Economic Empowerment of the Poorest (EEP/Shiree)

Lessons learnt from the nutrition intervention programmes

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Document Purpose

This document discusses the lessons learnt from the Nutrition Intervention that was implemented across a selection of DFID programmes in Bangladesh. Whilst the intervention was implemented across multiple programmes, the scope of this report is limited to lessons identified from the Economic Empowerment of the Poorest programme only.

The lessons are divided into two main sections, lessons from the Nutrition Intervention, and lessons from the Nutrition Innovation Fund. Where appropriate, these sections are subdivided.

Each lesson contains recommendations to help inform future intervention design and reporting. Annex 2 provides a table that summarises changes to the intervention regimes for DFID expert consideration.

Contents

Table of Acronyms

BDT	Bangladeshi Taka
BMI	Body Mass Index
CED	Chronic Energy Deficiency
CMS 3	Change Monitoring System 3
CPK	Community Pushti Kormi (healthcare volunteer)
DNI	Direct Nutrition Intervention
EEP	Economic Empowerment of the Poorest
GO	Government Organisation
HAZ	Height for Age Z score
IFA	Iron and Folic Acid
IFRPI	International Food Policy Research Institute
IQ	Intelligence Quotient
IYCF	Infant and Young Child Feeding
LRTI	Lower Respiratory Tract Infection
MNS	Micronutrient Sachet
NGO	Non-Governmental Organisation
RR	Relative Risk
SMD	Standardised Mean Difference
TBA	Traditional Birth Attendant
WHO	World Health Organisation

Executive Summary

The results from the Nutrition Intervention on EEP/Shiree were mixed and showed that some indicators in target groups improved, whilst others worsened; these results also differed significantly if a cross sectional or longitudinal measurement approach was used. There are some key lessons that should be considered for future programmes regarding design, effectiveness, operations, and innovation.

Intervention Design:

1. Indicators need to be appropriate to the intervention, and be directly influenced by the intervention: treatments to reduce anaemia are unlikely to have an effect on thinness (which is influenced by calorific intake).
2. Targets should be disaggregated by target group, and should be evidence based, rather than on arbitrary changes that may or may not be achievable.
3. Longitudinal surveys should be used, in order to measure change within individuals, and to reduce heterogeneity in samples.

Intervention Effectiveness:

4. The interventions can be effective at reducing anaemia in some target groups, and work best when done in combination, i.e. deworming plus treatment. Proposed changes to regimes are given in Annex 2.
5. Extension of treatment duration for some groups should be considered in order to give a greater chance of success, and sustainability of result. Extension of deworming to all members of households should be continued.
6. Anthropometric indicators in children worsened when measured on a within child basis. A literature review shows that MNS supplementation alone is unlikely to have an effect on improving stunting. Further work is required to understand whether different a supplementation regime or protein supplementation is required.

Operations:

7. Benefits of the intervention were observed by beneficiaries, a large proportion of whom expressed a willingness to continue.
8. CPKs play a significant role in providing context based counselling, overcoming community norms and beliefs, and improving practices. Additionally, the support and guidance they provided has helped improve the uptake and management of the intervention.

Innovation:

9. A challenge fund is not an ideal approach to test nutrition innovations. A more strategic top-down design is required, in combination with a solid and consistent approach to both partner selection, assessment of contribution to outcomes, and measurement of results.
10. The programme cycle should ensure that the benefits can be identified over the course of the project life.

Background

In 2013 UKAid started to implement a Direct Nutrition Intervention (DNI) consisting of a micronutrient and anthelmintic (deworming)[3] supplementation programme for EEP/shiree households targeted at three groups. Each group received a different intervention package:

Pregnant and lactating mothers received 1 iron and folate (IFA) tablet/day from 3 months of pregnancy until 6 months after delivery and were dewormed at 6 monthly intervals using albendazole from 42 days after delivery. No deworming was done during pregnancy in line with the National De-worming Plan.

Adolescent girls received 2 iron and folate tablets/week from the age of 10 years old until either the end of the project, or the age of 16 (whichever occurred first), and were dewormed using albendazole every 6 months.

Children under 5 years of age received a different intervention based on their age structure. ***Children between 6-23 months of age*** received a micronutrient sachet (MNS) containing iron, folate, zinc etc. on a daily basis for 2 months (60 days) starting at 6 months of age, followed by a 4 month non-supplementation period. The aim was that another round of supplementation would start every 6 months (this regimen follows World Health Organisation (WHO) guidelines published in 2011). ***All children between 1 and 5 years of age*** were dewormed with albendazole (either tablet or syrup) at 6 monthly intervals.

All groups received advice on nutrition and hygiene practices from the community health worker (CPK).

Whilst the nutrition intervention was included as part of Contract Amendment 6 which was signed in 2013, due to concerns by UKAid of potential harmful side effects due to MNS[4] and uncertainty of the micronutrient formulation (whether to use 5 micronutrients or up to 15 micronutrients), the distribution of MNS to children did not commence until June 2014. The formulation that was settled on contained Iron (12.5mg), Folic acid (0.16mg), Zinc (5mg), Vitamin A (0.3mg) and Vitamin C (30mg). All interventions ceased by December 2015 (except for those households that were part of the International Food Policy Research Institute (IFPRI) control group).

The logframe revision set out the following targets for the nutrition intervention at Outcome level:

Outcome indicator 2.1	Target for 2015
Improved nutritional status of target groups for the Accelerated Improved Nutrition for Extreme Poor in Bangladesh project- under 2 year old children	3% point reduction in stunting, 4% point reduction in underweight, 2%point reduction in wasting, 10% point reduction in anaemia.

[3] Albendazole (a broad spectrum anthelmintic which acts primarily against flatworms and nematodes) was used for all groups.

[4] Research had suggested that supplementation by multiple micronutrients might lead to an increase in neonatal mortality. However, an article in the Lancet found no evidence for adverse effects on maternal mortality, stillbirths, perinatal and neonatal mortality (Bhutta et al.) 2013.

