Use of the Essential Nutrition Actions framework improved child growth in Bangladesh

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Abstract

The Essential Nutrition Actions (ENA) framework is an evidence-based set of cost-effective, integrated tools for training health and community workers to promote optimal nutrition practices for the first 1,000 days. This ENA pilot project (ENAPP) was implemented with United States Agency for International Development (USAID) funding from August 2008 to September 2009 in six unions of the working area of an existing USAID-funded, Title II programme in southern Bangladesh. ENAPP, which targeted governmental and non-governmental service providers, was intended to strengthen the behaviour change component of the nutrition strategy of this project. Following a qualitative review of ENAPP's activities, this evaluation uses administrative (growth monitoring) data and propensity score matching of pre-intervention characteristics to create multiple counterfactuals for difference-in-difference estimations of the impact of ENAPP on child nutritional status. Records indicated that government and community healthcare workers received intensive training, and these staff reported that they could effectively integrate ENA messages into their existing responsibilities. Both longitudinal and cross-sectional analyses indicate that ENAPP was successful in increasing children's weight-for-age z-scores, and the difference in z-scores between the treatment and the comparison group increased with time. The materials and methods used in this pilot project should be scaled up, based on the success of these tools and the project's ability to link with and influence the local health system.

KEYWORDS

early childhood nutrition, ENA, growth monitoring, nutrition mainstreaming, propensity score matching

1 | INTRODUCTION

The Essential Nutrition Actions (ENA) approach is an evidence-based, cost-effective, integrated training and communications toolkit for building the knowledge and skills of health and community workers to promote adoption of optimal nutrition, health—and more recently water, sanitation, and hygiene—practices. ENA focuses on the critical first 1,000 days from pregnancy to the child's second birthday when nutrition foundations for life are established. The approach

encompasses improved nutrition for women, optimal infant and young child feeding practices, nutritional care for sick and malnourished children, the integrated control of anaemia, and other micronutrients such as vitamin A, iron, folic acid, and iodine through supplementation and counselling for improved dietary choices (CORE group, 2011; WHO, 2013). ENA was developed by the World Health Organization (WHO), UNICEF, and the United States Agency for International Development (USAID) to strengthen nutrition services both within and outside of the health sector, and it has been tested, validated,

and updated by civil society organizations over the past 20 years (Guyon et al., 2009; WHO, 2013).

ENA promotes key nutrition actions at critical contact points in the lifecycle, including antenatal care, delivery, postpartum care, well- and sick-child care, and immunizations. Behaviour change messages are repeated and reinforced through multiple channels, including interpersonal counselling, mass media, and community mobilization. The approach aims to deliver nutrition messages through all available platforms across relevant sectors from health to agriculture and water resources. Due to the multiple platforms utilized, ENA requires extensive networking with institutions, service providers, and community-level workers to help them identify opportunities to incorporate ENA into their contacts with caregivers.

ENA has been nested into government systems in Benin, Niger, Mali, Senegal, Ethiopia, and India and added to existing multisectoral projects in Madagascar, Bolivia, and Nigeria (Acharya et al., 2004; Baker, Sanei, & Franklin, 2006; Guyon et al., 2009; Jennings, Hirbaya, & Food and Nutrition Technical Assistance (FANTA) Project, 2008). It has also been scaled through community systems and Peace Corps in Benin, Gambia, Guinea, Senegal, and Sierra Leone (SPRING, 2014). Perhaps due to the use of the ENA framework integrated into existing systems, there have been few evaluations of these interventions as a package. Evaluations using a pre-post design (Baker et al., 2006) undertaken through the LINKAGES programme in Bolivia and Madagascar pointed to large changes in behaviour, but rigorous evaluations that include measures of child growth have been limited. In this paper, we describe an ENA pilot project (ENAPP) undertaken in Bangladesh, summarize ENAPP's reported impact on service providers and caregivers, and estimate the impact of ENAPP on child growth using double difference estimation on propensity-matched samples.

