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Intensifying efforts to reduce child malnutrition in India: an evaluation of the Dular program in Jharkhand, India

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Abstract

Background. *The Dular strategy is a unique nutrition initiative initiated by UNICEF India in collaboration with the states of Bihar and Jharkhand. Designed to complement the government's Integrated Child Development Services (ICDS) and build upon its infrastructure, one of the major goals of the Dular program is to capitalize and develop community resources at the grassroots level. The emphasis of the Dular program is on establishing a community-based tracking system of the health status of women and of children 0 to 36 months of age by neighborhood-based local resource persons (LRPs). The main objectives of the Dular program include increased prenatal attendance, improvement in breastfeeding and colostrum delivery, improved nutritional practices, and decreased malnutrition.*

Objectives and methods. *An impact evaluation of 744 women and children in Jharkhand examined antenatal and birthing practices, colostrum delivery, delivery of breastmilk as first food, reported use of iodized salt, measured iodized salt status, immunization and weight-for-age z-scores (WAZ) of children 0 to 36 months of age, controlling for various measures of socioeconomic status.*

Results. *Differences were found between Dular and non-Dular villages in all major outcomes. Particularly noteworthy is that young children in Dular areas had a 45% lower prevalence of severe malnutrition and were four times more likely to receive colostrum than those in non-Dular villages.*

Conclusions. *Our evaluation results indicate that programmatic overlays to the ICDS program, which focus primary attention on children 0 to 36 months of age and on women, have the potential to transform into a cost-effective instrument for reducing child malnutrition in India, with implications for women and children in India.*

Key words: Evaluation, maternal and child health, nutrition intervention

Introduction

Child malnutrition continues to represent a major problem in India, accounting for more than 40% of the world's malnourished children and adversely affecting child mortality rates, disease prevalence, and economic growth [1, 2]. A high proportion of this malnutrition is concentrated in a small number of north Indian states, including Jharkhand, which was newly created in 2000 with the division of Bihar State and contains a substantial tribal population [3].

The collection and analysis of statistical data in Jharkhand as a new state are not yet as well developed as elsewhere in India, yet certain information is available [4]. Only 8.8% of children aged 12 to 23 months in Jharkhand are fully immunized, as compared with 42% in India as a whole [4]. The proportion of women married by the age of 18 is 74.4%, as compared with 50% for the whole country [4]. Just over 15% of Jharkhand households have toilet facilities, as compared with over 35% in India as a whole [4]. The prevalence rates of underweight and wasting among children 0 to 36 months of age in Jharkhand are 16% and 41% higher, respectively, than those for India as a whole, while the prevalence of stunting in Jharkhand (49%) is more than twice the national average (23%) [4].

The Integrated Child Development Services (ICDS) program, introduced by the Indian Government in 1974, is inherently weaker in the very states where child

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malnutrition is most serious, including Jharkhand [5]. The ICDS was designed as a comprehensive program to improve health care, immunization, supplemental nutrition, and early childhood education to infants and children 0 to 6 years of age, adolescent girls, new mothers, and women of reproductive age. Female Anganwadi workers (AWWs), trained in health, nutrition, and child development, are responsible for health screenings, immunizations, health education, and other health-related services through village-based Anganwadi centers (AWCs) designed to serve as the focal points for health service delivery at the community level. Originally built to provide services for approximately 1,000 beneficiaries, most centers today provide services to about twice the intended population [1].

The ICDS has expanded substantially over its 30 years of operation to cover almost all development blocks in India, offering a wide range of health, nutrition, and education services to children, women, and adolescent girls. However, although the program is intended to target the needs of the poorest and the most undernourished, as well as the age groups that represent a significant "window of opportunity" for nutrition investments (i.e., children under three and pregnant and lactating women), there has been a mismatch between the program's intentions and its actual implementation [6]. Some highlighted challenges include the increase in both the geographic area and number of persons covered through ICDS over time, without analogous expansion of program resources. An additional weakness identified in the nutritional domain has been an emphasis on food distribution rather than on intervention and programs that focus on changing family-based feeding and caring behaviors [6]. Such obstacles have been held responsible for its limited impact [6].

