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An evaluation of the impact of a US$60 million nutrition programme in Bangladesh

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Objective: To compare levels of childhood malnutrition in areas where the Bangladesh Integrated Nutrition Project had been operational for over 5 years with matched non-project areas, with the purpose of evaluating whether the project had achieved its objective of reducing the prevalence of underweight among children <24 months.

Methods: The study involved an ex-post cross-sectional survey in six thanas (a locality with a population of approximately 200 000–450 000 people) in Bangladesh. Participants were 6820 households (4554 in the project areas and 2266 in the non-project areas) including 7183 children aged 6–59 months selected using a two-stage stratified cluster sampling frame. Main outcome measures were moderate and severe underweight, wasting and stunting reported using z scores, and indicators of mothers' reported nutritional knowledge and practice.

Results: 2388 children aged 6–23 months and 6815 children aged 6–59 months had clean anthropometric data. No significant difference was found between the socio-economic variables of households in the project and non-project areas. No significant difference was found in the prevalence of either severe or moderate underweight (weight-for-age) in children aged 6–23 months in the project and non-project areas: 183 (11.4%, 95% confidence interval 9.9–13.2%) children in project areas and 96 (12.2%, 95% confidence interval 9.9–14.8%) children in non-project areas. Mothers in project areas reported significantly better caring practices than in non-project areas.

Conclusion: There is no evidence that the Bangladesh Integrated Nutrition Project has achieved its objectives to reduce severe underweight by 40% if project areas are compared ex-post with non-project areas. There is urgent need to review the evidence behind investments based on growth monitoring and promotion.

Key words: nutrition, growth monitoring and promotion, programme impact, child health

Introduction

The Bangladesh Integrated Nutrition Project (BINP) was implemented by the Government of Bangladesh Ministry of Health and Family Welfare between 1996 and 2002 with the aim of reducing the prevalence of severe underweight by 40%, and moderate underweight by 25%, in young children in the project areas (World Bank 1995). It was largely funded by the Bangladesh government through a US$59.8 million loan from the International Development Association (World Bank). The project covered a population of 15.6 million in 59 thanas (a locality with a population of approximately 200 000–450 000 people).

The project was designed on the assumption that poor caring practices are an important cause of malnutrition and that a change in caring practices will lead to a decrease in malnutrition. Key objectives were educational: to improve the capacity of individuals, households, communities and national institutions to prevent and alleviate malnutrition. Supplementary food was given to children with severe malnutrition or with growth failure.

In the project areas, all carers were asked to bring their young children (0–23 months) to community-based nutrition centres monthly for growth monitoring and promotion. Growth monitoring and promotion is 'the process of weighing a child, graphing the weight, assessing the growth, and providing counselling and motivation for other actions to improve growth' (Griffiths et al. 1996). At each visit the child was weighed, and the carer received counselling on health, family planning, breastfeeding, caring practices, personal hygiene and the use of iodized salt. All children in project areas were eligible to receive these services.

Children who were severely malnourished ($<60\%$ weight-for-age compared to the National Center for Health Statistics references), or who failed to gain the required weight (600 g for 0–11 months and 300 g for 12–23 months) in three consecutive monthly weighings were enrolled in a supplementary feeding programme. All children in the project areas who met these criteria were eligible for feeding. The food (rice, pulses, molasses and oil) was given in standard packets. Severely malnourished children received a daily food supplement equivalent to 300 kcal of energy and 8–9 g of

protein. Half this amount was given to children who had failed to gain sufficient weight. Carers of children who were receiving food were required to visit the nutrition centre 6 days a week to receive the supplement and counselling. Growth faltering children graduated from the supplementary feeding programme after 3 months and severely malnourished children remained in the programme for 4 months. If the children had not gained 500 g over these periods they remained in the programme (maximum enrolment was for 6 months). Additionally the project supplied services for pregnant and lactating women.

This paper presents the findings of a study conducted by Save the Children UK to evaluate whether the BINP's objective to reduce malnutrition was achieved. It was carried out for two reasons.