1.1 | THE ENA PILOT PROJECT

ENAPP was implemented with USAID funding from June 2008 to September 2009 in six unions of two sub-districts in the working area of an existing USAID-funded Title II programme, Jibon-o-Jibika (JoJ). JoJ was implemented by Save the Children, Helen Keller International (HKI), NGO Forum, and 14 local non-governmental organizations (NGOs) in 13 sub-districts in Barisal Division. ENAPP aimed to further improve JoJ's nutrition and health outcomes through a series of trainings on the ENA approach. Working with more than 200 community workers and NGO staff, the project aimed to improve the nutritional status of an estimated 5,600 pregnant and lactating women and their children over a 1-year implementation period. Due to the short implementation period, ENAPP areas were purposively selected for ease of access and strength of NGOs in the areas (Figure 1).

HKI undertook the implementation of ENAPP based on the success of ENA in other countries and on the applicability of ENA to the nutrition situation in Bangladesh. ENAPP filled a need identified by the midterm evaluation of JoJ: an increased emphasis on behaviour change communication techniques was necessary to change nutrition-related practices. The midterm evaluation found that the nutrition education methodologies used were lecture-oriented, rather than participatory and consultative, with sessions focused on message delivery

Key messages

- An Essential Nutrition Actions Pilot Project (ENAPP) in southern Bangladesh was associated with improved child weight-for-age z-scores in project areas.
- ENAPP worked through the governmental health system, non-governmental organizations (NGOs), and community health volunteers to reach caregivers, their spouses, and mothers-in-law through repeated contacts at the individual, household, and community level.
- Challenges included maintaining linkages and motivation across government, NGOs, and volunteers and reaching mothers in the post-partum period.
- More research is needed to assess impacts on other outcomes and on the sustainability of this model.

instead of on problem-solving, listening, and experience sharing. To address this, HKI proposed ENAPP to strengthen the skills of health and community agents to more effectively counsel and negotiate with the target population about health and nutrition at key contact points (Helen Keller International, 2009).

The initial implementation phase involved networking with government institutions and local service providers, both within and external to JoJ. HKI conducted a stakeholder analysis to identify the operationally important NGOs in the project area and to invite them to participate. ENAPP established linkages with government health facilities and health providers such as the Expanded Program on Immunization (EPI) centres, family welfare assistants (FWAs), and health assistants (HAs), offering training to strengthen capacity and improve service delivery. The project also organized a series of programme review workshops to promote a dialogue on ENA and its incorporation into organizations' ongoing activities. Ultimately, ENAPP's network of partners included government and NGOs providing services from health to microfinance to disaster preparedness, all incorporating ENA into their work.

One key conduit of outreach was through community health volunteers (CHVs), supported by JoJ. Under JoJ, CHVs conducted monthly courtyard discussion sessions and individual home-based counselling. The courtyard sessions were open to all but were targeted to pregnant women and mothers of young children, as they covered nutrition topics relevant to the first 1,000 days of life. The ENAPP training taught CHVs to conduct these sessions using more interactive methodologies such as visual aids, games, role play, and group activities. In the home-based counselling, CHVs provided individually tailored counselling to mothers and other family members and helped to problem-solve specific challenges or obstacles to behaviour change. Home visits also gave mothers an opportunity to bring up issues too personal to share in a community session.

Successful behaviour change requires not only outreach to targeted individuals—in this case, caregivers—but also to others who influence them and provide the necessary social support to bring

FIGURE 1 Map of the ENAPP areas within the JoJ working area. ENAPP was implemented in a subset of the unions where HKI was working in Patuakhali and Barisal Districts. Counterfactuals were constructed from children in other unions in Patuakhali and Barisal Districts where HKI was working. . ENA: Essential Nutrition Actions; ENAPP: ENA pilot project; HKI: Helen Keller International; JoJ: Jibon-o-Jibika

about change (Storey & Figueroa, 2012). For example, mothers-in-law, who are traditionally highly influential in household practices in rural Bangladesh, were invited to join courtyard sessions and to receive individual counselling. Husbands received messages when they accompanied their wives to antenatal care visits or when CHVs made home visits. In addition, special community sessions for men and mothers-in-law were organized, with men's sessions held in the evenings, after working hours. In addition, ENAPP attempted to generate community support through organizing events such as celebrations with folk songs during Breastfeeding Week.