The Dular program was devised as a response to many of the challenges facing the ICDS, most noticeably the problem of expansion of the program without a corresponding increase in the number of health workers to serve the population, in addition to adequate attention to targeting poorer villages, lower castes, and more vulnerable regions (i.e., the states of Bihar and Jharkhand). With respect to child malnutrition, another identified problem was the disproportionate attention given by the ICDS to older preschool children rather than children under the age of three, and pregnant women.

UNICEF and the Bihar State Government launched the Dular strategy in 1999 to overcome these limitations and improve the delivery and utilization of ICDS services, particularly those addressed to women and young children. Dular ("to care and love" in Hindi) was designed as a low-cost replicable strategy that emphasizes systematic involvement of the family and community at large in efforts to facilitate child development. The program was initiated in Bihar, and efforts began in Jharkhand in 2001. Perhaps the most important of the Dular innovations has been the additional outreach capacity provided by neighborhood-based volunteers. Building on the already existing infrastructure of the ICDS, Dular trains local resource groups (LRGs), composed of local resource persons (LRPs) (approximately one for every 10 to 15 households), who assist the AWWs in providing services to pregnant women and mothers of newborns in their homes. These services are designed to implement a surveillance system on a grassroots level, which promotes safe delivery, breastfeeding, immunization, and other essential care practices during pregnancy and early childhood. Dular's life course approach seeks to ensure that girls and women of reproductive age have access to adequate nutrition, health care, and information about child care throughout their lives—especially while they are pregnant and nursing their young children. Since its inception, the Dular program has aimed both to improve the health and well-being of women and young children in Bihar and Jharkhand and to strengthen the ICDS, the Indian Government's primary programmatic vehicle for such services.

The Dular program is initially introduced to a village through the village contact drive (VCD). This event consists of 2 days of training and advocacy, during which the objectives of the strategy are discussed with villagers and information is gathered regarding local beliefs and practices (for example, one of the most problematic common practices in tribal areas is the so-called hell-fasting, a fasting period for the mother commencing just after giving birth) related to women and children's health. This information is used to plan project activities appropriate to local conditions that are maintained over a consistent period. LRPs identified during the village contact drive collectively form a local resource group, which meets weekly with the AWW to review progress. This Dular approach is consistent with increasing efforts internationally to encourage community participation by using such approaches and mobilizing women's groups for health and nutrition purposes [7].

With the active involvement of a group of health and nutrition advocates in the two state governments, in collaboration with UNICEF, the Dular strategy has been implemented in a steadily increasing number of villages in Bihar and Jharkhand over time. This paper reports on an evaluation of the program's impact in Jharkhand, looking specifically at breastfeeding practices, antenatal and birthing practices, immunization, weight-for-age z-scores (WAZ), and use of iodized salt in the household. These outcomes were chosen because they were the focus of Dular; however, benefits to these specific outcomes have been documented in the literature [8–11].

Methods

Data collection

In June and July 2004, trained data collectors in Jharkhand administered questionnaires that incorporated collection of extensive sociodemographic information as well as health outcome data among individuals in villages receiving the Dular program and not receiving the program. Villages were matched according to their status as "Dular-intensive," "Dular-regular," or "non-Dular." The first of these offered the full package of activities, including follow-up and monitoring; the last received regular ICDS services without the Dular overlay. A summary of the descriptions of these categories is shown in **table 1**.

Dular-intensive villages were chosen randomly from an alphabetized and numbered listing of all villages in the state of Jharkhand involved with the strategy. For each Dular-intensive village chosen, a team of ICDS government staff and UNICEF fieldworkers matched a Dular-regular and a non-Dular village according to factors of geography (e.g., distance from a larger village or city) and village socioeconomic characteristics (e.g., access to electricity and transportation). A total of 45 villages were sampled, and our final analytical sample consisted of 744 respondents: 200 from Dular-intensive, 229 from Dular-regular, and 315 from non-Dular villages.

All data collectors completed 16 hours of formal training in questionnaire administration, which included standardized testing of iodized salt and measurement of weight [12]. Teams of six data collectors, composed of five female questionnaire administrators and one male supervisor, traveled from the Jharkhand capital of Ranchi to villages daily over a 1-week period. In the case of Dular villages and their corresponding non-Dular matches that were considerably farther away from the capital city, four teams traveled and stayed overnight in nearby regional capitals to complete data collection.

