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Impact of integrated child development scheme on child malnutrition in West Bengal, India

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Abstract

With child malnutrition detected as a persistent problem in most of the developing countries, public policy has been directed towards offering community-based supplementary feeding provision and nutritional information to caregivers. India, being no exception, has initiated these programs as early as 1970s under integrated child development scheme. Using propensity score matching technique on primary data of 390 households in two districts of West Bengal, an Eastern state in India, the study finds that impact of being included in the program and receiving supplementary feeding is insignificant on child stunting measures, though the program can break the intractable barriers of child stunting only when the child successfully receives not only just the supplementary feeding but also his caregiver collects crucial information on nutritional awareness and growth trajectory of the child. Availability of regular eggs in the feeding diet too can reduce protein-related undernutrition. Focusing on *just* feeding means low depth of other services offered under integrated child development scheme, including pre-school education, nutritional awareness, and hygiene behavior; thus repealing a part of the apparent food-secure population who puts far more importance on the latter services.

KEYWORDS

child malnutrition, impact evaluation, integrated child development scheme, West Bengal, India, nutritional awareness, supplementary nutrition program

1 | INTRODUCTION

World policy matrix to curb malnutrition among children has overwhelmingly attempted to create enhanced access to *supplementary nutrition* with energy rich food-grains to children, often coupled with awareness generation programs. However, social scientists have identified that apart from food energy intake, certain *non-food* attributes, including access to safe drinking water, sanitation, health care, and environmental hygiene (Sukhatme, 1982; Martorell & Ho, 1984; Radhakrishna & Ravi, 2004), are crucial determinants of child malnutrition. Therefore, pure supplementary nutritional programs (SNP) have failed to garner improvement in malnutrition status among the children unequivocally (Hossain, Naher, & Shahabuddin, 2005; Dewey & Adu-Afarwuah, 2008; World Bank Independent Economic Group, 2010). Bhutta et al. (2008) and Onis et al. (2013) point out that supplementary nutrition intervention alone is almost certainly insufficient to create a strong impact, especially in food-secure settings and it needs to be complemented by strategies concerning water, sanitation and nutritional education and awareness.

In spite of significant increase in access to food grains and initiation of SNP program through integrated child development scheme (ICDS) in 1970s, India has continued to bear a heavy burden of child malnutrition till date. However, most assessments of the ICDS so far have located only limited evidence of impact of the presence of an ICDS center in a village on children's anthropometric outcome (Deolalikar, 2005; Lokshin, Gupta, Gragnolati, & Ivaschenko, 2005; Kandpal, 2011). Jain, Singh, and Pathak (2013) concluded that only the girls of 0–2 years receiving supplementary nutrition regularly tend to be least 1 cm taller than similar girls who did not receive it, though the impact is less robust for boys.

For evaluation of any public policy, one should highlight three dimensions: *breadth of the program* (population covered), *depth of the coverage* (services offered), and *height of the coverage* (risk protection provided; Selvaraj et al., 2014; Asher & Bali, 2015). There is clearly a research gap on identifying the *depth* of the program of ICDS and its impact on reduction of child stunting of the program. The service package of ICDS not only includes SNP but also other related services like nutritional education and counseling to caregivers. Also, the children

are expected to receive not *just* food-grains under SNP in the form of *khichri* (a wholesome traditional dish with boiled rice and lentils) but also protein-rich foods including soya beans and eggs. The paper attempts to bridge this very gap by focusing on receipt of disaggregated service-components and their respective impact on child's long-term growth process.

