated with increased birthweight. However the content of advice given during an ANC visit may be equally important, with incomplete advice associated with higher risk of LBW. Education, in turn, has been strongly associated with the utilization of ante-natal care in several countries including India. A nationwide study of National Family Health Survey data concluded that “education emerges as the single most important determinant of maternal health-care utilization in India when the influence of other intervening factors is controlled.”\textsuperscript{67} However there also is evidence that effective counseling in the context of programs can compensate for the lack of education, and achieve highly positive effects on behaviors among women with little or no education.\textsuperscript{68}

A review of pregnancy interventions by Rush (which challenges the conclusions of some of these studies) notes that typical birthweight increments are in the 20-50 g range except in cases of famine or season deprivation during which birthweights have been increased by as much as 200 g. The review also underlines the importance of initiating interventions early in pregnancy, and notes the toxicity effects of high density protein supplements.\textsuperscript{69}

2 NFHS 1998-99, op cit. 47% are moderately or severely underweight, 18% are severely underweight, and 26% are mildly underweight.

3 MDG nutrition objectives refer to under-5 malnutrition.

4 Statistics were taken from NFHS 1998-99 and the National Nutrition Monitoring Bureau 1975-1979. This paper uses the 2005 World Bank calculations for 1990 and 2015 projections. The reference for 1990, based on the rate of change from the 1992-93 and 1998-99 NFHS surveys, is cited as 54% (the 2004 World Bank document cites 54.8%) and the target prevalence in 2015 is 27.4%.


6 2005 World Bank, op cit. Underweight in India is 47% and in sub-Saharan Africa 24%; wasting in India is 16% and in Sub-Saharan Africa 8%, stunting in India is 45% and in Sub-Saharan Africa 35%.


8 2005 World Bank, op cit. India has half as many sanitation facilities in proportion to its population compared to Africa, p. 58.

9 IFPRI. “Despite efforts, why does child malnutrition persist in India?”

http://www.ifpri.org/media/BeijingPlus10/briefIndia.pdf Accessed 8/05/05


13 ibid. p. 42


15 ibid. p. 60

16 Underweight in Punjab was calculated at 47.8% using Harvard Standards and the Gomez Classification – which would translate to roughly 60% using NCHS standards and Z-scores.

17 In 1971 in rural Punjab, 55.8% of mothers expressed a belief that the cause of severe malnutrition was the casting of a shadow by an evil spirit or person. The 2001 was unable to find any mothers holding that or comparable beliefs.


19 2004 World Bank, op cit. Effects of economic growth on underweight was calculated using estimates of the elasticity of malnutrition to annual economic or income growth. Assuming a 3% average per capita growth rate and an income elasticity of underweight of 0.51, underweight prevalence for under threes would only fall to 39% by 2015. With a more generous estimation of economic growth of 5%, prevalence falls to 36.3%. Even using the unrealistic rate of 7% growth, prevalence falls only to 35%, well above the target 27.4% outlined in the MDGs. In order to reach this figure with economic growth alone, the per capita growth rate would need to be 8%, p. 24. If poor states were brought up to the national average (in terms of social indicators like sanitation, roads and electricity, female education, medical attention at delivery, and household income), national prevalence of underweight would still only decrease by 8 percentage points or 15%. If, instead, the poor states were boosted to averages found in non-poor states, underweight would decrease by 21 percentage points (21%), still shy of the MDGs. This analysis highlights the need for substantive and targeted supplemental interventions.

20 “Mid-term Appraisal of the Tenth Five Year Plan: Extracts of Overview and Priority Areas for Action” 2005.

21 ibid.

22 Analysis of 1995 data carried out by the BAIF Development Research Foundation found that the large majority of underweight Indian children come from households that are not severely food insecure.
The greater effect of some BCC messages in Jharkhand relative to Bihar may relate both to the smaller population coverage of individual AWCs in tribal areas (roughly one AWW per 700 population as opposed to 1000 elsewhere), and, in tribal areas, the generally higher status of women and their greater decision making power.


23 2004 World Bank, op cit. p. 54
24 2005 World Bank, op cit. Poorer states are those with lower per capita Net State Domestic Product (NSDP). Growth of program coverage was considered for the period from 1992 to 1998.
25 The greater effect of some BCC messages in Jharkhand relative to Bihar may relate both to the smaller population coverage of individual AWCs in tribal areas (roughly one AWW per 700 population as opposed to 1000 elsewhere), and, in tribal areas, the generally higher status of women and their greater decision making power.
26 Results from independent evaluations of the Dular program from 2003, 2004, and 2005. UNICEF.
29 As indicated in Table C, Dular low income households with “severe” children were, in fact, less likely to be visited by LRPVs than households with “normals.”
30 The issue of multi-micronutrient supplements for pregnant women is likely to be contentious for some time. While research continues, initial findings on their effects on birthweight have not been consistent.
33 2004 World Bank, op cit.
35 ibid
36 NFHS 1998-99, op cit. All data comes from this survey unless otherwise noted.
42 Taren D, Chen J. A positive association between extended breastfeeding and nutritional status in rural Hubei Province, People’s Republic of China.
57 This information on efficacy and program data is taken from Caulfield L, Huffman S, Piwoz E. Interventions to improve intake of complementary foods by infants 6 to 12 months of age in developing countries: Impact on growth and on the prevalence of malnutrition and potential contribution to child survival. Food and Nutrition Bulletin. Vol 20, No 2. 1999
59 ibid.
62 Chowdhury AKMA. Changes in maternal nutritional status in a chronically malnourished population in rural Bangladesh. Ecology of Food and Nutrition 1987; 19:201-11