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Toward understanding the value of intra-household survey data for age-based food targeting

Lawrence Haddad and Ravi Kanbur

Abstract

Through the use of a stylized, age-based eligibility feeding programme, we attempt to quantify the benefit of having individual- (as opposed to household-) level food intake data when it comes to targeting food transfers on the basis of age. In this context we show how optimum age eligibility cut-offs depend on the availability of intra-household data on food intake. Second, we provide quantitative estimates of the value of intra-household information and of knowledge of the process of intra-household allocation of calories. Age proved to be a good indicator of individual calorie deficit. However, this was not the case with household-level calorie adequacy, which rendered age apparently less useful as a targeting instrument, often at considerable calorie cost. Food sharing within the household, on the other hand, rendered age impotent as a targeting instrument because of within-household leakage. If age is to be used as an effective eligibility criterion for a food transfer, the implementation of that transfer has to ensure minimum leakage to other household members. This type of exploratory analysis is one step toward quantifying the usefulness of intra-household data in the design of nutrition interventions. The costs of collecting intra-household data may outweigh the benefits, but the experiments presented begin to answer questions about the costs of not collecting them.

Introduction

Many food and nutrition interventions are targeted to young children and infants. These age groups are generally considered vulnerable to undernutrition due to low-energy-density weaning foods and vulnerable to infection due to the move from breast-feeding to weaning foods and increased toddler mobility. Moreover, the functional consequences of poor health are thought by many to be more severe for these age groups. Hence, age is often used as an indicator of vulnerability to malnutrition [1].

The case for age-based targeting of interventions would be even stronger if the actual allocation of food and non-food nutrition inputs was skewed away from young children. That the food and nutrition status of some household members is not necessarily a good indicator of the food and nutrition status of other household members is by now a fairly well-established generalization [2, 3]. A recent review of the evidence on the intra-household distribution found some promale and proadult bias in terms of the quantity of food intake, especially in south Asia, although variation was seen within that region. The review also found strong evidence of promale bias in the region in the allocation of non-food nutrition inputs such as health care [4].

If information as to the intra-household allocation of nutrition inputs were available, nutrition targeting could be fine-tuned for maximum impact. Such information is, however, costly to collect (retroactively we could not get access to such cost estimates). This begs the question that we hope to answer: what is the value of intra-household food and nutrition data in designing targeted nutrition interventions?

We attempted to quantify the benefit of having individual-level (or intra-household-level) data as the costs of a departure from the optimum design of a stylized, age-based eligibility feeding programme due to reliance on household-level data. This modeling exercise was carried out under two different assumptions as to the intra-household distribution of food.

The stylized feeding programme we constructed used an upper age limit for eligibility [5–7], with children age 6 to 36 months especially highly targeted.

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A longer and more formal presentation of this paper appears in the *Annales d'Economie et de Statistique*, Vol. 29, January/March 1993.

The essential design question was what this upper age limit should be if the objective was to minimize food poverty with given resources for the provision of food supplements. In terms of the best age eligibility cut-off, how far wrong can one go with only household-level data on nutrition? A more appropriate objective function would be to minimize the effects of food poverty. This acknowledges that the benefits to an 18-month-old of eliminating food poverty could be greater than the benefits to an 18-year-old. This omission will likely bias the optimum age cut-offs upward but should not bias our estimates of the costs of not having intra-household data, as these are generated from a comparison of two identical objective functions.

The second objective was to provide a quantitative estimate of the value of the extra information that the costlier intra-household survey provides when the objective is to design optimally targeted nutritional interventions. It is recognized in the food and nutrition literature, however, that such interventions cannot be seen independently of intra-household food allocation, since a supplement to a child can be nullified by an equivalent reduction in feeding at home [8]. The third objective was therefore to provide a quantitative assessment of how far wrong one goes by neglecting the intra-household repercussions of a nutritional intervention.