The ENAPP training modules were developed by HKI-Bangladesh with support from external consultants based on existing ENA materials. The modules were adapted to suit the Bangladeshi context, with differing levels of technical information for different training groups. The most comprehensive trainings included information on

the nutrition situation in Bangladesh, emphasizing breastfeeding and complementary feeding, feeding of sick or recovering children, nutrition for adolescent girls and pregnant or lactating women, the lactational amenorrhea method of family planning, nutritional deficiencies, kangaroo mother care, counselling skills, special situations such as preterm births or twins, and micronutrient needs of women and children.

A total of 21 trainings were conducted between October 2008 and August 2009 (see Table S1 for a complete list of trainings). After a training-of-trainers programme in October 2008, materials were further adapted, and initial field-level training was conducted between December 2008 and March 2009. A round of refresher trainings were conducted between May and August 2009. The majority of those trained were CHVs. Training attendance was high with the vast majority of CHVs attending both basic and refresher trainings.

2 | METHODS

Due to the project's structure as supplemental to an ongoing programme, a comprehensive evaluation for ENAPP was not planned at project start. At project close, an external consultant conducted an adequacy performance evaluation to assess the performance of ENAPP in three areas: provision of training (i.e., whether training was available, accessible, and of adequate quality), utilization of training (i.e., whether people chose to attend the trainings), and coverage (i.e., whether the target population was reached; Habicht, Victora, & Vaughan, 1999). This evaluation relied on organizational and programme records, qualitative monitoring data collected during project implementation, qualitative data collected by a small field team at end line, and statistics taken from the baseline and end line survey of the JoJ programme (Sinharoy, 2009). Qualitative monitoring data consisted of notes from observations of counselling sessions; the notes recorded issues and problems discussed, counselling strategies used, and specific solutions offered by the health worker. End line qualitative data collection consisted of semistructured, key informant interviews (KIs) of frontline staff supervisors, and 12 semistructured focus group discussions (FGDs) with frontline workers and targeted individuals. The frontline workers included all categories of individuals who had been included in ENA training. Both the KIs and FGDs followed guides; the FGD guide included questions specific to each category of worker. Due to resource constraints, the end line qualitative methods did not include full transcription and translation of KIs and FGDs. Responses were summarized in notes, which were reviewed and subsequently entered into a computer. Key themes were then extracted from these notes.

2.1 | Quantitative data

To estimate impact, we used administrative data collected monthly at growth monitoring and promotion (GMP) sessions for all children under the age of two who were born to JoJ project participants. For the period from April 2008 to September 2009, all data were digitized and available for secondary analysis. The data set contained repeated observations of the weights of all children as well as child sex, area of residence, and age in months. We obtained data from 15 unions, the six in which ENAPP was implemented and nine from adjacent areas (Figure 1).

2.2 | Data processing

The GMP data contained the given age of the child in months but did not contain the exact date of birth of the child. After estimation of a standard birthdate, weight-for-age z-scores (WAZ) were calculated using the 2006 WHO growth reference (World Health Organization & WHO Multicentre Growth Reference Study Group, 2006).¹ Observations with WAZ outside the plausible range (-6 standard deviation [SD] to $+5$ SD) were dropped (116 of 231,250 observations, $<0.1\%$). The growth monitoring data included information about the EPI

centre, the first level of Bangladesh's government health service, to which the child was assigned. The evaluation period of April to September covers the period immediately after the initial field-level trainings took place and is the season in which food was most scarce.

2.3 | Statistical methods

Due to the non-random selection of working areas for ENAPP, we undertook propensity score matching of pre-intervention characteristics to create post-intervention counterfactual conditions on the individual and community level using the *psmatch2* command (Leuven & Sianesi, 2003). In line with recommendations, we used the *descending* option to derive an optimal matching structure, and the calliper length for matching was set at one-quarter of the square root of the SD of the propensity score (Stuart & Rubin, 2008).

We performed propensity score matching using data from the eight months of April 2008 through November 2008, before training began in implementation areas. Child-level matching was undertaken on children born from July 2007 to November 2008 who had no more than six records missing after their first recorded GMP session. Children were grouped into cohorts by district and month of birth. They were matched by cohort using child sex and the first eight records of WAZ, with dummy variables indicating when records were missing. We also did EPI-level matching: communities were stratified by district then matched by EPI centre on the mean WAZ (adjusted for child age, month of assessment, and child sex), prevalence of underweight (adjusted for child age, month of assessment, and child sex), and the average number of children monitored. Both matched samples contained an even variance on the child and EPI level between the treatment and control groups (Stuart & Rubin, 2008).