Households were chosen randomly by a standardized process in which villages were divided into geographic areas and teams of data collectors traveled door-to-door on foot and administered questionnaires to one individual within each household (or one mother–child dyad). For individual sampling within households, respondents were chosen according to the following categories: lactating mothers with children younger than 6 months, lactating mothers with children from 6 to 36 months of age, pregnant women, and adolescent girls. In all cases where women had children under 3 years of age, questions were asked pertaining to the youngest child (or most recent pregnancy) as well as the mother. Informed consent was obtained from study participants orally, and the study investigators protected the rights of participants as described in the Declaration of Helsinki. The Tufts University Institutional Review Board approved this study. **Table 2** presents the sociodemographic data collected for each respondent.

The data collectors and the team leaders who accompanied them were blinded to Dular status. The data collectors recorded all responses in pencil, and the evaluation team reviewed the questionnaires at the end of each day of data collection. During this review, any problems identified were sent back to the collectors for clarification.

TABLE 1. Summary of activities in non-Dular, Dular-regular, and Dular-intensive villages

Type of village	Description of activities
Non-Dular	Normal ICDS activities (working Anganwadi center with Anganwadi worker to promote health and nutrition activities and primary care)
Dular-regular	Normal ICDS + village contact drive and distribution of initial education materials
Dular-intensive	Normal ICDS + village contact drive, training and assignment of LRPs, monitoring, and follow-up activity

ICDS, Integrated Child Development Services; LRPs, local resource persons.

Data entry

All data were entered at the state capital by trained staff into an Excel database. Data entry was supervised and quality control was performed throughout the entry process with systematic checks between the database and original surveys. The database was additionally cross-checked with the surveys by the evaluation team. The Excel databases were transferred into an SPSS version 14.0 database for analysis. SAS version 8.2 was also used for analyses and confirmation of results.

Statistical analysis

We looked at all baseline frequencies and distributions of socioeconomic status indicators according to village and tested for differences between Dular (Dular-intensive and Dular-regular) and non-Dular participants using chi-square tests. Cases with missing values were excluded from the analysis of outcome measures. We then used multivariate logistic regression to examine outcomes of interest, adjusting for relevant socioeconomic status factors. Primary outcomes included reported use of iodized salt, iodization status of salt when tested, immunization status of the youngest child, antenatal care during pregnancy (at least one checkup), feeding of colostrum, feeding of breastmilk

before any other foods, and whether a delivery kit was used for childbirth. We used analysis of covariance (ANCOVA) with Bonferroni adjustments to compute adjusted means for the continuous outcomes of WAZ. Primary outcome variables and their operationalization are presented in **table 3**.

WAZ scores were computed to assess differences between Dular groups and examine potential differences between age groups for each Dular group. We constructed categories according to degrees of malnutrition and WAZ, including normal weight (≥ –1 SD), mild underweight (< –1 to –1.99 SD), moderate

TABLE 2. Collected sociodemographic data

Variable	Categories	Description
Respondent's caste	Scheduled Backward Nonbackward	Scheduled caste is considered the lowest, followed by backward and then nonbackward. Treated as a class variable
Respondent's religion	Hindu Christian Muslim	Nominal, treated as a class variable
Respondent's education	None Primary Middle or high school Intermediate or graduate	Ordinal, treated as a class variable
Husband's or father's education	None Primary Middle or high school Intermediate or graduate	Ordinal, treated as a class variable
Respondent works for pay		Dichotomous (yes/no)
Husband or father works for pay		Dichotomous (yes/no)
Male head of the household		Dichotomous (yes/no)
Type of house	Hut Mud Concrete Other	Hut is the most basic type of house. Mud house is considered better and concrete best. Treated as a class variable
Type of cooking fuel	Wood Kerosene Liquefied petroleum gas	Wood is the most basic fuel. Kerosene is considered better and liquefied petroleum gas best. Treated as a class variable
Site of defecation	Open space Public latrine Private toilet Flush toilet Other	Open space is the most basic defecation site, followed by public latrine and then private toilet. Flush toilet is considered best. Treated as a class variable
Electricity in household		Dichotomous (yes/no)