Outcome indicator 2.2	Target for 2015
Improved nutritional status of target groups for the Accelerated Improved Nutrition for Extreme Poor in Bangladesh project- pregnant and breastfeeding mothers and adolescent girls	5%point reduction in anaemia - pregnant and breastfeeding women; 15% point reduction in anaemia and 3% point reduction in Chronic Energy Deficiency in adolescent girls

Recommendation 2 of the Annual Review of EEP 2014 called for EEP to *make sure the direct nutrition intervention produces the expected results through strengthening the link between outputs and outcomes.* Cambridge subsequently conducted a review of the targets in the logframe, and identified shortcomings that resulted in the revision of the targets in March 2015 (the rationale for this is given at Annex 1). The revised targets are given below:

Outcome indicator 2.1	Target for 2015	2015 Result
Improved nutritional status of target groups for the Accelerated Improved Nutrition for Extreme Poor in Bangladesh project- under 2 year old children	3% point reduction in stunting 5% point reduction in anaemia	**7.5%** point reduction in stunting **0.5%** point reduction in anaemia
Outcome indicator 2.2	**Target for 2015**	**2015 Result**
Improved nutritional status of target groups for the Accelerated Improved Nutrition for Extreme Poor in Bangladesh project- pregnant and breastfeeding mothers and adolescent girls	5% point reduction in anaemia in pregnant and breastfeeding women and adolescents 5% point reduction in thinness in adolescent girls	**27.3**% point reduction in anaemia in pregnant women, **12.1**% point reduction in anaemia in breastfeeding women[5], **25.8%** point reduction in adolescents **1.2%** point reduction in thinness in adolescent girls

As can be seen from the results, not all components of the targets were met for both indicators. An in-depth review to investigate some reasons why has been conducted, and the key lessons are included in the subsequent section. These lessons also help to shed further light on why the indicators needed to be changed.

To report progress against these indicators, EEP/Shiree conducted two nutrition surveys, a baseline survey in March/April 2013 and a follow-up (endline) survey in March/April 2015. The endline study as far as possible reassessed the same individuals who took part in the baseline study, but also included additional children born since 2013 as well as new pregnant and lactating mothers (via a separate

[5] In the endline survey, relatively few (n=51) breastfeeding women were identified, therefore this reduction is not statistically significant. However, a highly significant 24.8% point reduction in anaemia was observed for all mothers (both breastfeeding and not) in the survey, suggesting success from the intervention is possible.

survey conducted in 2015). No survey took place in 2014 as the micronutrient supplementation programme in children had not started at that time.

Lessons learned from the Nutrition Fund

Intervention Design

1. ***Measures of under-nutrition need to be relevant to the intervention duration and target group.***

The original logframe target for indicator 2.1included both targets for stunting, wasting, and underweight. However, this confounded acute and chronic under-nutrition as stunting is a measure of long-term under-nutrition while wasting, (and to some extent underweight), are indicative of more immediate or short term weight loss. Programmes that are concerned with longer-term sustainability should focus on overcoming chronic under-nutrition (stunting) as the primary aim.

Additional problems were identified with the use of Chronic Energy Deficiency (CED), a measure appropriate to adults and not adolescents, which was replaced by the use of thinness. This also presented problems (see lesson 2 below).

2. ***Measures of under-nutrition identified in targets need to be attributable to, and directly influenced by the intervention supplementation regimen.***

The present regimens focussing on IFA/micronutrients and deworming are most likely to impact on haemoglobin concentration in all groups and reduce the prevalence of anaemia, but these regimens on their own are unlikely to improve stunting in under 2 year old children (see lesson 15) or thinness in adolescents.

Thinness is most easily improved through increasing calorific intake. Meta analyses on the effect of deworming per se tend to show little or no improvement in weight for height. It is therefore unlikely that the EEP target 5% point reduction in thinness in adolescents could be achieved via the intervention unless indirectly through nutrition and hygiene advice received from community health workers leading to increased calorie intake.

3. ***Longitudinal approaches to measurement of longer term iterative nutrition interventions overcome results ambiguities caused by the influence of external factors.***

The independent (IFPRI) nutrition surveys that were originally envisaged as the source of verification in the logframe were to be designed on a cross-sectional basis[6]. The nutrition targets in the logframe were similarly designed, and the cross-sectional approach became the de facto method for measuring results. This approach was not recommended by Cambridge, as the key issue here is the risk that the baseline and endline samples are heterogeneous, and results may be

[6] There are two ways of testing whether a change in, for example, prevalence of anaemia in adolescents has occurred over a time period (a) take a random sample of adolescents initially (baseline) and another random sample at the end of the time period (endline) and compare prevalences (cross-sectional approach) or (b) take a random sample of adolescents initially and then follow-up the same adolescents at endline (longitudinal approach).

misinterpreted[7]. Unless the baseline and endline cross-sectional surveys are properly matched, errors can occur. Overcoming this via a cross-sectional approach can require larger sample sizes and age and duration correction during analysis, which increases costs significantly.

The longitudinal approach overcomes the limitations of sampling as it is able to detect changes at both the group and the individual level, (provided that there is no serious attrition), between baseline and endline surveys. Had this approach been adopted from the outset, EEP might have met its outcome target of 5% reduction thinness in adolescents[8], and its target for anaemia reduction in under 2 year olds[9]. Moreover, given that the EEP intervention required repeat doses of IFAs and anthelminthics, a longitudinal survey is the optimal way to allow assessment of the cumulative effects of the interventions: there is less chance of single treatment recipients skewing the data[10].

4. Targets (changes in number, percentage) need to be realistic, evidence based, properly disaggregated, and attributable to the intervention.