We undertook all analyses after adjusting for clustering on the EPI centre and child level using the multilevel *mixed* command in Stata 13.0. Difference-in-difference results were estimated using standard interaction terms (Khandker, Koolwal, & Samad, 2010).

3 | RESULTS

In FGDs with frontline workers, such as FWAs, HAs, CHVs, and NGO workers, feedback about the quality of the ENAPP training was overwhelmingly positive. Although the ENA knowledge level varied among trainees, all said that they had learned new information, most often breastfeeding techniques and kangaroo mother care. Nearly all FGD participants said that they had been able to apply the training in their work, and many were using their new skills and knowledge in conversations with colleagues, friends, and family. Many stated that the material had improved service delivery. Most NGO staff who were not working in health said that they also had been able to use ENA. For example, one had integrated nutrition into microcredit and income generation programmes by explaining to mothers that they and their children needed to consume nutritious diets to be healthy and productive. Throughout the qualitative work, trainees said that they would have wanted the trainings to be longer so that they could have learned more.

Although frontline workers were overwhelmingly positive in describing their experiences in incorporating the knowledge and skills into their work, their supervisors were often less favourable. Several

¹As the data set's age variable was expressed in running months and not completed months, the child date of birth was defined as $date_{birth} = date_{first\ record} - [(age_{month},\ first\ visit - 0.5) \times 30.4375]$.

supervisors said in individual interviews that ENAPP had meant more work for their staff, with a need for additional motivation or incentives to perform job responsibilities properly. Some suggested needing additional funding or more staff, and others said that the project should have hired a specialized person to supervise, train, and help manage these additional ENA activities.

In FGDs, mothers reported learning new information from CHVs, particularly about infant and young child feeding. Mothers in multiple FGDs said that they had learned about timely initiation of breastfeeding and exclusive breastfeeding from CHVs and that, prior to learning this information, they had been feeding other liquids to newborns (e.g., goat's milk, honey, and water) following birth. Similarly, in interviews, mothers demonstrated knowledge of actions relating to nutrition during pregnancy and the immediate postpartum period, although they were less knowledgeable about actions recommended for older infants and young children. For example, there was rarely any mention of appropriate feeding of sick or malnourished children or of maternal nutrition during lactation. Mothers recalled messages about the importance of iodine but recalled substantially less about other micronutrients. They also reported that it was more difficult to practice some of the other behaviours, such as resting during pregnancy and feeding five meals a day to older infants and young children, due to a lack of time and other resources.

When asked about counselling mothers-in-law, CHVs and others reported that their strategy was to explain that investing in the health of the mother is investing in the health of the grandchild. They also reminded the mothers-in-law of their own experiences with children who became ill or died and explained that the same did not have to happen to their grandchildren. Similarly, CHVs counselled husbands about food purchases as they were most often responsible for household spending. In FGDs, husbands, in turn, expressed that they had been trying to ensure better diets for their pregnant wives, by both purchasing and growing the foods that were recommended by the CHVs. Both husbands and wives reported that the evening sessions for men were very valuable, and wives additionally reported that husbands helped more with housework after receiving advice from CHVs.

Caregivers reported respecting the staff trained through ENAPP. When asked in household interviews why they trusted the advice of the CHVs, the most common answer was that the CHVs had consistently given them good advice and had proven to be reliable. Several caregivers also said that the CHVs' advice had been corroborated by other health service providers or by messages they had seen on TV. Similarly, FWAs, HAs, and NGO workers had established themselves in the target communities over a period of many years.

3.1 | Quantitative impact assessment

The project proposal outlined indicators that the project had hoped to move, but due to resource and time constraints, these indicators were not measured for the ENAPP areas exclusively. Due to the small ENAPP implementation area (relative to JoJ as a whole), the early timing of the JoJ end line, and a sampling structure that changed between the baseline and end line, there was not sufficient sample size to reanalyse these data to track how changes in behaviour differed between the ENAPP and other JoJ areas. From the end line report, we have evidence that JoJ did positively impact nutrition behaviours (Table 1), but these data do not allow an estimate of the extent to which ENAPP supported these changes.