TABLE 3. Primary outcomes and their operationalization

Outcome	Operationalization	Modeling
Prenatal care	Did the respondent report receiving an antenatal checkup during her most recent pregnancy? If so, how many?	Dichotomous
Breastmilk	Did the respondent report that breastmilk was the first food given to the youngest child?	Dichotomous
Colostrum	Did the respondent report that colostrum was given to the youngest child?	Dichotomous
Immunization	Did the respondent report that the youngest child was up to date with necessary immunizations?	Dichotomous
Iodized salt use	Did the respondent report that the household uses iodized salt?	Dichotomous
Iodized salt status	Did the salt have an iodization level of 15 to 30 ppm when tested?	Dichotomous
Use of a delivery kit	Did the respondent report that a delivery kit was used during her last delivery?	Dichotomous

TABLE 4. Descriptive statistics of sociodemographic variables

Variable	Dular-intensive	Dular-regular	Non-Dular
	% (no.)		
Reproductive status			
Adolescent	21.0 (42)	20.6 (47)	22.2 (70)
Pregnant	19.0 (38)	20.2 (46)	19.7 (62)
Lactating with child 0 – ≤ 6 mo	21.5 (43)	20.6 (48)	21.3 (67)
Lactating with child > 6–36 mo	38.5 (77)	38.6 (88)	36.8 (116)
Caste*			
Scheduled caste	53.5 (107)	48.9 (112)	42.2 (133)
Backward	38.5 (77)	44.5 (102)	53.0 (167)
Nonbackward	8.0 (16)	6.6 (15)	4.8 (15)
Religion			
Hindu	65.0 (130)	76.9 (176)	76.8 (242)
Christian	6.5 (13)	6.6 (15)	0.3 (1)
Muslim	25.0 (50)	10.9 (25)	22.9 (72)
Other	3.5 (7)	5.7 (13)	0 (0)
Mother's education*			
None	52.4 (106)	44.1 (101)	53.0 (165)
Primary	21.0 (42)	18.3 (42)	22.2 (70)
Middle or high school	25.0 (50)	30.1 (69)	23.5 (74)
Intermediate or graduate	1.0 (2)	7.4 (17)	1.9 (6)
Husband's or father's education			
None	28.6 (58)	29.8 (65)	26.9 (82)
Primary	24.8 (51)	19.8 (46)	23.2 (72)
Middle or high school	40.8 (81)	35.5 (81)	41.0 (125)
Intermediate or graduate	5.8 (10)	14.9 (35)	8.9 (26)
Respondent works for pay*			
Yes	48.9 (87)	49.1 (108)	36.0 (99)
Husband or father works for pay*			
Yes	93.3 (181)	94.7 (215)	83.3 (254)
Sex of head of household			
Male	90.5 (181)	95.6 (218)	92.7 (292)
Type of house*			
Concrete	9.0 (18)	11.8 (27)	28.3 (89)
Mud	89.5 (179)	87.3 (200)	68.3 (215)
Hut	1.5 (3)	0.9 (2)	3.5 (11)
Type of cooking fuel*			
Liquefied petroleum gas or kerosene	1.0 (2)	10.0 (23)	1.9 (6)
Leaves or wood	99.0 (198)	90.0 (206)	98.1 (309)
Source of drinking water*			
Public well	59.2 (116)	52.4 (118)	49.5 (152)
Own hand pump	7.7 (15)	8.0 (18)	21.2 (65)
Public pump	31.1 (61)	36.0 (81)	28.7 (88)
Other	2.0 (4)	3.6 (8)	0.7 (2)
Place of defecation*			
Flush toilet	0.5 (1)	0 (0)	0. (0)
Indian-style toilet	7.5 (15)	8.3 (19)	2.2 (7)
Open space	92.0 (184)	91.7 (210)	97.5 (307)
Public latrine	0 (0)	0 (0)	0.3 (1)
Electricity in home*	52.5 (105)	67.7 (155)	61.9 (195)

*$p < .05$, χ^2 test.

underweight (–2 to –2.99 SD), and severe underweight (≤ –3 SD). Children were stratified into those less than 1 year old and those 1 year of age or older. Percentages (unadjusted for socioeconomic status variables) were then calculated for each Dular group.