The micronutrient supplementation programme for 6-23 month old children consisted of 2 months supplementation followed by 4 months of non-supplementation. This however is unlikely to lead to a rapid reduction in prevalence of anaemia as the intervention period (2 months) is too short (see also lesson 14). Studies have shown that micronutrient supplementation can impact on child growth (Annex 3: Relevance of Micronutrients for the prevention of stunting, but whether this is sufficient on its own to lead to a 3% reduction in stunting is unclear (see lesson 14). For the anticipated reductions in anaemia, additional complications were observed in how anaemia in different age classes was defined[11], and whether the anticipated reduction was achievable. The final target for anaemia is written as a combined result for mothers, breastfeeding women, and adolescents: this target should have been disaggregated further by group to show the impact of the intervention on each of the three target groups (as has been done when reporting against that target). Targets should therefore be clearly defined according to age, be based on what is achievable through reviews of scientific literature, and additionally take account of the percentage existing prevalence of (e.g. anaemia) in a target population.

[7] For example, haemoglobin concentration tends to fall with age and if, by chance, the adolescents were older in the initial cross-sectional sample and significantly younger in the endline survey, the apparent improvement in haemoglobin concentration might be incorrectly ascribed to the success of the intervention.

[8] Actual reduction: 1.2% via a cross sectional sample, vs. 7.6% longitudinal sample, (Goto and Mascie-Taylor, 2016a).

[9] Actual reduction: 0.5% via a cross sectional sample, vs. 5.1% longitudinal sample, with an average increase in haemoglobin concentration of 8.8g/L, (Goto and Mascie-Taylor, 2016b).

[10] For example, under two year olds might have gone through one 60 day cycle of MNS or two or more cycles, (given the 2 months on and 4 months off WHO regimen). It is therefore not possible to measure like with like via a cross sectional method, or the overall impact of prolonged treatment.

[11] E.g. for 10-11 year old girls, anaemia is defined as a Haemoglobin concentration <115g/l, for 12 and above, it is <120g/l. Yet both of these age groups are classified as adolescents.

5. ***A combination of IFA and deworming is an essential tool for meeting anaemia targets.***

The iron and folate supplementation programme for pregnant and breastfeeding mothers and adolescents is likely to impact on iron-deficiency anaemia on a large scale if there is good compliance. Deworming *per se* will rid the body of hookworms, a bloodsucking parasite, thus preventing further blood loss, but will not improve haemoglobin concentration unless combined with iron and folate supplementation. This is the case for all target groups.

6. ***To reduce anaemia in older children, micronutrient supplementation should be extended to children older than 2.***

44% of over 5 year old children were anaemic at endline, but once past the age of 2, were only eligible for deworming, (MNS supplementation ceased at 2 years old). Children between 2 and 5 years of age should also be included in the micronutrient supplementation programme (as deworming alone is unlikely to lead to improvement in haemoglobin concentration).

Notwithstanding this, the IYCF study did find a beneficial effect of deworming alone on weight-for-height[12] in children.

7. ***Consideration should be given to extending the assessment to include measurement of IQ and cognitive functions of children.***

Severe anaemia is associated with considerable Intelligence Quotient (IQ) and cognitive deficit, which has an impact on future economic success. Exploring this link could be a powerful way to advocate for wider rollout of anaemia interventions via Government or other agencies.

Intervention Effectiveness

8. ***Regular iron and folate supplementation can significantly reduce the prevalence and risk of anaemia in extreme poor pregnant women.***

In a small EEP study of 138 extreme poor pregnant women, a reduction of 27% in anaemia was observed between baseline (70%) and endline (43%), with good compliance (Goto and Mascie Taylor, 2015). In mass-intervention, provision of IFA supplementation to <u>all</u> pregnant women (irrespective of their anaemic status) is advisable for the following reasons:

a) Supplementation appears to benefit both anaemic and non-anaemic women albeit differentially;
b) There are savings to be made in logistics, equipment, and time through not having to take a blood sample from each women in order to measure haemoglobin concentration (and therefore to identify anaemic women);
c) High compliance among pregnant women could be achieved through positive acceptance by women and through the work of CPKs;
d) There appears to be little risk of overdose: no excess haemoglobin concentration cases were found (no women had a haemoglobin concentration above 135g/L);

[12] Children over 2 who took more than 3 deworming doses showed considerably better weight for height than those who did not receive deworming doses.

e) This supplementation should also be conducted in parallel with a regular 6 month deworming programme.

However, ensuring that all pregnant women receive daily IFAs could be challenging to deliver at scale, and should be considered when setting targets.

9. Measurement of haemoglobin concentration in pregnant and lactating mothers should take place immediately after the intervention ceases.

EEP conducted an annual survey, and used the field enumerators to collect the blood samples. In some cases, this may have meant a gap of up to 6 months between the end of the intervention (which stopped 6 months after birth) and measurement during the survey. It is possible that some beneficial effects of the intervention may not have been observed, as haemoglobin concentration could have declined once the intervention stopped. Consideration should be given to training CPKs to collect and measure blood samples once the intervention stops, rather than waiting until an annual survey is conducted: this approach does of course, pose additional challenges over record keeping, reliability, etc.

10. Continue to supply IFA and deworming to adolescent girls as there are beneficial effects on reducing anaemia and thinness.

A 19% reduction in anaemia and 7.6% reduction in thinness were observed in the sample group (longitudinal) over a timeframe of two years. Compliance was good, with 95% recognising the benefits and expressing the desire to continue. Additionally, as 86% of girls reported an increase in appetite following deworming, this suggests that deworming may have a subsequent impact on thinness (which is most easily influenced by increasing calorific intake).

11. Consideration should be given to extending IFA and deworming provision from adolescence into adulthood.

Extending this treatment would help to ensure that women entering marriage, or newly married women, have adequate iron stores before their first pregnancy. This in turn may reduce the risk of premature or low birth weight babies.

12. Provision of albendazole to all household members will reduce the risk of reinfection of all the family.

The original intervention de-wormed all household members at the start, and thereafter provided only specific groups with deworming. This was later revised to ensure all members of the household (except pregnant women) were dewormed at 6 monthly intervals to take into account the role of other members of the family in preparing food, child care, etc., which could continue the cycle of infection. We would recommend extending the scope of the intervention to all, not just those members who are in the supplementation programme.