2 | DATA AND METHODOLOGY

2.1 | Data

ICDS project is structured from district project officer at the apex center of each district in a state to central development project officer at the specific subregion to Anganwari workers (AWW) and helpers at each ICDS centers, named Anganwari centers (AWC). Normally, AWCs are available in each big village. AWW renders six packages of services to the beneficiaries at each AWC, including submission of reports and returns, health check up of children, growth monitoring, vaccination, organizing mothers' meetings, pre-school education (PSE), and to impart nutritional education to caregivers. The present study is based on a primary survey on 390 households and 65 AWCs, conducted in two districts of West Bengal, a medium performing Eastern state bordering Bangladesh. For choosing a representative sample of households, stratified random sampling method at three tiers (namely, at districts, blocks, and villages) was used. The aim of this kind of stratification was to select some households from relatively better off regions, while some from worse off regions, to represent the average situation on the gamut. To choose the two out of 18 districts in the state and blocks for the study, a composite index combining the demography-related backward population component and human development component (HD) is considered. While the former captures the share of ethnic population from backward castes (termed Scheduled Caste and Scheduled Tribes) and religious minority of the districts, the second component considers the overall human development of the subregion. The idea behind this kind of index was to capture both social inequalities in terms of ethnicity as well as in terms of actual outcomes of health, education, and income. Considering only HD component might have bypassed the enabling environment of the equitable distribution process, as indicated by social and ethnic identities (Marmot et al., 2008). Data for constructing these component indices are taken from Census 2011, District Handbook (Government of West Bengal, 2007), and State Human Development Report of UNDP (2004). Taking average of the two indices related to two components, the composite index is constructed. The study considered two districts, namely, Howrah and Uttar Dinajpur, representing one good performing and one bad performing region. At the next tier, the identification of backward and advanced blocks within these two districts has been made similarly on the basis of a composite index of backwardness comprising two parameters with equal weight to each, namely, share of female illiteracy[1] and share of backward class population in each block. According to that, Bally Jagachha (top most position), Uluberia II (lowest position), and Amta II and Domjur (at the median position) were selected in Howrah district (out of 14 blocks in the district), while in Uttar Dinajpur, the corresponding four blocks are Raiganj, Goalpokhor, Hemtabad, and Kaliaganj (out of nine blocks in the district), respectively. The number of sample households was divided across the blocks depending upon the share of population of blocks within the district.

Once the blocks were chosen, the next step was to choose the villages and households there from. We divided the sample across different size classes according to population quota. Next, we chose those households randomly which had at least one child within the age group of 0–5 years. For this, we started to choose the households from a corner of the village and picked up every third household moving towards the center of the village. This way, we chose those households, which had at least one child within the age group of 0–5 years, both situated at the center and at the outer periphery of the villages. This procedure was followed to get a good representation of all classes as it is generally found within Indian villages that people from better socio-economic status reside at the center of the villages, while people that are more vulnerable reside at the outer rings with lesser access to almost all public facilities (Sathyamala et al., 2012). We received complete information from 390 youngest children from these households. Out of them, 383 observations were complete. Along with the households, we also surveyed 65 AWCs in these localities, which catered to the households chosen. The survey was conducted during January–March, 2014.

2.2 | Methodology

Apart from simple statistical analysis, in order to estimate the actual impact of the program participants on child stunting, propensity score

[1]We consider female illiteracy instead of HDI as block-wise HDI values are not available.

Key messages

- India continues to bear significant burden of child nutrition in spite of gradual improvement in food security and public policy intervention, including that of supplementary nutritional support (SNP) under integrated child development scheme (ICDS) since 1970s.
- Incidence of child stunting is rampant in the state of West Bengal, a medium performer in other health outcomes across states.
- Though physical availability of ICDS centers is high in study setting, the impact of the program appears weak.
- The status of child nutrition can improve only if SNP is coupled with nutritional awareness generation among care givers.
- Access to protein-rich food in SNP is scarce, even if it can potentially reduce child stunting far more effectively.

matching (PSM) has been used. This method is particularly suitable to simulate an experiment and measure the treatment impacts in non-experimental studies, especially only observing the post-treatment effects, like this one (Khandekar et al., 2010). Simple comparison of mean anthropometric HAZ scores (height-for-age index calculated using WHO ANTHRO software) between those who received the program treatment (treatment group) and who did not (control group) will not do because self-selecting into the ICDS program might involve serious sample bias. In this case, the children from poorer households (who need supplementary food more because of low food security) are expected to reach ICDS centers more, thus creating a possibility of a negative selection bias. On the other hand, there is a possibility of children belonging to more informed and educated households to enjoy better physical access to AWC and more services there. Thus, assessing the impact of any such intervention requires making an inference about the outcome that would have been observed for treated, *had they not been treated*. If Y_1 denotes the outcome conditional on treatment and Y_0 denotes the outcome conditional on non-treatment, the treatment effect can be written as $\Delta = (Y_1 - Y_0)$.

However, it is not possible for the same person to be a participant and a non-participant simultaneously (the problem of counter-factual); hence, it is not possible to observe Y_0 and Y_1 for same individual. Thus, an intrinsic problem of non-observability of Δ is recognized in this kind of evaluation. To solve the problem, more emphasis is to be given to estimate the *average treatment effect on the treated* (*ATT*), where

$$ATT = E[Yi(1) - Yi(0)|x, Wi = 1] \quad (1)$$

$Wi = 1$ isolates those who are likely to participate in the program. That means the average value of the outcome variable will be compared across two groups: one containing those who are *likely* to participate and *participated* and the other one formed of those who are also *likely* to participate but *did not participate*.