However, JoJ growth monitoring data does enable us to estimate the impact of the program on WAZ. Table 2 presents descriptive statistics for the entire GMP sample of 23,964 children in 343 EPI centres, as well as the characteristics of the matched subsamples. The number of observations was roughly equivalent across the months of measurement (not shown), but there were more births in the winter season compared with the monsoon season. The sample was evenly divided between male and female children. In the full sample, there was a roughly equal number of treatment and control children in Barisal but around double as many control children as treatment children in Patuakhali.

Table 2 also indicates the implications of the matching systems. For child matching, children could only be matched if they were born before the start of ENA training in December 2008 and if they were young enough to have observations after the initial field-level ENA training ended in March 2009. This resulted in a younger sample at the outset that aged over the period of analysis. In contrast, the EPI-centre matching method included a cross section of child ages at each observation point. Both matching systems created samples roughly equal between the two districts, though the EPI matched sample contained more children in Patuakhali. Child matching was limited to children with no more than six records missing, resulting in more observations per child in this matched subsample compared with the whole sample and children matched by EPI.

As shown in the upper half of Figure 2, there were systematic differences in child growth between the ENAPP areas and nearby control areas, even before the implementation of ENAPP. Children in ENAPP areas had better weight-for-age outcomes in all months. Matching methods reduced these differences in the period before the project was implemented but could not fully eliminate them. WAZ varied by season, but, for the whole sample, weight outcomes improved over the period. Between April 2008 and April 2009, mean WAZ for the whole sample rose significantly by 0.12. This trend was also seen in

TABLE 1 Baseline and end line estimates of promoted behaviours, JoJ programme (2005 to 2009)

	Baseline	End line
Exclusive breastfeeding among children aged 0–5 months	30% (n = 1236)	64% (n = 604)
Children receiving the same or extra food during illness	57% (n = 1065)	80% (n = 482)
Women making 3+ antenatal care visits during pregnancy	37% (n = not given)	95% (n = not given)
Women eating more during pregnancy	18% (n = 4715)	62% (n = 2821)

Note. Source from Langworthy, 2009. Other prioritized indicators that were not included in the final report include continued breastfeeding to 2 years of age, dietary diversity for children 6 to 23 months of age, and women eating more during lactation. JoJ: Jibon-o-Jibika.

TABLE 2 Descriptive statistics

	All observations				Child matching				EPI matching			
	ENAPP		Control		ENAPP		Control		ENAPP		Control	
	#	%	#	%	#	%	#	%	#	%	#	%
Observations per child												
Mean	9.7		9.6		15.1		15.1		9.7		9.6	
Children	9,398		14,566		3,138		3,138		8,712		8,743	
Birth month												
Apr-June 2006	384	4	590	4		0		0	355	4	375	4
July-Sept 2006	633	7	979	7		0		0	596	7	603	7
Oct-Dec 2006	877	9	1,402	10		0		0	826	9	833	10
Jan-Mar 2007	723	8	1,114	8		0		0	669	8	692	8
Apr-June 2007	617	7	970	7		0		0	574	7	618	7
July-Sept 2007	677	7	1,025	7	460	15	460	15	628	7	657	8
Oct-Dec 2007	1,076	11	1,644	11	849	27	849	27	998	11	981	11
Jan-Mar 2008	917	10	1,270	9	676	22	676	22	840	10	755	9
Apr-June 2008	650	7	978	7	481	15	481	15	605	7	592	7
July-Sept 2008	624	7	946	6	448	14	448	14	574	7	551	6
Oct-Dec 2008	815	9	1,222	8	224	7	224	7	744	9	715	8
Jan-Mar 2009	637	7	1,107	8		0		0	588	7	630	7
Apr-June 2009	465	5	826	6		0		0	435	5	468	5
July-Sept 2009	303	3	493	3		0		0	280	3	273	3
Male	4,759	51	7,470	51	1,577	50	1,589	51	4,408	51	4,467	51
District												
Barisal	4,761	51	5,056	35	1,557	50	1,557	50	4,108	47	3,969	45
Patuakhali	4,637	49	9,510	65	1,581	50	1,581	50	4,604	53	4,774	55
EPI centres	140		203		140		202		130		130	

Note. ENAPP: Essential Nutrition Actions pilot project; EPI: Expanded Program on Immunization.

the EPI centre matched sample but not in the matched children sample. The decline in the matched children sample is linked to their aging over the period.