13. A combined regimen of micro-nutrient supplementation and deworming is effective at improving haemoglobin concentration in children.

The within-child haemoglobin concentration improved significantly between 2013 and 2015. The measurement of haemoglobin concentration took place about 18 months

after MNS distribution ceased[13] suggesting that improvements in haemoglobin concentration had been retained, probably as a result of the deworming programme.

14. The MNS regimen in 6-23 months olds of 2 months supplementation and four months non-supplementation is unlikely to reduce anaemia prevalence rapidly.

The Cochrane Review[14] on which the WHO guidelines were based appears to be flawed: whilst the guidelines call for a two month on, four month off supplementation regime, none of the studies used adopted this regimen. It is possible that this and other review flaws have contributed to the limited success in reducing anaemia in children under 2,[15], due to an assumption that anaemia (whether mild or severe) will in most cases be cured after only two months of supplementation.

The need to follow WHO guidelines is recognised; however, given that the IYCF endline identified a very high (71%) prevalence of anaemia in children under 2 (Goto R. and Mascie-Taylor, N. 2016b) in order to improve success in controlling a very serious medical condition which has cognitive implications, we suggest that consideration be given to measuring the haemoglobin concentration of 6-23 month old children at the end of the 2 months supplementation. If the child is still anaemic, supplementation should continue for a further 2 months before retesting. The 2 month supplementation regimen should continue until the child is no longer anaemic.

Review flaws notwithstanding, alternative (untested) explanations for the limited success include:

- A delay of MNS supplementation meant many children in the CMS 3 sample missed the opportunity to receive MNS (this might have been compounded further by the 4 months interval);
- An interval based supplementation regime may cause confusions between CPKs and mothers of children over what has been provided when;
- Children in extreme poor households are at higher risk of anaemia; therefore there may be a higher prevalence in extreme poor households than is suggested via national statistics.

15. The impact of MNS on anthropometric indicators in children is unclear and requires further research under future programmes.

The problems from using cross-sectional versus longitudinal samples have been discussed; however the challenges arising from attempting to address anthropometric indicators in children warrant further mention. The endline survey indicated that via a cross-sectional method, the target for stunting has been achieved. However, longitudinal analysis indicates that ***all*** within-child

[13] Due to the gap between surveys (2 years) all children had reached the age of 2 years at endline, and therefore were not provided with MNS after that age. The oldest children would have stopped receiving MNS 18 months before endline.

[14] Cochrane Reviews are systematic reviews of research into human health care and policy, and are widely regarded as authoritative standards for evidence based healthcare resources.

[15] A reduction of 0.5% was observed, versus a target reduction of 5% in children under 2 when measured cross-sectionally. However, when using a longitudinal method, a 5.1% reduction in anaemia in under 2 year olds was achieved.

anthropometric measures (including stunting) ***worsened*** over the intervention period: for children aged between 0-2, there was an ***increase in within-child stunting of 16.2%***[16].

The reasons for this are not known. It is possible that children aged 0-2 years are simply not getting enough quality protein and choline, despite the efforts of EEP/Shiree to promote breastfeeding and child nutrition, and despite the delivery of MNS containing zinc and Vitamin A (both of which appear from some studies to have an impact on growth (Annex 3: Relevance of Micronutrients for the prevention of stunting. It is also possible that other essential micronutrients are limiting growth, and are not being corrected under the interventions (see Annex 3 for more meta-analyses of this); studies suggest that a significant reduction of stunting from a combination of micronutrient supplementation, education and complementary feeding is unlikely.

If a reduction in stunting is desired from future projects, it is advisable to consider designing longitudinal pilot tests to test the impacts of different treatments *in the Bangladesh context*. This could consist of comparing the efficacy of at least three different regimes of supplementation such as i) increased protein, ii) increased protein, Vitamin A and Zinc, and iii) increased protein, Vitamin A, Zinc, and other micronutrients.

Operational lessons

16. Beneficiaries must understand the reasons for worm infection, the rationale for deworming, and nutritional supplementation. The benefits should be emphasised in behavioural change counselling materials to encourage compliance.

Knowledge of worm infection and benefits of deworming, IFA and micronutrients were generally good[17]. Mothers understood that deworming treatment was beneficial to their children and only a minority could not explain why their child was treated: 95% of mothers expressed a willingness to continue deworming, and 85% to continue micronutrient supplementation. Children were reported to have bigger appetites and be more energetic post treatment. Adolescent girls mainly knew that taking IFA treated anaemia, but a significant minority thought taking IFA was good because the community health worker provided it. Most of the girls found that physical weakness was reduced by taking IFA, and appetite increased (lesson 10); these positive effects helped healthy adolescents and women to fulfill their multiple roles.

17. The CPKs played an effective role in transferring knowledge and instruction to beneficiaries.

Almost no side effects were reported by mothers, adolescents and children. This suggests that the correct dosages were taken at the correct frequency, and therefore that the information passed to beneficiaries by CPK's was understood. 88% of

[16] Note that for children between 2-5 years, within-child improvements of 12.6% were seen (this result is not captured in the logframe).
[17] Although nearly 20% of mothers thought that eating sweets caused worm infection.

adolescent girls understood that IFA tablets treat anaemia; only 2.3% of women did not know why they were giving micronutrients to their child; 80% of women understood that anthelmintics killed worms.

18. Tracking beneficiaries via community support mechanisms (e.g. CPKs) is important to avoid attrition.

There was a higher degree of attrition in adolescents (43.4% were measured at baseline and endline). To overcome attrition, especially in adolescents, some tracking is required as it was unclear whether absence on the day of the survey was due to school attendance or marriage and living separately. The tracking process would help to identify those who were living elsewhere, and ensure they can be included in endline surveys, either through prior notification of sampling dates, or sensitive planning with parents, schools or husbands.

19. The nutrition intervention plays a key role in a multidimensional poverty alleviation programmes. Nutrition and gender-specific counselling should be included from the beginning of the intervention cycle.