Firstly, the project's mid-term evaluation (Institute of Nutrition and Food Sciences of the University of Dhaka, 1999) failed to show an improvement in nutrition which could be attributed to the project. The prevalence of severe underweight (< -3 z-scores weight-for-age) among children aged 6–23 months fell by a similar amount in both the project areas (30% at baseline to 18% at the evaluation) and control areas (from 27% to 19%). This drop is similar to the secular trend observed more widely in Bangladesh (Bangladesh Bureau of Statistics/UNICEF Bangladesh 2001). No final term evaluation was conducted before the project was expanded nationally. The expanded project has the same basic goals and uses almost the same strategies as the BINP at considerable cost (Kabir and Levinson 2000; World Bank 2000).

Secondly, Save the Children UK hopes to initiate a policy debate concerning the effectiveness of growth monitoring and promotion approaches to addressing malnutrition. The Uganda Nutrition and Early Childhood Development Project and the Ethiopia Food Security Project are further examples of loan projects which rely heavily on growth monitoring and promotion to improve nutritional status (World Bank 1997, 2002). These two projects face major implementation constraints (Save the Children UK 2003). Similar projects are financed by loans and grants from bilateral donors in other countries (BASICS, undated).

Methodology

The hypothesis for the study was that if we compare two populations with similar socio-economic characteristics, those in the project areas should have lower rates of malnutrition. To test this hypothesis Save the Children UK undertook a cross-sectional survey in 2002 comparing the rates of malnutrition in three thanas (in three different districts) where the project had been implemented for 6 years (randomly selected from the six original project thanas) to three matched thanas where there had been no major nutrition projects.

This ex-post study design is inherently weak as it is not possible to control for any differences in the rates of malnutrition between project and non-project areas at the start of the intervention. At the time of the study no alternative was possible because Save the Children UK was not able to obtain project baseline data. In order to minimize any potential bias in initial nutritional status of the thanas, the project and non-project thanas were matched.

A list of non-project thanas without any major nutrition projects and adjacent to each project thana was made. For each, information from the 1991 census was compiled on literacy and school attendance rates, water sources, latrine type, roof material, land ownership and income source (Cochran 1977). The non-project thana whose statistics most closely matched those of the project thana was chosen. Unfortunately, it was not possible to match the thanas according to levels of malnutrition as this information was not available. However, the six original project thanas were not selected because they had unusually high levels of malnutrition. Rather they were chosen to be locations where the project could be easily implemented: criteria included the avoidance of disaster prone areas, the presence of basic health infrastructure and at least 80% immunization coverage (World Bank 1995).

Sample sizes were calculated using an inverse sampling procedure (Bangladesh Bureau of Statistics 1991). The design effect was 1.2 and the proportion of children aged 6–23 months in the total population was assumed to be 4.5% (Bangladesh Bureau of Statistics/UNICEF Bangladesh 2001).

Two-stage stratified cluster sampling was employed. The primary sampling units (PSU), which were selected using probability proportional to size sampling techniques, were community nutrition centres in project thanas, and villages in non-project thanas. A total of 105 project PSUs and 54 non-project PSUs were chosen. The sampling frame within each PSU was a list of households having at least one child aged 6–59 months. Eighty-six households from each PSU were systematically sampled from the list. All children under five in each household were measured, and their carers were interviewed and mothers measured.

Questionnaires were used to obtain information on household demographic and socio-economic information and children's illness. Further questions on maternal knowledge and caring practices assessed the effectiveness of counselling during growth monitoring and promotion. In the project areas, extra questions focused on specific project activities.

Age, weight and height, or length, were recorded using standard methodologies for children aged 6–59 months (WHO 1983) and mothers (Jelliffe and Jelliffe 1989). Standard definitions of malnutrition were employed for children aged 6–59 months (WHO 1983).

The survey methodology and questionnaires were fully piloted. Quality control officers visited the teams throughout the data collection period. Some 5–10% of households were re-interviewed by these officers to monitor the quality of the data collection.

Socio-economic status was defined by a composite variable that combined land ownership and occupation (Bhuiya et al.

Table 1. Descriptive statistics of children aged 6–59 months anthropometry (n = 6815)

Characteristic	Mean	Standard deviation	Standard error
Weight	10.6 kg	2.5	0.03
Height	83.6 cm	10.6	0.13

2001). Area of household dwelling (in square feet) was also used to compare socio-economic profiles (Islam and Becker 1981).