Besides program participation, the outcome variable may depend on a number of other covariates represented by the vector x. So to estimate *ATT*, the first task is to *match* those observations from the sample who have equal chance (or probability) of participation in terms of x. The function for *ATT given in Equation* (1) *above* is termed as propensity score and is defined as $p(x) = P(W = 1|x)$. Consequently, each individual receiving the treatment is matched with the individual not receiving the program and having nearest propensity score, and their outcome variables (which is HAZ score) are compared. In this paper, balancing for selection bias was done using a probit model, whose estimates were used to obtain the propensity scores for selection into the program (Dehejia & Wahba, 2002). Once the scores had been generated, we checked if the selection bias had been removed by performing bi-variate tests against the treatment variable on all the variables used to remove selection. Since the differences for treatment indicator was insignificant after balancing, we concluded that the selection bias had been successfully removed, and our subsequent models would be balanced.

In this paper, we have not considered only one treatment variable corresponding to the coverage of the policy. Often, inclusion into the program does not guarantee receipt of all the services outlined in the program document, thus depicting shallow depth of the policy. The actual treatment effect arises when the individual gets included into the program and receives the services properly. According to this idea, we define five additional treatment variables, which club inclusion into the program along with receipt of several services and run PSM exercise with each of them. The treatment variables (T) are defined in the following way along with their control groups (C).

- $\mathbf{T_1}$ Children with simple access to ICDS
- $\mathbf{C_1}$ Children without access to ICDS
- $\mathbf{T_2}$ Children with simple access to ICDS for last 6 months
- $\mathbf{C_2}$ Children either without access to ICDS or Children who have access for less than 6 months
- $\mathbf{T_3}$ Children with regular access to ICDS for 4 or more days preceding week
- $\mathbf{C_3}$ Children either without access to ICDS or Children who have access, but did not go to ICDS for more than 4 days in the preceding week
- $\mathbf{T_4}$ Children with simple access to ICDS and received eggs more than thrice a day regularly
- $\mathbf{C_4}$ Children either without access to ICDS or Children who have access, but did not receive eggs regularly
- $\mathbf{T_5}$ Children with simple access to ICDS and mothers received information about child nutrition from AWW
- $\mathbf{C_5}$ Children either without access to ICDS or Children who have access, but whose mothers did not receive any information about child nutrition from AWW
- $\mathbf{T_6}$ Children with simple access to ICDS and received information about child growth from AWW
- $\mathbf{C_6}$ Children either without access to ICDS or Children who have access, but whose mothers did not receive any information about child growth from AWW

While the first-treatment variable considers only the simple coverage of ICDS program and the second one focuses on coverage for at least preceding 6 months (to allow a child to improve the growth trajectory with a minimum gestation lag), the last three variables attempt to capture both coverage and depth of either of the services. The third variable actually considers the persistent and regular coverage of the program, as literature identifies infrequent and discontinuous SNP might not be able to improve the child nutrition status. The fourth variable identifies coverage and regular receipt of eggs (as reported by the caregivers). Eggs are protein-rich and essential ingredients of child growth, which can help the child to bypass the wide incidence of protein energy malnutrition. Last two variables capture the co-occurrence of reaching ICDS program and receiving nutrition-related awareness.

3 | RESULTS

3.1 | Breadth and Depth of ICDS program

The sample households mostly use non-green fuel for cooking, water from shallow tube-well for drinking and lack any proper drainage system. On the whole, nearly 42% of households practice open defecation, with that proportion reaching more than 55% for Uttar

Dinajpur. Nearly, 55% of both mothers and fathers of the children are educated more than primary, while nearly 14% of mothers work outside the house. According to 90% of the mothers of the sample, there is sufficient food at their house, thus representing a food-secure environment.

Applying the above mentioned concept of Selvaraj et al. (2014), we have found that overall 48.46% of children go to ICDS and the rest do not. However, in terms of depth of services, it is found that even after reaching AWCs, not all services, which are expected to be provided, are actually received by the children (Table 1). Overall, there is a huge disparity in services received and their perceived quality across districts as shown in chi square statistic and its significance. According to the norm, AWC should open for 4 hours per day and focus group discussion with AWWs reported that they keep their centers open even beyond that. However, maximum respondents claim that the centers are open for only 2 hours a day. Only 9% of all mothers have said that it is open for 4 hours a day, while the figure is far lower in Uttar Dinajpur (only around 3%). Though the AWWs are expected to discuss about growth potential and supplementary nutrition education with the mothers (or caregivers), only 35.98% mothers of children going to ICDS report that AWW actually do so. In case of growth monitoring, the response is even lower (25.4%). As per norms, one egg should be given with *khichri* every day. However, the actual situation is quite different. Out of the 390 households, only 54.21% said that their children are receiving regular egg.