Optimum age cut-offs for nutritional targeting: Application to Philippine data

The data set came from a household survey in the Philippines. The data and methods of collection are described fully elsewhere [9]. Information on nutrition among 448 households in the southern Philippine province of Bukidnon was collected and averaged over four rounds to account for seasonality and other fluctuations. The distinctive feature of the data is that the food intake of each individual in the household was obtained using the 24-hour recall method [9]. This intake can be converted into calories using standard conversion factors. In addition, we can calculate the calorie requirement for each individual based on 32 age-gender-pregnancy status categories. For this reason, the data are illustrative rather than definitive measures of individual-level nutrient adequacy. For more precise analysis, individual energy requirements would in addition be based on body weight and activity patterns. The calorie adequacy ratio, the ratio of intake to requirement, was the measure of food poverty in this application, and a calorie adequacy ratio of 1 was the benchmark. This is referred to as a food poverty line.

Food poverty is defined in terms of the P_α poverty index [10]. For $\alpha = 0$, P_α becomes the head-count index, or the proportion of n individuals falling below a food poverty line (z). The larger the value of α, the greater the sensitivity of the index to the depth of food poverty. For example, at $\alpha = 0$ the index gives equal weight to the individual with a calorie adequacy of 0.7 and the individual with a calorie adequacy of 0.99. For $\alpha = 1$, P_α becomes the gap index, or the average shortfall of calorie adequacy below the food poverty line. For $\alpha = 2$, P_α measures the average squared shortfall of calorie adequacy below the food poverty line. Squaring the shortfall gives an even greater weight to individuals with larger calorie deficits and makes the index even more sensitive to the depth of food poverty. In figures 1–4, the vertical axes refer to P when $\alpha = 1$. Thus the units refer to the average calorie adequacy shortfall from 1.0. We call these shortfalls food poverty.

The daily food energy deficit in our sample, namely, the sum of the individual differences between intake and requirement, is 1,048,631 calories for the 2,880 individuals in the 448 households. Let I be an individual's calorie adequacy ratio. If we did not have individual-level data, we would be forced to assign a household's calorie adequacy ratio to each individual in that household. This variable is designated H. Figure 1 shows that the mean of I in an age group increases, by and large, with age, but that the mean of H does not. This insensitivity of H to age drives many of the results below. The sensitivity of I to age may suggest a prima facie case for an upper age limit to calorie supplements through feeding programmes and the like. But what is the optimum age cut-off?

To calculate the optimum age eligibility, consider what happens to overall food poverty at different age cut-offs and different food transfer sizes. Figure 2 shows that for a food transfer size of zero, there is obviously no impact on overall food poverty at any

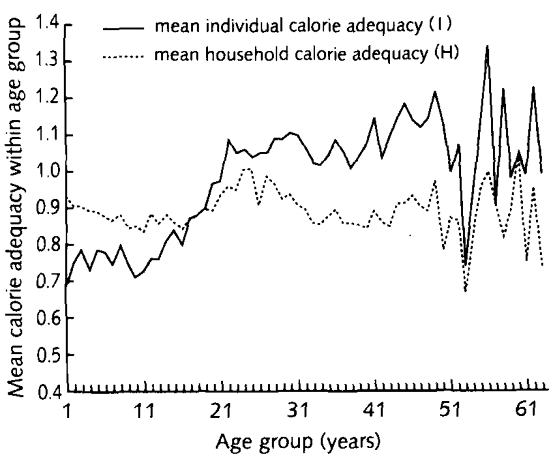

FIG. 1. Mean calorie adequacy within each age group for individual and household measures of calorie adequacy

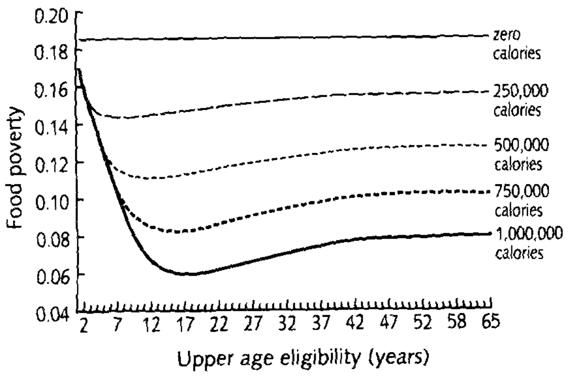

FIG. 2. Food poverty levels ($\alpha = 1$) for different upper age cut-offs and calorie interventions based on individual data (example 1)