EPINUT (CDC/WHO 1996) was used to create nutritional indices. Children with extreme values of anthropometric indices were excluded from the analyses. Other analyses were conducted in STATA (StataCorp, Texas, USA) (Statacorp 2001) including cross-tabulations, and multiple regressions. All analyses took account of the stratified cluster sampling frame. STATA's pearson χ^2 test (svytab) produces two-way tabulations with tests for independence for clustered data. The linear regression function (svyreg) also allows for clustering (Statacorp 2001).

Results

The total sample was 6820 households (4554 in the project areas and 2266 in the non-project areas). A total of 8321 children aged 0–59 months were found in all the households. Measurements were taken from 7241 children aged 6–59 months (children aged 0–5 months were not measured). Either height or weight measurements were missing from 58 children. A further 99 children were excluded because they had extreme values for any of the anthropometric indices (weight-for-age, weight-for-height, or height-for-age >5 z-scores, or <-5 z-scores). Missing values for non-anthropometric data points (for example, questions on maternal knowledge etc.) resulted in the exclusion of a further 268 children. The analyses are based on 2388 children aged 6–23 months and 6815 children aged 6–59 months for whom all data points are available. There was no significant difference in weight-for-age z-score between children with missing data and those with all the data. Descriptive statistics for the weights and heights of the children used in the analyses are shown in Table 1.

There were no significant differences between the households in the project and non-project areas in terms of socio-economic variables (see Table 2). This suggests that the matching procedure was effective.

Table 3 shows the results of analyses assessing differences in children's nutritional status in the project and non-project areas. There were no significant differences in the rate of either severe or moderate underweight (weight-for-age) in children aged 6–23 months in the project and non-project areas. Similar results were obtained for stunting (low height-for-age) and wasting (low weight-for-height). There were also no significant differences in the 6–59 months age group (data not shown).

Further analyses, using adjusted two sample t-tests, found no differences in the mean underweight (given in z-scores) of children in the project and non-project areas (-1.92 and -1.92 respectively, $p = 0.97$). Again, similar results were obtained for stunting and wasting (data not shown).

Table 2. Some characteristics of households in the project and non-project areas (n = 6815)

	Project area (n = 4539)	Non-project area (n = 2276)	Difference in prevalence (95% confidence interval)	Adjusted two sample t-test p value
Proportion of heads of household who are male (%)	94.1	95.2	1.1 (−0.3 – 2.5)	–
Proportion of heads of household having some formal education (%)	41.5	43.5	2.0 (−2.3 – 6.3)	–
Proportion in lowest SES class (%)	71.1	74.5	3.4 (0 – 6.8)	–
Average bedroom size (sq. feet)	288.0	299.0	–	p = 0.11
Average family size	6.3	6.2	–	p = 0.70

Table 3. The prevalence of severe and moderate underweight, stunting and acute malnutrition in project and non-project areas in children aged 6–23 months (n = 2388)

	Project (n = 1598)	Non-project (n = 790)	Difference in prevalence (95% confidence interval)
Severe low WAZ (< −3 z-scores)	11.4%	12.1%	0.7% (−2.2 – 3.6)
Moderate low WAZ (≧ −3 z-scores and < −2 z-scores)	35.2%	36.3%	1.1% (−3.3 – 5.5)
Severe low HAZ (< −3 z-scores)	11.6%	12.4%	0.8% (−2.4 – 4.0)
Moderate low HAZ (≧ −3 z-scores and < −2 z-scores)	27.5%	27.6%	0.1% (−3.8 – 4.0)
Severe low WHZ (< −3 z-scores)	1.0%	1.1%	0.1% (−0.7 – 0.9)
Moderate low WHZ (≧ −3 z-scores and < −2 z-scores)	13.4%	14.3%	0.9% (−2.2 – 4.0)

WAZ = weight-for-age z-scores; HAZ = height-for-age z-scores; WHZ = weight-for-height z-scores.