The combined approach of behavioural change counselling and direct nutrition interventions was effective. Beneficiaries reported changes in their understanding of hygiene, food preparation, and other issues[18], and this has contributed to the improvements in some indicators (morbidity decision making capacity, etc.). It is likely that this and the DNI had an effect on improving health status, which in turn reduced avoidable household expenditure on medical expenses. Implementing DNI in parallel to regular interventions is important to improve the uptake of the DNI, and to reduce project supervisory costs.

20. Context based counselling plays a crucial part to implement this combination of interventions.

Counselling based on community context plays a vital role to address spatial inequality regarding food intake and dietary pattern. It is important to conduct a contextual analysis into cultural norms (including breastfeeding and weaning practices) before counselling is initiated, so that that the nuances in cultural norms of a community are understood before they can be addressed.[19] The design and implementation of region specific counselling should be an inclusive process (which includes the orientation of key male household members) to build support within communities and household.

[18] Early introduction of counselling is particularly important for adolescent girls to improve decision making capacity, household reproductive work sharing, ensure menstrual hygiene and prevent child marriage.

[19] For example, in some regions, women were permitted to eat rice only for a period following childbirth. A BCC process that includes components on balanced diets can help overcome this to an extent, but it needs to be supported by counselling that addresses the underlying reasons for, and drivers of this practice, i.e. cultural beliefs. Additionally, social mobilization of Traditional Birth Attendants (TBAs) helped to improve initiation of breast milk within one hour of birth, to ensure that babies were fed colostrum.

21. Sensitivity to existing beneficiary commitments is essential for working with more members of target groups.

Choosing a different day for conducting sessions was an effective way of reaching the school-going adolescent girls and working effectively with them in addition to those who did not go to school. This does however place further burdens on CPK time.

22. Getting the right balance of staff and incentives increases the efficacy of the intervention.

At the outset, there were insufficient resources (the Nutrition Officer cum Master Trainer (NOMT) to Community Pushti Kormi (CPK) ratio was 1:40) to support the intervention at scale. Recruitment of 36 new NOMTs strengthened supervision, monitoring and improved quality of implementation.

CPKs were “paid volunteers”, and received an honorarium and expenses in return for conducting their duties. Increasing this from BDT 1,800 to BDT 3,200 was effective at boosting the performance and motivation of these volunteers.

23. Simplified reporting can increase the quality of information returned.

Whilst a mobile based information capture system was found to be less time consuming for community volunteers, it was difficult for them to use it as necessary. A revised and simplified reporting system that took account of volunteer education was found to be the most effective way of obtaining and managing quality information.

24. GO-NGO health service facility mapping exercises are important to permit linkages to GoB health and nutrition services, and prevent duplication.

Preparing linkage flow charts for CPKs helped to link beneficiaries to the health service facilities in their immediate area. This helps to make DNI more sustainable, and can address increased demand, once communities use a government outlet to obtain their supplementation when an intervention concludes. Additionally, these mapping exercises identify government programmes, and can help to prevent duplication, therefore improve value for money.

25. Local advocacy has multiple benefits, and is required to ensure that government health facilities have sufficient stocks of supplements.

The EEP nutrition intervention challenged cultural perceptions, and created a demand for services, both of which require government support to be sustainable. Increased demand for services can put extra pressure on departmental budgets, and if not addressed, risks losing gains already made. Furthermore, advocacy can help to ensure that safety nets (e.g. maternity allowances) are accessible and sufficient. Partnerships with other donors or civil society development practitioners, and a MoU with Ministry of Health and Family Welfare are important first steps.

Lessons learned from the Nutrition Innovation Fund

26. Demonstrating innovation and fund alignment within the proposals was a challenge for most of the respondents.

The nutrition innovation fund was run as a Challenge Fund. There were two calls for proposals held, as only two of sixteen proposals were accepted in the first round, and two of four accepted from the second round. There was a lack of quality within many of the submitted proposals, with many of the proposals (including some of those accepted for funding) struggling to demonstrate either sufficient innovation, improvement to protein intake, or organisational capability to deliver. Some of the proposals recommended by the Independent Assessment Panel did not fully meet the goals of the Fund, i.e. the activities were not directly linked to improving protein intake.

27. Many of the concept notes submitted would have benefitted from technical advice to help refine them, which EEP was not permitted to give.

Whilst the importance of independent assessment is paramount, for relatively small projects this should be reconsidered. Many of the ideas in the proposals were not adequately explained, which may have led to their premature elimination. Future innovation programmes may wish to consider the importance of technical support during the development of highly tailored proposals, or to consider providing more guidance as to what could, or could not, be included. This would go some way to ensuring that genuine innovation is not stifled through a failure to explain the concept fully.

28. Adequate budgetary provision for M&E is essential.

Each project was allocated £100,000, which was insufficient to cover both implementation and a realistic degree of M&E to evaluate the success of the innovation. The size of the projects did not warrant full baseline and endline surveys, which would have amounted to a significant amount of the project budget, or of EEP funds.

Furthermore, after the projects were selected, EEP needed to provide external support to two of the projects, as the M&E frameworks were poorly designed.

29. A prescriptive approach to measure the impact on protein intake needs to be included in the call for proposals.

Whilst a detailed guidance note was produced, EEP was unable to include a standard independent survey mechanism to measure protein intake. This was because the permitted innovations included projects concerning direct interventions, social marketing, academic studies, and institutional and market linkages, which eliminated the ability to design a consistent process.

Had the sole focus been on direct interventions, an approach could have been developed prior to issuance of the call for proposals, so that respondents would be clear on how success would be measured, and could adapt accordingly. This could have acted as a “proof of concept”, i.e. it could have shown the *potential* for the intervention, even if the project was not an overall success. This results focussed

approach could have ensured EEP was able to better support the projects, and taken a significant planning burden off the PNGOs.

30. The duration of projects was too short in to measure the impact of protein intake among children under 5 years of age.