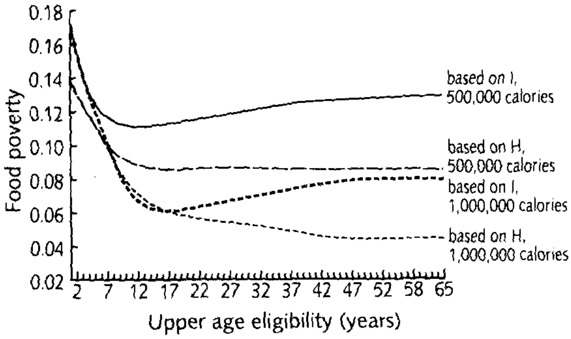

FIG. 3. Food poverty levels ($\alpha = 1$) for different upper age cut-offs and calorie interventions based on individual and household data (examples 1 and 2)

age eligibility: the average calorie deficit remains approximately 18%. The lowest line in figure 2 is when the overall food transfer is fixed at 1 million calories, just about the amount necessary to eliminate the energy deficit if it could be targeted only to those with energy deficits. But when this is not possible, the curve shows the best that can be achieved with age-based targeting. As the upper age limit increases, more individuals are brought into the eligibility net, but the size of the individual transfer is reduced because the fixed calorie transfer is divided equally among those eligible. At low age cut-offs, overall food poverty falls, and thus the marginal effect of bringing more people into the net dominates the infra-marginal effect of spreading resources more thinly over the existing beneficiaries. However, as figure 2 shows, eventually this balance is reversed, and overall food poverty increases. The age cut-off corresponding to the lowest overall food poverty is the optimum age cut-off. This is called example 1.

The value of intra-household information

The analysis of the previous section is based on a survey that collects information on individual nutrition within the household, but intra-household information is costly to collect, and it would be useful to know its benefits. In particular, how useful is it in targeting? With this data set, we can provide an answer to this question. As before, let I be the true individual calorie adequacy ratio and H the individual calorie consumption adequacy ratio when each individual is simply allocated the household's calorie adequacy ratio. Here the household's calorie adequacy ratio is the mean of I within the household. Another household calorie adequacy measure is the ratio of the sum of calorie intakes across all household members and the sum of requirements across all household members. We have shown, at least for this sample, that these two measures track each other very closely (i.e., only a slight negative correlation between calorie intake and calorie requirement) [11]. Without information on individual intakes, we would be forced to use the distribution of H to calculate the optimum upper age eligibility. Call this example 2.

Figure 3 compares the behaviour of food poverty lines based on I and H for fixed transfers of half a million and for 1 million calories. It is clear that the optimum age cut-offs can be different for I and H. In general, the curves based on household-level data are flatter and lower than those based on individual-level data. Intuitively, the flatness reflects the insensitivity of H to age. The suppression of intra-household inequality as represented by H results in age being a much poorer correlate with observed food poverty and hence a poorer targeting instrument. The marginal food poverty-reduction effect dominates the infra-marginal effect until much higher age eligibility levels are reached. In addition, the lowness of the H curve reflects the shallowness of observed food poverty, in all age groups, once intra-household inequality is suppressed.

What is the cost of getting the age cut-off "wrong" through the use of household-level data? One way to estimate this is to use individual-level data to calculate the extra calories that would be required to achieve the same level of food poverty reduction with the "wrong" age cut-off based on H, as was achieved with the correct age cut-off based on I. This idea is adapted from work on land-contingent poverty alleviation transfers [12]. Table 1 presents the amounts of these extra calories for various values of overall transfer and sensitivity to food poverty. The costs of not having accurate individual-level calorie adequacy information by which to identify the optimum age cut-off are in the range of 2% to 35% of the original interventions. The costs are substantial

TABLE 1. Equivalent cost (in calories) of not having individual-level data with which to target (example 1 versus example 2)