The lower half of Figure 2 displays the slope of mean WAZ in the same months between the 2 years; after ENA training, mean child WAZ in the overall and EPI matched samples trend upwards, in contrast to the preceding year when they were largely flat. For the matched child sample, both periods show a decline in WAZ, but the slope for the treatment group after the training is shallower than the previous year.

In difference-in-difference models (Table 3), treatment areas had consistently better scores, even after matching. Simple double difference estimates indicate that WAZ improved slightly but significantly in the ENAPP areas after training, with a difference ranging from 0.03 in the unmatched and EPI matched samples to 0.05 in the child matched sample. To further test the plausibility of ENAPP driving these results, we examined these double difference impact estimates by month. A delayed impact is expected from behaviour change programmes, where families take time to learn and then adopt new practices. In the unmatched and EPI matched samples, this difference was not seen until 3 months after the training ended in July, whereas in the child matched sample, this impact began right at the end of training in April and grew larger over time.

4 | DISCUSSION

In this programme, government and community workers received intensive additional training, intended to enable these workers to integrate ENA and counselling for behaviour change skills more effectively into their existing roles. Workers reported appreciating the newly designed participatory curriculum and incorporating the knowledge and skills gained into their routine activities. The JoJ project, as a whole, led to improvements in behaviours related to ENA (Table 1). In addition, analysis of GMP data indicates that ENAPP was successful in further increasing children's WAZ compared with areas that received only the standard JoJ intervention (Table 3). In line with an ENAPP-driven impact, the size of the difference in z-scores between the treatment and the comparison groups increased with time.

WAZ has historically been considered an important indicator of undernutrition due to its strong positive associations with disease burden and mortality in infants and young children (Black et al., 2008). Millennium Development Goal 1 (eradicate extreme poverty and hunger) included a reduction in the prevalence of underweight, which is calculated based on WAZ, as one of its targets (United Nations, 2015). However, low weight-for-age can be a consequence of both acute undernutrition (e.g., due to acute illness or short-term food shortages) and chronic undernutrition (e.g., repeated illness or

FIGURE 2 Trends in average WAZ in ENAPP working and comparison areas. The top panel displays mean WAZ by treatment status over time for the sample as a whole and for children in the EPI and child matched samples. The lower panel compares treatment and control groups by matching system in the same months before and after the training period. ENAPP: Essential Nutrition Actions pilot project; EPI: Expanded Program on Immunization; WAZ: weight-for-age z-score

inadequate diets over a longer term; Black et al., 2008). For this reason, nutrition studies now typically use separate indicators for acute and chronic undernutrition rather than underweight to assess child nutritional status. In the case of ENAPP, it is not clear from the data whether improvements in WAZ may have been due to reductions in acute undernutrition, chronic undernutrition, or both.

The results of the difference-in-difference analysis suggest that children living in ENAPP areas had WAZ that were 0.06 SDs higher after the programme than children living in the JoJ areas that were not part of ENAPP around 6 months after initial training. In South Asia, there are a limited number of other studies with measures of nutritional status and rigorous evaluation methods against which we can put these results in context (Bhutta et al., 2013; Lassi, Das, Zahid, Imdad, & Bhutta, 2013). The two studies identified were from smaller, prospective trials, and our impact is 20% to 30% of that seen in these projects. In addition, we do not have the behavioural outcomes included in these studies (Kilaru, Griffiths, Ganapathy, & Ghosh, 2005; Roy et al., 2007). Although our estimated effect size is modest, it has implications for important health, education, and economic impacts at the population level over the short and long term. In addition to associations with disease burden and mortality, WAZ at 2 years of age has been associated with attained schooling, with each improvement of one SD being associated with 0.52 years of attained schooling (Victora et al., 2008). This is

weaker than the association between height-for-age z-score and attained schooling but nevertheless has implications for adult income.