Most of the projects funded ran for two years. However, in several cases, this was insufficient to raise awareness, deliver the activities, and observe an improvement. For example, in the case of Toymu, there was no pre-project assessment of the knowledge of pigeon rearing. Once the project started, it found that it needed more time than planned to build the capacity of the beneficiaries to rear pigeons and raise awareness on their consumption before the any impact on protein intake could be measured. It would have been better to support the activity (pigeon rearing) with pigeon meat supplementation to under 5 year olds to ensure that an impact could be measured. This was also an issue encountered by Worldfish, where production problems in the chutney supply chain delayed roll-out.

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Goto R. and Mascie-Taylor, N. 2016a: Shiree/EEP nutritional surveys in 2013 and 2015: adolescent girls

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Shiree Guidance Document: Innovation Fund Round: Nutrition – Enhancing protein intake

Annex 1: Changes to EEP nutrition outcome indicators (agreed in March 2015)

Outcome indicator 2.1 Improved nutritional status of target groups for the Accelerated Improved Nutrition for Extreme Poor in Bangladesh project - under 2 year old children

A. Proposed changes in outcome 2.1 indicator and source

	Current	Proposed
March 2016 Target	3% point reduction in stunting, 4% point reduction in underweight and 2% point reduction in wasting. 10% point reduction in anaemia	3% point reduction in stunting and 5% point reduction in anaemia
Source	Independent Impact Monitoring (IFPRI)	Baseline survey IYCF and CMS3 survey 2013, follow-up CMS3 surveys

B. Background and Rationale for the Changes

1. **Outcome 2.1 should just focus on reductions in stunting and anaemia.** The current outcome 2.1 confounds acute and chronic undernutrition as stunting is a measure of long-term undernutrition while wasting, and to some extent underweight, are indicative of more immediate or short term weight loss. The EEP/Shiree programme is concerned with graduation out of poverty and longer-term sustainability so overcoming chronic undernutrition (stunting) should be the primary aim.
2. **The baseline prevalences of stunting and anaemia should use the combined IYCF and CMS3 survey data**. In 2013 EEP/Shiree conducted a baseline IYCF survey in parallel with the CMS3 survey across 9 NGOs before the nutrition intervention commenced. 555 under 2 year-olds were measured (both anthropometry and haemoglobin concentration) in the IYCF survey and 129 children from the CMS3 survey. There were no significant differences in nutritional status between the two groups, so we believe this can act as an effective baseline (40.5% of stunted, 72.6% anaemic). As the IYCF survey was not conducted in 2014, the data source for changes in stunting and anaemia of under two year olds should be based on the annual CMS surveys, and compared against this baseline.
3. **The IFPRI study cannot provide verification information**. The IFPRI study is a *cross-sectional* survey on under 2 year olds so it cannot provide information on the *within-child* changes in nutritional status as a result of the nutrition intervention. Furthermore the IFPRI survey is not measuring haemoglobin concentration so cannot address reduction in anaemia. It includes only one of

EEP/Shiree partner NGO projects and it is uncertain of how representative the IFPRI sample is of EEP beneficiaries.

4. **The reduction in anaemia should be changed from 10% point reduction to 5% point reduction to reflect the discontinuous nature of the micronutrient intervention.** Many studies have shown that micronutrient supplementation with sprinkles or iron supplementation increases haemoglobin concentration and reduces anaemia in under two year olds. However the extent of reduction in anaemia varies considerably depending on a number of factors including the frequency of supplementation (e.g. daily versus flexibly) and on compliance. In the EEP/Shiree nutrition programme children follow a 6 monthly cycle in which under two year old children receive daily sachets (sprinkles containing iron, folic acid, zinc, Vitamins A and C) for 2 months followed by 4 months without supplementation. This cycle is repeated until the child is 2 years old.

Outcome Indicator 2.2 Improved nutritional status of target groups for the Accelerated Improved Nutrition for Extreme Poor in Bangladesh project – pregnant and lactating mothers and adolescent girls

A. Proposed changes in outcome 2.2 indicator and source

	Current	Proposed
March 2016 Target	5% point reduction in anaemia in pregnant and breastfeeding women. 15% point reduction in anaemia and 3% point reduction in CED in adolescent girls	5% point reduction in anaemia in pregnant and breastfeeding women and adolescents. 5% point reduction in thinness in adolescent girls
Source	Independent Impact Monitoring (IFPRI)	IYCF and CMS3 Surveys

B. Background and Rationale for the Changes

1. **The baseline prevalences of anaemia in lactating women and adolescents should use the EEP/Shiree and IYCF survey data from 2013.** The verification source in the Logframe for outcome indicator 2.2 is currently the IFPRI database. However the IFPRI study is currently not measuring pregnant and lactating women or adolescent girls. In 2013 EEP/Shiree conducted a baseline survey including 242 adolescents and 662 lactating women across 9 NGOs before the nutrition intervention commenced: 43.5% of women and 38.8% of adolescents (age adjusted) were anaemic.
2. **The IFPRI surveys cannot provide verification information.** The data source for changes in outcome 2.2 indicators should be the follow-up IYCF and CMS3 surveys.
3. **The percentage point reduction in anaemia should be harmonised in women and adolescents at 5% point reduction**. For adolescent girls to meet the 15% point reduction target would require very large changes in mean haemoglobin concentration (17g/l) that are unlikely to be realised. Furthermore,

adolescents have two different thresholds for defining anaemia (115g/l under 12 yrs old, and 120g/l over 12) which complicates reporting[20]. A 3-4g/l increase in mean haemoglobin concentration would equate to a reduction of over 5% in anaemia. For pregnant and lactating women a 3-4 g/l increase would equate to a reduction of over 5% in anaemia.

4. **For improvement in weight of adolescents relative to their height (thinness) the WHO BMI z-score threshold of <-2 should be used rather than BMI of < 18.5.** The use of Chronic Energy Deficiency (CED) is inappropriate for adolescents. CED is an adult measure and is defined by a Body Mass Index (BMI) of <18.5; for adolescents the average BMI is commonly less than 18.5. The appropriate measure for adolescents is the WHO BMI z-score where <-2.00 is the threshold for thinness. An additional problem of using CED is that large weight gains are required in order to improve BMI[21].