Results

Table 4 presents descriptive statistics of the total sample of individuals. Statistically significant ($p < .05$) differences between types of villages were observed for a handful of socioeconomic factors, including caste, mother's education, whether the mother works for pay, whether the husband/father works for pay, presence of electricity in the home, site of defecation, type of house, and type of fuel. Persons in the Dular-intensive villages generally were of lower socioeconomic status. For example, 53.7% of those in Dular-intensive villages had electricity, as compared with 68.1% of those in Dular-regular and 62.0% of those in ICDS control villages. On a similar note, 89.7% of individuals in Dular-intensive villages lived in mud houses, as compared with 87.1% of those in Dular-regular villages and 67.5% of those in ICDS control villages. Although these variables point to some differences among the villages, these variables were controlled for in all subsequent analyses.

After adjusting for multiple socioeconomic factors, we observed that both Dular-regular and Dular-intensive villages had significantly more women with positive practices for prenatal care, delivery of breastmilk, delivery of colostrum, use of iodized salt, iodized salt status (when tested), up-to-date immunizations, and use of delivery kits. As shown in **table 5**, women in Dular-intensive villages were 4.6 times more likely, and women in Dular regular villages were 4.0 times more likely, to feed their newborns with colostrum than those in non-Dular villages (adjusted probabilities of colostrum delivery, 95.0%, 82.0%, and 20.7%, respectively). There was also a noticeable difference among Dular-intensive, Dular-regular, and non-Dular villages in the proportion of women breastfeeding their infants before giving them other foods or liquids (adjusted probabilities, 53.0%, 41.4%, and 17.1%, respectively). Reported immunization status also showed significant differences, with Dular-intensive villages having significantly better immunization status than Dular-regular villages, and both Dular-intensive and Dular-regular villages having better immunization status than non-Dular villages. For iodized salt use, prenatal care, and use of a delivery kit for childbirth, although there were differences between Dular and non-Dular villages, women in Dular-regular villages fared better than those in Dular-intensive villages. This, in addition to the fact that the non-Dular villages had lower percentages for all measured health behaviors than one might have expected through the initiative of the ICDS, is further discussed later in the paper.

Adjusted mean WAZ values are given in **table 6**. Statistically significant ($p < .05$) differences were observed between non-Dular and Dular-regular villages and between non-Dular and Dular-intensive villages. Although the data are not presented in the table, among children under 1 year of age, we observed significantly higher ($p < .001$) adjusted WAZ scores (less malnutrition) among children enrolled in Dular, compared with children in villages without Dular. Among children 1 year and older, we also observed significant differences in adjusted WAZ scores; however, there were virtually no differences between Dular-regular and Dular-intensive children. Discussion of this is addressed later in the paper.

Discussion

We observed statistically significant differences in all measured outcomes between Dular and non-Dular villages. Differences between Dular-intensive and Dular-

TABLE 5. Adjusted probabilities of primary binary outcomes according to Dular status[a]

Outcome	Dular-intensive	Dular-regular	Non-Dular
Received prenatal care	94.3%	91.1%	70.7%[+]
Breastmilk fed before other foods or liquids	53.0%	41.4%*	17.1%
Colostrum fed	95.0%	82.0%**	20.7%
Immunization	97.1%[++]	89.1% *	85.3%
Iodized salt use	93.3%[a]	95.8%	53.2%[+]
Iodized salt status	90.5%	94.4%	76.8%[+]
Use of a delivery kit for childbirth	45.4%	48.2%	6.5%[+]

[a] Percentages are adjusted for caste, highest level of education, electricity in home, site of defecation, type of house, and type of fuel.
[+] Significant difference from Dular-intensive and Dular regular ($p < .05$).
[++] Significant difference from Dular-regular and non-Dular ($p < .05$).
* Significant difference between Dular-intensive and Dular-regular ($p < .05$).
** Significant difference between Dular-intensive and Dular-regular ($p < .001$).

TABLE 6. Adjusted mean WAZ

Dular respondent status	Adjusted mean WAZ ± SE	*N*
Dular-intensive	–1.95 ± 0.15	132
Dular-regular	–1.93 ± 0.14	146
Non-Dular	–3.24[a] ± 0.13	165

WAZ, weight-for-age z-score
a. Significantly different from Dular-intensive and Dular-regular

regular villages were most pronounced for breastmilk delivery, colostrum delivery, and immunization. Socioeconomic differences among the villages were controlled for in the analyses. However, socioeconomic variation would have biased the estimates toward the null, thus lessening the observed effects of the Dular program. We also note that the differences found in Jharkhand exceeded those found in the Dular program in Bihar State (not yet published). We speculate that these results are due in part to the smaller population coverage of AWCs in the tribal areas of Jharkhand and to the generally higher status of women in tribal areas, which increases their control over resources and decision-making.