Increases in weight without concurrent improvements in height have also been associated with adverse outcomes. However, these adverse associations have been observed primarily with rapid weight gain in midchildhood and adulthood, not in the first 2 years of life (Adair et al., 2013). ENAPP targeted mothers of children under age two, and the mean WAZ in our sample was negative (maximum monthly average of -0.8), indicating a need for weight gain to normalize children's WAZ. Given that the GMP activities did not include measurement of length, it is not possible to determine whether ENAPP resulted in concurrent improvements in linear growth. However, in this case, weight gain in our sample population does not pose a risk of adverse health outcomes.

We hypothesize that these improvements in WAZ may have been achieved through several pathways. Primarily, improved infant feeding practices, both breastfeeding and complementary feeding, may have resulted in better weight gain (and less weight loss due to illness), as is evidenced by the larger and earlier impact among children who were transitioning to complementary foods during training. Secondly, improved dietary intake during pregnancy may have resulted in higher birth weight. Although this pilot project did not collect quantitative data to document these pathways, qualitative data support these

TABLE 3 Estimated impact on WAZ

	All observations		Child matching		EPI matching	
	Coefficient	<i>n</i>	Coefficient	<i>n</i>	Coefficient	<i>n</i>
Simple difference-in-difference estimates ^a						
Treatment area	0.12*	231,134	0.08**	94,940	0.09*	168,285
Double difference	0.03*		0.05*		0.03*	
Month-wise difference-in-difference estimates ^b						
Treatment area	0.13*	231,134	0.07**	94,940	0.09*	168,285
Double difference						
December	−0.03*		−0.01		−0.01	
January	−0.02***		0.02		0.01	
February	−0.03*		0.01		−0.01	
March	−0.02***		0.02***		−0.01	
April	0.00		0.04*		0.01	
May	0.00		0.04*		0.02	
June	0.01		0.04*		0.02	
July	0.03*		0.06*		0.04*	
August	0.03*		0.07*		0.05*	
September	0.04*		0.08*		0.06*	

Note. All models also control for child age in days, child sex, district, and a series of dummy variables for each month of measurement. Models were clustered on child and EPI centre levels. EPI: Expanded Program on Immunization; WAZ: weight-for-age z-score.

^aThe double difference variable took a value of one if the time period was after training and a zero otherwise.

^bDouble difference variables were the interactions between month of measurement and treatment for all months after training began in December.

* $P < 0.01$. ** $P < 0.05$. *** $P < 0.1$.

hypotheses. Future projects should plan to collect data to document potential pathways of impact, as has been done in the Alive and Thrive programme where the intervention found significant impacts on exclusive breastfeeding, consumption of iron and folic acid, and dietary diversity (Nguyen et al., 2017).

A major strength of ENAPP was its multifaceted approach. Successful behaviour change strategies require utilization of multiple channels of communication, partnership both within and beyond the health sector, involvement of respected community members, and an understanding of the local context (Fabrizio, van Liere, & Pelto, 2014; Sanghvi, Seidel, Baker, & Jimerson, 2017); all were in place for ENAPP. ENAPP worked to build and strengthen partnerships between the government, NGOs working in a variety of sectors, and community health workers, to ensure harmonized promotion of ENA. The project utilized both individual and group or community level strategies, from counseling in women's homes to peer group meetings to community events. This combination ensured that mothers had heard ENA messages in a variety of formats and from a variety of sources, reinforcing the actionable information. Finally, ENAPP targeted an extended network of key influencers. Knowing the important role that family members play in household decision making in rural Bangladesh, the project aimed to influence not just mothers but also their husbands and mothers-in-law.

ENAPP training provided accurate, in-depth information, using hands-on and interactive methods and practical exercises to engage trainees who were already trusted in their communities and build their knowledge and skills. The project was responsive to ongoing training needs, offering refresher trainings to reinforce knowledge and skills. ENAPP also went beyond training to deliver appropriate supervision and feedback.

The main challenge to successful implementation of ENAPP was the extensive time and effort required leading up to the trainings, coupled with the short timeline. The preparatory phase of the project lasted for the entire original project period of 1 year. Although the strategy of inviting NGOs working in the local area who were not part of the existing JoJ consortium to participate in ENAPP had strengths, it presented some challenges as well. Some project partners had stronger capacities and motivation levels to carry out the project objectives. Supervisory staff in both districts expressed frustration that ENAPP had expanded CHVs' workload, giving them more topics to cover and more households to reach, and reported that the CHVs were having difficulty fulfilling their original job responsibilities.