[20] *An 11 year old adolescent may be classified as non-anaemic in year 1 and anaemic in the following survey even if the haemoglobin level remains stable in both surveys.*

[21] *For example an eleven year old weighing 30kg and 146cm tall would have a BMI of 14; to improve to a BMI of 18.5 and allowing for 10cm growth over 2 years requires a weight gain of 15kg compared with the usual annual weight gain of 3 to 4 kg. The same adolescent would have a WHO BMI z-score of -2.49 initially; allowing for a 10cm growth over two years requires a weight gain of just over 6kg to drop below the thinness threshold.*

Annex 2: Proposed changes in intervention design

The following recommendations for nutrition interventions for each household should be considered if reduction in the prevalence of anaemia is to be continued. Note that there is evidence to suggest that these regimens will result in an improvement in anaemia; regular monitoring may not be necessary if there is no requirement to report results:

Group	Basic Intervention Package	Results Measurement Approach	Results Measurement frequency	Notes
Children under 2 years	Micro nutrient powders. According to WHO guidelines (currently daily for two months, followed by 4 months off ("2+4" regimen)). Repeat every 6 months. 6 monthly deworming with Albendazole	Longitudinal panel N/A	Annual Survey	Test for anaemia after two months. If positive, continue MNS for two months and retest. Repeat until child is no longer anaemic, and resume the 2+4 regimen. For non-anaemic children: continue with the 2+4 regimen.
Children from 2-5 years	Micro nutrient powders according to WHO age specific guidelines. 6 monthly deworming with Albendazole	Longitudinal panel N/A	Annual Survey	Test and treat for anaemia as above, modified to suit any age-specific requirements.
Adolescent girls	2 iron and folate tablets/week 6 monthly deworming with Albendazole	Longitudinal Panel	Annual Survey	Consider extending into adulthood so women entering marriage, or newly married women, have adequate iron stores before first pregnancy.
Pregnant and Lactating mothers	1 iron and folate (IFA) tablet/day from 3 months of pregnancy and for 6 months after delivery for all women (not just anaemic ones). Deworming with Albendazole 42 days after delivery.	Longitudinal Panel	Immediately post-intervention end	Measurement of anaemia some months after intervention may not indicate whether a reduction in anaemia has taken place. IFA should be continued if anaemia a mother is still anaemic.
All members of household	6 monthly deworming with Albendazole	N/A		To reduce risk of re- infestation of treated family members

Annex 3: Relevance of Micronutrients for the prevention of stunting

Vitamin A

There is a lack of hard empirical evidence to suggest that Vitamin A supplementation has a consistent effect on increasing linear growth (although an effect is more apparent where a clinical Vitamin A deficiency has been observed). The following three points are noteworthy:

(a) A meta-analysis in 2009 by Ramakrishnan, Nguyen and Martorell showed that 11 of 17 studies showed positive effect sizes for change in height following Vitamin A supplementation. However the weighted mean effect size of vitamin A intervention was not statistically significant (effect size = 0.08; 95% Confidence Interval (CI) -0.18, 0.34. The effect size is simply a way of quantifying the size of the difference and a value of 0.2 indicates a small effect, 0.5 as a medium effect and 0.8 as a large effect.

(b) The potential for Vitamin A supplementation to improve linear growth has been described in children who were more clearly Vitamin A deficient and experiencing growth limitations – e.g. an Indonesian study of preschool children showed that the growth benefit was considerably higher in children with low serum retinol concentrations[22] (< 0.35µmol/L). Breast feeding was also found to be protective against linear growth deficits attributable to Vitamin A deficiency in children 6 to 24 months of age living in regions where subclinical Vitamin A deficiency and stunting were prevalent (Hadi et al., 2000).

(c) However in other at-risk populations recurrent bouts of respiratory infection were found to blunt linear growth response to vitamin A supplementation (Hadi et al., 1999).

Zinc

Impaired linear growth is considered to be a well-known feature of zinc deficiency among children but despite strong evidence linking zinc deficiency to impaired height-for-age, the results of studies on zinc supplementation are mixed. There is good evidence to show that Zinc does have other beneficial effects (reducing morbidity, etc.)

(a) Brown et al. (2002) found a statistically significant effect on height (effect size = 0.350; 95% CI 0.189 – 0.511) particularly in children < 6 months of age with lower initial height-for-age. These results were confirmed in a 2009 review by the same authors that included additional studies but the effect size fell (effect size = 0.170; 95% CI 0.075 – 0.264) (Brown et al., 2009).

(b) In contrast a 2009 meta-analysis by Ramakrishnan, Nguyen and Martorell (2009) on under 5 year olds found a minimal and statistically insignificant effect on linear growth (n = 43, effect size = 0.07: 95% CI -0.03, 0.17).

(c) A 2011 meta-analysis by Imdad and Bhutta (2011) confirmed Brown's results in children less than five years of age but the effect size was small (effect size = 0.13: 95% CI 0.04, 0.21)

[22] Serum retinol concentration is used as an indicator of Vitamin A deficiency.