Further explorations suggest that mothers tend to send their children to the ICDS centers primarily to receive some PSE. However, there is utter dissatisfaction with quality of teaching. Only 1.67% at the gross level is satisfied with quality of teaching, with worse picture coming from Uttar Dinajpur. In fact, 15.14% of mothers have informed that no PSE activities take place in AWCs, the figure being almost 40% in Uttar Dinajpur. Twenty percent respondents report that AWWs do not use any teaching learning materials, while for Uttar Dinajpur, the figure is about 47%. In short, the availability of PSE and its quality is unsatisfactory in the surveyed districts, which might result in partial failure of broadening access net of ICDS program. According to norm, there should be at least one mothers' meeting every month per AWC. However, survey results show that around 45% of total respondents experience irregular monthly mothers' meeting.

Table 2 posits the distribution of different treatment variables discussed in previous section. It shows that out of the children with age more than 12 months, 32.82% are going for last 6 months, while 21.54% children reported to visit ICDS for more than 3 days in the preceding week. The share of children visiting AWC for last 6 months in Howrah is higher (the difference being significant at 10% level) than Uttar Dinajpur. Within the two districts, T_4 has widely different coverage in two districts.

The outcome variable, child-stunting, is measured by HAZ score, and it is also found that district characteristics do not really matter much. In Howrah, 47.7% children are stunted, while the corresponding figure is 51.66%. Though Howrah and Uttar Dinajpur have completely different kind of demographic, economic, and human development characteristics, incidence of child nutrition does not vary statistically significantly. Also, the incidence of stunting is not significantly different across income classes and hence reiterates the idea discussed in the first section.

3.2 | Impact of ICDS on height of the program

As indicated in the methodology section, we first run probit regressions taking six treatment variables, which are all binary in nature. They take value 1 if treated and 0 otherwise. The results of probit analysis is reported in Table 3. All the regression models seem to be reasonably good fits, as the LR chi-square figures are high and statistically significant at 1% levels. We here use bootstrapping methods for more robust results. Simple access to ICDS is determined by physical availability in close locality, availability of toilet at the household and the mother's combined status of education and employment. The chance of sending the child to ICDS centers increases significantly when the mother is

TABLE 1 Depth of services across districts as reported by the respondents (% among those who went to ICDS)

Depth of services	Total	Howrah	Uttar Dinajpur	Chi square statistic for district-wise difference test[a]
AWCs open for only 2 hours a day	46.56	33.06	70.59	3.37* (0.04)
AWCs open for at least 4 hours a day	9.00	12.40	3.00	4.35* (0.032)
AWWs discuss about growth process of individual child to their mothers	25.40	21.49	32.35	0.04 (0.829)
AWWs discuss about nutritional information to mothers	35.98	36.66	35.29	0.12 (0.731)
Children receive regular eggs	54.21	79.84	6.06	10.44** (0.01)
No PSE reported	15.14	0.85	40.00	68.19** (0.00)
Quality of PSE good	1.67	2.68	1.00	31.96** (0.00)
No TLM is used for PSE	20.00	5.79	47.00	45.9** (0.00)
Mother's meeting not regularly held	45.00	38.84	55.88	3.93*(0.47)

AWCs = Anganwari centers; AWWs = Anganwari workers; PSE = pre-school education; TLM = teaching learning materials; ICDS = integrated child development scheme.

[a]Chi square statistics and respective *p* values are reported in parenthesis.

**Significant at 1% level.

*Significant at 5% level.

Source: Analysis of primary data

TABLE 2 Distribution of treatment variables and incidence of child stunting across districts

Different treatment variable	Howrah	UD	Total	Chi square statistic for district-wise difference test[a]
T_1: % of children with access to ICDS	51.46	43.71	48.46	2.23 (0.135)
T_2:% children who go to ICDS for last 6 months	35.98	27.81	32.82	2.80* (0.094)
T_3:% children who went to ICDS for 4 or more days preceding week	23.43	18.54	21.54	1.31 (0.253)
T_4:% of children who received eggs for more than 3 days a week	48.95	31.13	42.05	12.07*** (0.001)
T_5:% of children whose mother received information about child nutrition from AWW	18.83	16.56	17.95	0.32 (0.569)
T_6:% of children whose mother received information about child's growth process from AWW	17.57	15.89	16.92	0.18 (0.667)
Incidence of child stunting captured by HAZ scores	47.70	51.66	50.77	0.58 (0.446)
Incidence of severe malnourishment (SAM) captured by MUAC	2.93	3.31	3.08	0.04 (0.831)

AWWs = Anganwari workers; ICDS = integrated child development scheme; HAZ = height-for-age *z* score.