Table 4. Differences in the knowledge and practice of mothers in the project and non-project areas. All questions were asked about the youngest child in the house (aged more than 6 months)

	Project (n = 3872)	Non-project (n = 1967)	Difference in prevalence (95% confidence interval)
Knowledge			
Should take rest during pregnancy	77.6%	70.2%	7.4% (4.2 – 10.6)
Should give colostrum to newborn	63.1%	52.5%	10.6% (5.9 – 15.3)
Know how long to exclusively breastfeed	78.0%	69.5%	8.5% (5.5 – 11.5)
Know when to give complementary food	63.9%	64.7%	0.8% (−2.7 – 4.3)
Know benefits of iodized salt	32.4%	40.1%	7.7% (3.5 – 11.9)
Practice			
Take rest during pregnancy	59.9%	53.5%	6.4% (3.4 – 9.4)
Take iron tablets during pregnancy	58.7%	23.8%	34.9% (31.1 – 38.5)
Have iodized salt in the house	70.0%	62.9%	7.1% (2.4 – 11.8)
Give colostrum to newborn	77.6%	73.1%	4.5% (1.4 – 7.6)
Exclusively breastfeed for 5/6 months	3.7%	4.8%	1.1% (−0.6 – 2.8)
Give complementary food at 5/6 months	56.9%	48.5%	8.4% (4.8 – 12.0)
Attend at least 3 antenatal check-ups	42.1%	10.3%	31.8% (28.1 – 35.5)
Dispose of faeces correctly	30.2%	20.6%	9.6% (4.7 – 14.5)

Table 4 demonstrates that carers in project areas report significantly better caring practices than carers in non-project areas. These differences are especially marked in the proportion of women who report attending three or more antenatal visits, and in the reporting of taking iron tablets during pregnancy.

The results of multiple regression analyses are given in Table 5. Variables which were significantly associated with malnutrition (defined as < -2 z-scores weight-for-age) in cross-tabulations were entered into the regressions. The regression shows no association between living in the project area and nutritional status. Factors significantly associated with malnutrition in the 6–23 month age group included: socio-economic status (defined using land ownership and occupation), maternal body mass index (BMI), child's age and formal education of the mother.

Table 6 gives project-related information collected only from households in the project area.

Discussion

This study shows that the project and non-project areas have similar rates of malnutrition even though communities in the project areas have been exposed to the intervention for over 5 years.

These findings indicate that the project failed to achieve its objective of reducing the prevalence of severe underweight by 40%, and moderate underweight by 25%, in young children in the project areas. It is possible that the project was effective for a sub-group of the population who actually received the intended services and responded to them.

Table 5. Coefficients of multiple regression of weight for age (defined in z-scores) and various other factors in children aged 6–23 months and 6–59 months (significance of coefficients given in brackets)

	Project (1 = project, 0 = not project)	SES (0 = poor, 1 = medium, 2 = better-off)	Formal education of mother (0 = none, 1 = some)	Diarrhoea (0 = no, 1 = yes)	Sex of child (1 = male, 2 = female)	Age of child (months)	Maternal BMI	R^2
6–23 months (n = 2388)	0.032 (0.47)	0.104 (<0.001)	0.154 (<0.001)	−0.063 (0.16)	0.057 (0.14)	−0.056 (<0.001)	0.080 (<0.001)	14.4%
6–59 months (n = 6816)	0.012 (0.66)	0.092 (<0.001)	0.136 (<0.001)	−0.104 (<0.001)	−0.057 (0.02)	−0.006 (<0.001)	0.074 (<0.001)	7.6%

Table 6. Some characteristics of mothers and children in the project areas

	Proportion (95% confidence interval)
Mothers who understood the growth chart at the interview	7.2% (5.7–8.6%)
Percentage of severely malnourished (<60% median weight-for-age) children aged 6–23 months enrolled in supplementary feeding programme on the day of the survey	22.2% (11.1–39.6%)

The majority (95%) of eligible children were enrolled in the growth monitoring and promotion section of the project (Ministry of Health and Family Welfare 2002). If growth monitoring and promotion was working as anticipated, it would be expected that the carers of the enrolled children would have been able to correctly interpret growth charts. However, this study found that only 7% of women in the project area were able to understand the growth chart (Table 6). An independent study of the project funded by the International Centre for Diarrhoeal Disease Control, Bangladesh (ICDDR,B) found similar results (Mannan et al. 2000). A further ICDDR,B funded study reported that the community nutrition workers were unable to take weights of children satisfactorily (Chowdhury et al. 1999). Similar problems with growth monitoring and promotion have been widely reported elsewhere (Roberfroid et al. 2001).