(d) The variability between the four meta-analyses has been the subject of much debate. Imdad and Bhutta initially attributed the inconsistency in results to differences in inclusion and exclusion criteria. However when changes were made to the criteria to better match those used by Brown et al. and Ramakrishnan et al. there were no significant changes in the results or direction of the effect.
(e) A Cochrane review published in 2014 found there was moderate-quality evidence of a very small improvement in height with zinc supplementation (standardised mean difference (SMD) -0.09, 95% CI -0.13, -0.06; 50 studies), but the size of this effect might not be clinically important (Mayo-Wilson et al., 2014).
(f) A more recent meta-analysis by Stammers et al. (2015) involving nine studies found no significant effect of zinc supplementation of between 2 weeks and 12 months duration on weight gain, height-for-age, weight-for- age, length-for-age, weight-for-height Z scores in children aged 1-8 years. The authors concluded that many of the children in the included studies were already stunted and may have been suffering from multiple micronutrient deficiencies, and therefore zinc supplementation alone may have only a limited effect on growth
(g) Strong evidence also links zinc supplementation to the reduction of morbidity and mortality from infectious diseases, particularly diarrhoeal disease. A 2 week course of zinc supplementation on the growth of Bangladeshi children with persistent diarrhoea reduced the episodes of diarrhoea and increased growth in more malnourished children (Roy et al., 2007). A Cochrane review published in 2014 on zinc supplementation for preventing mortality, morbidity and growth failure in children 6 months to 12 years of age found that supplementation reduced diarrhoea morbidity, including the incidence of all-cause diarrhoea (Relative Risk (RR) 0.87, 95% CI 0.85,0.89, 26 studies, moderate-quality evidence). (Mayo-Wilson et al., 2014).
(h) Zinc supplementation has also been shown to prevent respiratory disease, with additional efficacy in children with stunted growth (Shrimpton and Shankar, 2008). However the Cochrane review (Mayo-Wilson et al., 2014) found the results for lower respiratory tract infections (LRTI) and malaria were imprecise: LRTI (RR 1, 95% CI 0.94 to 1.07, 12 studies, moderate-quality evidence); malaria (RR 1.05, 95% 0.95, 1.15, four studies, moderate-quality evidence).

Multiple micronutrient interventions

Studies suggest that supplementation of multiple micronutrients simultaneously may have an effect on reducing stunting; however the effect is not consistent.

(a) The 2009 meta-analysis by Ramakrishnan et al. analysed the effects of 20 multiple micronutrient interventions, each of which contained a minimum of 3 micronutrients and 80% of which consisted solely of Vitamin A, iron and zinc. The multiple micronutrient interventions had a small but statistically significant effect on height of under 5 year olds (effect size = 0.09; 95% CI 0.008, 0.17). Two way combinations between iron and zinc, Vitamin A and zinc and iron and folic acid did not significantly improve linear growth compared with the placebo.
(b) Another meta-analysis also published in 2009 by Allen, Peerson and Olney found multiple micronutrient supplementation significantly improved child length or

height compared with a control group with an effect size of 0.13 (95% CI 0.055, 0.21).

(c) Imdad and Bhutta (2011) also found a significant positive effect of multiple micronutrient interventions containing zinc on linear growth (effect size = 0.13; 95% CI 0.04 - 0.21) and these became more pronounced when studies on combined zinc and iron were removed (effect size = 0.19; 95% CI 0.08,0.30) suggesting that co-supplementation of iron may diminish the bioavailability of zinc due to common uptake pathways.

(d) A 2011 study found a significant decrease in the prevalence of stunting in both Nepal and Kenya following the administration of multiple nutrient powders (MNPs, containing 15-16 micronutrients) in children aged 6 to 59 months (Rah et al., 2012). The positive findings were potentially attributed to the extended duration of supplementation and the inclusion of younger children who are at higher risk of stunting.

(e) A 2005 study by Smuts and colleagues demonstrated that while multiple micronutrient supplementation restored micronutrient deficiencies, the intervention did not prevent growth faltering in South African infants or improve growth and morbidity in Indonesian (Untoro et al.., 2005) and Peruvian infants (Lopez de Romana et al., 2005).

Comprehensive interventions

Studies suggest that education and complementary feeding alone are insufficient to have a reduction on stunting; recent evidence points to amino acid deficiency playing a significant role as a growth limiting factor:

(a) Studies of nutrition education in food secure populations showed a significant increase in height (standard mean difference = 0.35, 95% CI 0.08, 0.62 in four studies and HAZ (standard mean difference = 0.22, 95% CI 0.01,0.43, in four studies, whereas the effect on stunting was not statistically significant (RR = 0.70, 95% CI 0.49, 1.01). (Bhutta et al., 2013).

(b) Complementary feeding strategies[23] have been most clearly linked with a reduction in stunting as demonstrated by an increase in height-for-age Z score of 0.39 (95% CI 0.05, 0.73) in food insecure populations relative to controls, but the effect on stunting did not reach statistical significance (Relative Risk = 0.33, 95% CI 0.11,1.0). (Lassi, Zahid, Das and Bhutta, 2013).

(c) A very recent research paper published in February 2016 found that child stunting in Malawi is associated with low serum concentrations of all nine essential amino acids (tryptophan, isoleucine, leucine, valine, methionine, threonine, histidine, phenylalanine and lysine), with conditionally essential amino acids (arginine, glycine and glutamine), non-essential amino acids (asparagine, glutamate and serine) and six different sphingolipids compared with non-stunted children (Semba et al., 2016). The study also found significant differences in phosphatidylcholines which are involved in chondrogenesis, a major determinant of linear growth. Phosphatidylcholines are mainly synthesised in a biochemical pathway which requires dietary choline, of which the richest dietary sources are mostly animal-based foods that are not regularly consumed by poor families in

[23] Defined as the transition from feeding exclusively on breast milk to other foodstuffs.

low-income countries. The authors suggested that children with a high risk of stunting may not be receiving an adequate dietary intake of essential amino acids and choline.

(d) A recent study of urinary metabolites suggested that biochemical pathways involving choline and tryptophan metabolism are associated with catch-up growth in undernourished Brazilian children (Mayneris-Perxaches et al., 2016).

(e) The last two studies suggest that an insufficiency in essential amino acids could potentially explain why micronutrient and lipid supplements have had limited impact on child growth. Recent evidence shows that human growth is controlled by a master growth regulation pathway (called mTORC1). When specific amino acids are deficient in the diet, mTORC1 senses amino acid deficiency and represses protein and lipid synthesis and cellular growth (Efeyan, Comb and Sabatani, 2015).

(f) The striking finding was that all nine essential amino acids were significantly lower, by as much as 15-20% in stunted children, compared with non-stunted children. Stunted children are not receiving sufficient quality protein from their diet and this lack of essential amino acids means that children will not grow normally even if they receive the necessary micronutrients.

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