[a]Chi square statistics and respective *p* values are reported in parenthesis.

***Significant at 1% level.

**Significant at 5% level.

*Significant at 10% level.

Source: Analysis of primary data

TABLE 3 Results of probit regression

	T_1: Access to ICDS	T_2: Access to ICDS for last 6 months	T_3: Access to ICDS with regular visits	T_4: Access to ICDS with regular eggs	T_5: Access to ICDS with advice on general nutrition	T_6: Access to ICDS with knowledge of growth of child
District (Howrah ref)Uttar Dinajpur	−0.26	−0.32	−0.12	−0.95***	−0.03	0.01
BPL card holder (Yes ref)	0.1	0.13	0.85**	0.6	0.46	0.26
No						
Perception about availability of AWC in locality (No ref) Yes	2.43***	2.76***	2.21***	2.13***	2.03***	2.89***
Toilet at home (Yes ref)	0.62**	0.45*	0.21	0.79***	−0.25	−0.31
No						
Edu-Emp (illiterate unemployed ref)						
Illiterate employed	0.90**	0.40	0.35	0.62	1.56***	1.29***
Literate unemployed	0.21	0.41	−0.01	0.33	−0.28	−0.21
Literate employed	0.07	0.36	−0.05	0.18	0.49	0.51
Received SNP from AWC when pregnant (No ref) Yes	1.05***	0.91***	1.94***	0.93***	1.57***	1.25***
Child put on early Breastfeeding (Yes ref)	−1.1***	−0.53***	−0.85***	−1.45***	−0.90***	−0.77***
No						
AWW informed about colostrums (No ref)	−0.35	−0.23	−0.25	−0.23	0.47	0.31
Yes						
Received advise from AWW when pregnant (No ref)	−0.01	0.17	−0.29	0.12	0.53	0.47
Yes						
Pseudo R^2	0.20	0.14	0.15	0.23	0.20	0.15
LR Chi^2	109.74***	66.46***	60.21***	119.92***	74.72***	53.26***
No of observations	383	383	383	383	383	383

AWC = Anganwari centers; AWWs = Anganwari workers; ICDS = integrated child development scheme; SNP = supplementary nutritional programs; Edu-Emp = education and employment.

***Significant at 1% level.

**Significant at 5% level.

*Significant at 10% level.

Source: Analysis of primary data

illiterate and employed (coefficient being 0.9, significant at 5% level of significance). The possibility of going to ICDS for the child also increases strongly if the mother had received SNP during her pregnancy period. Breastfeeding of the child improves the chance of the child to reach ICDS as the mother appears to be more well-informed. The results remain more or less similar in case of other treatment variables. However, education and employment status of the mother do not determine much for T_2 and T_4 variables, whereas the district location appears to have a strong association with T_4 where the children with treatment go to ICDS and receive eggs regularly.

The ATT differences between treated and control children with different definitions of treatments are reported in Table 4. The balancing after the matching and common support criteria are checked for each of these treatment effects (Table 5). The latter table shows that the *t* statistic for many variables before matching (unmatched) is significant, showing considerable difference in nature of the treatment and control groups. However, after matching, the sample difference between treatment and control groups is culled out as none of the variables have significant difference between the two groups (as *t* statistic reported is insignificant for all variables after matching). Also, the common support region for each matching was quite large, leaving no treated child unmatched. Results posit that the impact of just having access to ICDS or even consistent access (for last 6 months or 4 days in preceding week) cannot guarantee significant improvement in HAZ score of the children. Rather, when the children have access to services other than *khichuri* (that are expected to be provided always in ICDS), the impact becomes significant. When the child receives eggs regularly, impact of ICDS services ranges from 15 to 16%. However, results that are more dramatic appear when we consider T_6 and T_5. The anthropometric outcome measurement HAZ improves significantly for those children who go to ICDS and whose mothers receives supplementary nutritional information or information about child growth. For both these cases, the difference in *z* score is about 17%, with high statistical significance.