Particularly interesting are differences in WAZ, as we observed that the mean WAZ for the youngest child of each interviewed woman (1 year of age or older) was –3.8 in non-Dular areas, well into the "severely underweight" category, whereas in Dular areas the mean was –2.6, which is toward the upper end of the "moderately underweight" category. Overall, the prevalence of severe underweight was 45% lower among Dular children than non-Dular children. This highly significant result, coupled with the effects of Dular counseling on the feeding of colostrum (with Dular newborns four times as likely to receive colostrum) and on early breastfeeding practices, suggests that the far greater Dular outreach capacity with the use of LRPs, focusing even on a relatively small number of behavioral change messages, is capable of considerable impact at low cost. (The cost of the Dular overlay, excluding ICDS costs, is just over US$16 per child per year.)

On the same note, many of the differences were not as pronounced, or, in two cases, Dular-regular villages had better outcomes than Dular-intensive villages. There are several possible reasons why this could be the case. One main reason we suggest is related to the nature of the outcomes. The variation in outcomes between Dular-regular and Dular-intensive villages might not be pronounced enough to observe sustained and substantial change, especially when measuring, for example, weight-for-age. A second possible explanation is that we carried out the evaluation just 3 years after Dular was implemented, a period that may not be long enough for the program to have had differing impacts on Dular-intensive and Dular-regular villages.

Exceptions that stood out included use of a delivery kit for childbirth and iodized salt use, where Dular-regular villages demonstrated better outcomes than Dular-intensive villages, although none of these differences were statistically significant. With respect to limited iodized salt status, it is possible that there is a minimum amount of concentrated effort needed (e.g., nutrition education and outreach) in order to effect behavior change. Similarly, use of delivery kits may have been emphasized adequately during the village contact drive (received by all Dular villages) and may in fact be a behavior that does not need the sustained programming found in Dular-intensive villages. Finally, because these differences were not statistically significant, they may have been due to simple variation in this particular sample, rather than actual differences in the population whose behaviors this sample intends to capture. In all cases where there were statistically significant differences between Dular-intensive and Dular-regular villages, more women in the Dular-intensive villages engaged in the beneficial behaviors (**table 5**).

At the same time, the fact that the prevalence of malnutrition among young children in Dular areas is still unacceptably high suggests the need for further intensified efforts to expedite its reduction. With the valuable LRP infrastructure now in place, it now may be possible to intensify behavioral change messages relating to the timely introduction of complementary food and to improved hygiene and sanitation practices seeking to reduce diarrheal infection, to reduce the prevalence of low birthweight through further intensified attention to pregnant women (seeking to increase antenatal care, food intake, and daytime rest, and perhaps identifying those at particular risk by early-pregnancy measurement of body mass index and monthly pregnancy weight gain monitoring), and to reinforce micronutrient supplementation efforts for both pregnant women and young children.

As in any nonrandomized study design, we cannot completely exclude the possibility of confounding variables that were not controlled for in our analysis. However, we are confident that the process of choosing villages by individuals familiar with the territory provided for a design with comparable groups [13, 14]. Still, an overall limitation to our design is that we were unable to follow individuals over time. Even so, given our random sampling within each of the villages and rigorous data collection methods, we feel confident that the results we observed were due to the Dular strategy.

Perhaps a limitation that is more difficult to examine is the generalizability of the Dular program. The leadership under which Dular was organized, in addition to the small and manageable aspect of the strategy as a program run in two states in India, both may contribute to its success. To this extent, a qualitative examination and documentation of the political process that allowed Dular to grow in each of the two Indian states where it was implemented by UNICEF was conducted, and its findings complement our quantitative results that demonstrated the success of the strategy.

Thus, even given the limitations of this evaluation, we conclude that this examination indicates that programmatic overlays to the ICDS program that seek to focus primary attention on children 0 to 36 months of age and on women have the potential to transform this massive program into a cost-effective instrument for reducing child malnutrition in India.

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