ENAPP emphasized reaching targets through linkages with as many key contact points as possible, but some contacts were more heavily utilized as message delivery points than others. For example, a majority of mothers made regular antenatal care visits and received information about pregnancy, but most delivered their babies at home, often with only relatives or unskilled attendants. Thus, their contact with health service providers was lower at delivery, and attendance at postnatal care was also lower than at antenatal care. Perhaps for this reason, mothers were less knowledgeable about certain actions that become relevant after their children's birth. In this sense, the project missed opportunities to establish linkages and reach mothers at key contact points, particularly at childbirth and postpartum.

A closely related issue is that the project offered a great deal of information to persuade mothers to adopt new practices, but it was less successful in building a system to provide sustained support to help them overcome obstacles as they arose. Some practices, such as exclusive breastfeeding for six months, must be sustained.

Increased support to overcome breastfeeding challenges could come from CHVs, other health workers, or the woman's own family and community, but the length of the project did not allow this comprehensive support system to completely develop.

The project would have been benefited from additional data collection, both before implementation and throughout the project period. Accurate baseline quantitative data would have allowed project planners to gauge which behaviours needed emphasis. Qualitative formative research would have assisted the programme in identifying the values, beliefs, and practices that most strongly influenced behaviour. In addition to enabling a more robust impact evaluation, data collection would have enabled enhanced coordination between institutions at all levels. Increased coordination and communication would have helped to maintain commitment and engagement and encourage greater harmonization of messages, enabling extra energy to be focused on actions that had obstacles to their adoption and maintenance.

Despite these programmatic limitations, there is evidence that ENAPP did increase child growth in the near term. The observed impact was in line with the training timeline, though modest. Still, the short time frame in which this impact occurred is promising. Additional growth monitoring data for October 2009 and later were not available, so it was not possible to see if child WAZ continued to improve after the project period had ended.

Our quantitative analysis had data limitations as we tried to maximize what we could learn through administrative data sources. The effect would not have been detectable at the sample sizes typically used in surveys. In addition, we have no measures through which to better understand the behavioural pathways through which the observed growth improvements occurred. For matching procedures and subsequent regression analysis, there was a limited number of covariates available. Time discontinuity design was originally considered but could not be executed as many health workers shared the same name and there were not unique CHV identifiers. The only child nutrition variable for which data were available was WAZ. Data on other administrative features, including CHV characteristics (age, education, years of experience, etc.), were collected but were incomplete and therefore could not be used.

Future ENA programmes should try to corroborate these results by testing the approach over a longer time frame of 3–5 years, to allow for extensive networking and advocacy at start-up, a comprehensive training schedule with a range of participants and training types, and subsequent monitoring of the behaviour change process. ENA could also be a valuable support to the mainstreaming of nutrition within the government system that has been undertaken in Bangladesh since 2009; basic nutrition training has been scaled to most areas, but much focus is still on curative instead of preventative interventions (Saha, Billah, Menon, El Arifeen, & Mbuya, 2015). The ENA framework is designed to support multisectoral nutrition strategies such as that promoted by the Scaling Up Nutrition movement and to ease the burden on underresourced health systems such as Bangladesh's by utilizing all available platforms to reach clients with nutrition services and counselling (SUN MOVEMENT: Strategy and Roadmap [2016–2020], 2016). The ENA framework with actors from a wide range of organizations could assist the National Nutrition

Services to “invest more deeply in an alternative and predominantly outreach-based platform for delivering core preventive” measures (Saha et al., 2015).

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CONFLICTS OF INTEREST

The authors declare that they have no conflict of interest. The contents expressed in the article are those of the authors and do not necessarily reflect the policies or views of the organizations that they are affiliated with.

CONTRIBUTIONS

JLW, SSS, and DL drafted the study methodology. DL and SA designed and managed ENAPP. SSS conducted the qualitative analysis. JLW undertook the quantitative analysis design and execution, including data management. JLW drafted the manuscript. JNN revised the manuscript to better link our results to the current literature. All authors critically reviewed and approved the manuscript.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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