Further, it must be noted that the nearest neighbor matching uses the nearest member of the control group with a member of the treated group in terms of propensity score. It does not, however, mean that each control member is used only once. This is particularly important in case of relatively uncommon treatment variables like T_5 and T_6. For the former, maximum repetition is found for one child in control group, which has been used to match with four different members of treatment group. For the latter, one member from control group has been used maximum for two members in treatment group.

4 | DISCUSSION

While looking at the breadth of the policy, the study finds that on the average less than half of the children were inducted into the program. Surely, this breadth or simply coverage of the program is not at all satisfactory, given the mandate of *univerzalization* of ICDS program since the new millennium. What is interesting is that in spite of considerable difference between the two districts in terms of human development, as well as demographic characteristics, no significant difference emerged between the two districts in relationship with ICDS coverage. Though slightly more share of children report to be visiting AWCs regularly (at least 4 days in the preceding week) in Howrah compared to Uttar Dinajpur, the difference is statistically insignificant. Thus, the utilization behavior of ICDS services too remains invariant across districts. Further analysis portrays that there is also no systematic difference among poor and non-poor households in the choice of ICDS. The apparent food security among the caregivers within the setting probably leads them to opt for ICDS only because of reasons, which are not related to supplementary food supply. This is also reflected when we analyze the reasons behind self-selection into or out of the program. Mothers opt for AWCs primarily because they want some PSE for their children, while others do not send their children mainly under the perception of bad quality of education. Supply of SNP, undoubtedly the central focus of the program delivery, is not thought to be that crucial by the community stakeholders. Surely, there exists a mismatch between the perceptions of provider's side and its users. This very divergence in delivery and acceptance of the policy truncates the coverage and impact of the program.

TABLE 4 ATT difference % of different treatment effects

	Mean HAZ score for treated group	Mean HAZ score for control group	ATT difference	*t* Statistic	ATT difference %
T_1: Children with access to ICDS	41.30	39.32	1.98	0.70	6.64
T_2: Children who go to ICDS for last 6 months	41.12	38.77	2.35	0.91	6.35
T_3: Children who went to ICDS for 4 or more days preceding week	43.63	41.17	2.46	0.74	5.97
T_4: Children who received eggs for more than 3 days a week	42.14	36.57	5.57	1.96	15.23*
T_5 Children whose mother received information about child nutrition from AWW	43.72	37.44	6.28	2.16	16.77**
T_6: Children whose mother received information about her child growth from AWW	43.47	37.23	6.23	2.00	16.73*

AWWs = Anganwari workers; ICDS = integrated child development scheme; ATT = average treatment effects on treated; HAZ = height-for-age *z* score.

**Significant at 1% level.

*Significant at 5% level.

Source: Analysis of primary data

TABLE 5 Percentage bias between treated and control after matching for different treatments

		T_1		T_2		T_3		T_4		T_5		T_6	
Variables		BR	*t*-stat	BR	*t*-stat	BR	*t*-stat	BR	*t*-stat	BR	*t*-stat	BR	*t*-stat
Districts	U		−1.27		−1.52		−1.02		−3.26		−0.46		−0.32
	M	81.4	−0.23	70.6	−0.39	−16.5	1.01	62	1.27	51.5	−0.17	−257	0.92
Regular BPL card holder	U		−0.15		0.19		2.13		0.4		0.58		0.27
	M	−164.1	0.36	−105.1	1.78	79.2	−0.42	100	0	−113.8	0.95	6.8	0.2
Toilet in the house	U		3.24		2.38		1.27		2.93		0.21		−0.04
	M	76.2	0.70	93.3	−0.13	16.2	0.83	41.5	1.53	−358.6	−0.72	−1193.9	0.39
Mother illiterate employed	U		2.68		1.29		1.33		2.02		4.99		4.23
	M	68.8	0.72	100	0	21.5	0.76	−6.7	1.98	83.9	0.41	70.7	0.66
Literate unemployed	U		−0.98		0.18		−0.94		−0.24		−2.93		−2.46
	M	29.4	0.65	−456.1	0.88	79.4	−0.15	50.5	−0.11	85.1	0.36	100	0
Literate employed	U		−0.4		0.15		−0.21		−0.24		0.2		0.34
	M	100	0	−532.2	−0.75	−506.1	1.36	−12.2	0.26	−137.1	−0.34	−199.9	0.83
Food from AWC when pregnant	U		7.83		6.28		6.27		7.3		6.4		5.39
	M	96.8	−0.24	92.7	−0.45	100	0	89.5	−0.8	92.9	−0.56	87	−0.78
Breastfeeding	U		−5.44		−3.03		−4.26		−6.8		−3.29		−3.42
	M	86.8	0.66	85.6	0.38	95.4	−0.16	100	0	100	0	86.7	−0.36
AWW informed about colostrums	U		1.96		1.41		0.93		1.51		3.81		3.13
	M	100	0	57.2	−0.51	56.8	0.32	83.5	−0.23	75.8	−0.68	77.2	−0.52
Food assistance from AWW when pregnant	U		4.22		3.78		2.51		4.12		5.41		4.62
	M	88.8	−0.44	96.1	0.13	92.3	−0.16	61.8	−1.5	100	0	85.1	−0.6