However, this study shows that mothers in project areas reported better caring practices than mothers in the non-project areas (Table 4), which was a likely outcome of growth monitoring and promotion. Reported practices are notoriously unreliable measures of real practice (Piwoz et al. 1995) and the improvements in reported behaviour do not appear to have been sufficient to improve the nutritional status of their children after over 5 years of implementation. Nutrition education combined with growth monitoring and promotion can only be effective in reducing malnutrition if (a) inappropriate caring practices are a major cause of malnutrition, (b) inappropriate caring practices are due to carer's attitude, confidence or lack of knowledge (as opposed to a lack of resources), and (c) households have the capacity to change their behaviour. It is unclear from the project design documents whether these conditions were evident in project areas.

Unlike growth monitoring and promotion, the coverage of the supplementary feeding programme was low. On the day of Save the Children UK's survey, only 20% of severely malnourished (<60% weight-for-age) children aged 6–23 months in the sample were actually enrolled in the programme (Table 6). This suggests that the growth monitoring and promotion failed to identify and/or successfully refer children eligible for feeding. Analysis of the children enrolled for supplementary feeding showed that children aged 12–23 months significantly improved their weight-for-age z-score through the period of supplementary feeding, though the improvements were not sufficient to result in high rates of recovery from malnutrition. A similar analysis for younger children (aged 6–12 months) found that the supplementary feeding did not improve their weight-for-age significantly (Duffield et al. 2002).

The children enrolled on the supplementary feeding programme did not receive all the food they should have. According to interviews in our survey, although 98% of children who were enrolled on the supplementary feeding programme received supplementary food on average 6 times per week, 28% of mothers reported that their child had shared the food with another child during the feeding sessions. Moreover, 67% of mothers reported that they did not feed the child any other food when s/he took the supplementary food. For these children it appears that the project food replaced, rather than supplemented, normal feeding. There are several possible reasons for this, including that either the mother was not adequately advised that the food should be additional to the child's normal diet, or the mother treated the supplement as a replacement because the household was already food insecure, or the child had no appetite because s/he was sick.

Supplementary feeding that supplies the nutrients missing from the diet in the quantities required for catch-up growth and, when necessary, adequate medical care can be a short-term solution to acute malnutrition (low weight-for-height) when other household members have access to enough food (Beaton and Ghassemi 1982). Some authors have also reported that supplementary feeding is useful to prevent mild to moderate wasting in non-emergency conditions (Rivera and Habicht 2002). However, unless the underlying causes of chronic malnutrition are adequately addressed, supplementary feeding cannot be expected to yield significant impact on low weight-for-age. Food insecurity (lack of access to enough food of adequate quality), poor health and poor caring practices contribute to these causes. The BINP fails to address two of these three factors.

Conclusions

The data presented above, although not conclusive, suggest that the BINP has not achieved its objective to reduce child malnutrition at a population level. It is not possible to determine from this study whether the reasons for this lie with design or implementation failures, but there are plausible reasons for failures in both. In any case, major problems in implementation are often attributable to design failures. Moreover, the resource intensity of the project throws into question whether greater impacts could be achieved in another developing country context. In spite of this, similar projects are about to be implemented elsewhere. In Ethiopia, the recently approved Food Security Project, also funded by a loan, aims to reduce stunting through growth monitoring and promotion in the community. This section of the project is not directly linked to any of the food security activities (Save the Children UK 2003).

Investment in improved nutrition is important and its potential impact should be maximized. However, the international community has an obligation to see that loans and other investments are based on sound and proven techniques. There is a need to undertake a general review of the impact of large-scale growth monitoring and promotion and nutrition education programmes. The current evidence base is inadequate to inform major investments (Panpanich and Garner 1999, for example). Finally, in order to inform future nutrition investment, there is a need to compare the cost-benefit of alternative long-term approaches to combating malnutrition, such as improving health services, access to formal education, food security and environmental health.

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