AWC = Anganwari centers; AWWs = Anganwari workers; U = unmatched; M = matched; BR = bias reduction measured by change in bias for each variable before and after matching *t* statistics = whether the *t* test of mean difference in corresponding variable before and after matching is significant or not.

Table 2 clearly posits that the depth of the services offered is extremely low in the program. Though SNP is available regularly, availability of protein component through eggs is low. It varies significantly across districts too. It is really surprising that less than 10% of respondents from Uttar Dinajpur report that their children receive regular eggs from AWC. Implementation leakages, lack of supervision, institutional incapacity, and related bottlenecks, like any other program, have added to the list of barriers of SNP too as pointed out by Allen and Gillespie (2001).

Also, the other services in the program basket, namely, informing caregivers about growth process of the children and imparting them complementary nutritional information, have remained completely under-focused and inadequately delivered.

While trying to calculate the impact, the study has combined the breadth and depth of the program together. Unless the services outlined in program document are actually offered and received, just reaching to the institution is not enough to impart significant positive impact of the program. Thus, we consider three more variables, T_4, T_5, and T_6, combining different services with the simple coverage (Table 1). Using PSM technique, combining both coverage and depth of services is a newer concept for evaluation, and the present study uses this in locating impact of SNP on child malnutrition for the first time. Results confirm that in this apparently food-secure community, just supplementary nutrition program of offering *khichri* cannot bring the children out of the net of malnutrition. Awareness about the growth trajectory of the child and counseling on nutritional information creates far more important pathways to escape from stunted growth process. SNP in AWCs provide only one meal, while all other meals are provided at household level. Hence, good awareness and information on healthy diet as well as hygienic feeding practices can improve the situation in a better way. Here, physical access to AWCs is a necessary but not a sufficient condition for considerable impact on outcome variable. Shallow "depth of services" appears to be one of the "bottlenecks" not only of reaping significant impact but also can be a serious motive not to attend services at all, shrinking the general coverage of ICDS in general.

5 | CONCLUSION

The objective of the paper was to explore why the government's long-term policy intervention in the form of ICDS has remained unsuccessful to in reducing child stunting in a typically under-developed, yet food secure, setting of West Bengal, India. It attempts to capture the difference in anthropometric HAZ score of treated children receiving exposure at ICDS centers, compared to those who were not treated. However, the uniqueness of the paper is that it identifies treatment as not just have access to ICDS, rather having access to several kinds of services under ICDS. Ranging from having access regularly to having access consistently for last 6 months, the treated children do not really benefit much. However, whenever they receive access as well as nutritional information and awareness at AWC, their HAZ scores differ significantly from their control group. Also, those who receive eggs regularly have better growth trajectories than who do not. In these cases (except the first simple one with just having access to ICDS at the time of survey), the control groups consist of two sets of children; those who did not go to ICDS at all and those who go to ICDS, yet do not receive the corresponding service. The latter group, though reached the ICDS centers and received SNP, did not actually got treated in real sense as they were not offered other related services.

These results are of crucial significance for the policy. *Firstly*, it is not just the breadth of the policy that needs to be enhanced, rather the depth of services should be improved simultaneously. *Secondly*,

the ICDS program focuses solely of SNP, neglecting other components like PSE and awareness generation. Lack of quality of PSE in fact repeals the potential beneficiaries, because this setting is a rather food-secure community where caregivers overwhelmingly opine that there is enough food for their children at home. This demand–supply mismatch puts serious barrier in expanding the breadth of the policy. *Thirdly*, given the knowledge of large-scale protein energy deficiency among the Indian children, the importance of eggs in SNP is crucial. Further deep dive into analysis shows that as the number of supervision at the ICDS centers increases, the proportion of households receiving regular eggs also increases. This result posits that supervision is extremely important for getting maximum impact of ICDS services. *Finally*, the impact of simultaneous receipt of supplementary food and complementary nutritional education results in significant improvement in child growth process. In short, the complementary programs of nutritional awareness and community-based food supply together appear to break the intractable barrier of child malnutrition in a developing, but food-secure, setting in India.

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CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

While AD conceptualized the paper and analysed primary data, SG was instrumental in collecting the primary data and do the descriptive analysis.

REFERENCES

Allen, L. H., & Gillespie, S. R. (2001). "What works? A review of the efficacy and effectiveness of nutrition interventions". *UN Administrative Committee on Coordination Subcommittee on Nutrition, in collaboration with the Asian Development Bank*. Manila.

Asher, M., & Bali, A. S. (2015). Public pension programs in Southeast Asia: an assessment. *Asian Economic Policy Review*, *10*, 225–245. doi: 10.1111/aepr.2015.10.issue-2

Bhutta, Z. A., Ahmed, T., Black, R. E., Cousens, S., Dewey, K., Giugliani, E., & Haider, B. A. (2008). What works? Interventions for maternal and child undernutrition and survival. *The Lancet*, *371*(9610), 417–440.

Dehejia, R. H., & Wahba, S. (2002). Propensity score-matching methods for nonexperimental causal studies. *The Review of Economics and Statistics*, *84*(1), 151–161.

Deolalikar, A. B. (2005). Poverty and child malnutrition in Bangladesh. *Journal of Developing Societies*, *21*(1–2), 55–90.

Dewey, K. G., & Adu-Afarwuah, S. (2008). Systematic review of the efficacy and effectiveness of complementary feeding interventions in developing countries". *Maternal & Child Nutrition*, *4*(s1), 24–85.

Government of West Bengal (2007). *District handbook*. Kolkata: Bureau of statistics.

Hossain, M., Naher, F., & Shahabuddin, Q. (2005). Food security and nutrition in Bangladesh: Progress and determinants. *Electronic Journal of Agricultural and Development Economics*, *2*(2), 103–132.

Jain, N., Singh, A., & Pathak, P. (2013). Infant and child mortality in India: Trends in inequalities across economic groups. *Journal of Population Research*, *30*(4), 347–365.

Kandpal, E. (2011). Beyond average treatment effects: Distribution of child nutrition outcomes and program placement in India's ICDS. *World Development*, *39*(8), 1410–1421.

Khandekar, S., Gayatri, K., & Hussain, S. (2010). "*Handbook on Impact Evaluation: Quantitative Methods and Practices*". Washington DC: The World Bank.

Lokshin, M., Gupta, M. D., Gragnolati, M., & Ivaschenko, O. (2005). Improving child nutrition? The integrated child development services in India. *Development and Change*, *36*(4), 613–640.

Marmot, M., Friel, S., Bell, R., Houweling, T. A. J., Taylor, S., & Commission on Social Determinants of Health (2008). Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet*, *372*(9650), 1661–1669.

Martorell, R., & Ho, T. J. (1984). Malnutrition, morbidity and mortality. *Population and Development Review*, A Supplement to Vol*10*, 49–68.

Onis, M., Dewey, K. G., Borghi, E., Onyango, A. W., Blössner, M. D., Piwoz, B. E., & Branca, F. (2013). The World Health Organization's global target for reducing childhood stunting by 2025: Rationale and proposed actions. *Maternal & Child Nutrition*, *9*(S2), 6–26.

Radhakrishna, R., & Ravi, C. (2004). Malnutrition in India: Trends and determinants. *Economic and Political Weekly*, 671–676.

Sathyamala, C., Kurian, N. J., De A. Saxena, K. B., Priya, R., Baru, R., Srivastava, R., … Samson, M. (2012). Public reports on health: Some key findings and policy recommendations. *Economic and Political Weekly*, *47*(21), 43–54.

Selvaraj, S., Mukhopadhyay, I., Kumar, P., Aisola, M., Datta, P., Bhat, P., … Pachauli, C. (2014). *Universal access to medicines: Evidence from Rajasthan* (pp. 289). India: *WHO*.

Sukhatme, P. V. (1982). Poverty and malnutrition. In P. V. Sukhatme (Ed.), *Newer concepts in nutrition and their implications for policy* (pp. 11–64). Pune: Maharashtra Association for the Cultivation of Science.

UNDP. 2004). State human development report of West Bengal. www.undp.in

World Bank Independent Economic Group (2010). *What can we learn from nutrition impact evaluations? Lessens from a review of interventions to reduce child malnutrition in developing countries*. Washington DC.

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