Sensitivity to food poverty	Size of calorie intervention	Best age cut-off (yr) (individual data)	Best age cut-off (yr) (household-level data)	Cost of not collecting intra-household data as percentage of original intervention
Low ($\alpha = 0$) (index: head count)	100,000	2.3	3.5	20.2
	200,000	3.7	5.1	9.2
	500,000	6.0	9.1	13.2
	600,000	7.0	10.5	8.5
	900,000	10.5	15.7	11.1
	1,000,000	11.6	18.7	11.0
Medium ($\alpha = 1$) (index: average calorie deficit)	100,000	5.0	9.1	2.5
	200,000	7.3	11.5	1.9
	500,000	13.3	55.0	30.7
	600,000	14.2	65.4	29.5
	900,000	17.5	65.4	24.2
	1,000,000	17.5	65.4	22.2
High ($\alpha = 2$) (index: average squared calorie deficit)	100,000	5.4	11.9	0.0
	200,000	11.4	18.3	2.0
	500,000	14.3	65.4	32.8
	600,000	17.5	65.4	29.2
	900,000	21.2	65.4	22.0
	1,000,000	21.2	65.4	19.6

precisely because actual calorie adequacy is strongly associated with age, and suppression of intra-household calorie information deprives us of a useful targeting instrument.

Intra-household allocation, leakage, and the implications for targeting

The analysis so far has assumed zero sharing of the calorie intervention that the eligible individual brings into the household. Either because the intervention is divided within the household, or through reductions in non-intervention calorie intake of the eligible member, it is highly unlikely that intervention calories add, one for one, to the total calories consumed by the eligible individual. What are the implications for the age-based targeting of calorie leakage from the eligible individual to fellow household members? Does it still make sense? In general, this depends on the extent to which there is intra-household calorie allocation away from the targeted group, namely, children.

Specifically, our data set allows us to answer the question, how useful is it to know the calorie reallocation outcome if age is used as a targeting instrument? As before, let I be the true calorie adequacy ratio, and let each eligible individual receive an equal share of the overall transfer. Now, however, the individual shares the calories with the other household members. The arbitrary rule imposed here is that the individual's pre-intervention share of household calories is unaffected by the intervention. (This rule can be justified, however, by reference to certain principles of bargaining theory [13].) Call this example 3.

Figure 4 compares the behaviour of food poverty under the three different examples. When the three functions are compared on the same vertical scale,

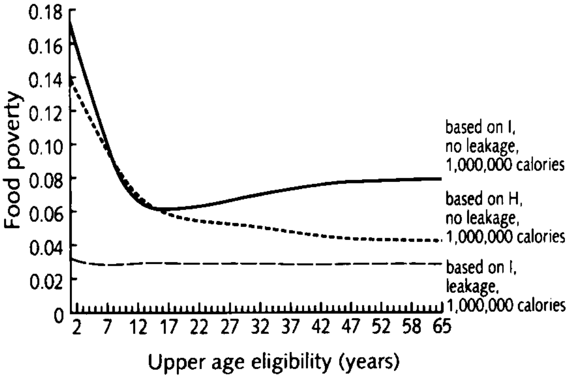

FIG. 4. Food poverty levels ($\alpha = 1$) for different upper age cut-offs based on individual and household data and no food sharing and food sharing (examples 1, 2, and 3)

we can see that the food poverty line for example 3 is the flattest and lowest.

The flatness occurs because the original sampling design required that each rural household in the Philippines survey contain at least one preschooler. With leakage, each household immediately receives calories even when the upper age eligibility is only two years. Therefore age is a good targeting instrument only if poor households contain more young children and intra-household allocations are not skewed away from them. The same analysis with a more demographically representative sample containing older, richer households with no children would produce a more curved food poverty line for this example.

The low position of the line would seem to indicate that in a community where children and adolescents are deficient in calories, food poverty is significantly reduced if calories nominally directed to children are leaked to other household members. This counter-intuitive result is generated because the objective function we have chosen to minimize incorporates the food poverty across all individuals in the sample and places equal weights in the objective function on the alleviation of infant food poverty and adult food poverty. The former assumption means that when calories designated to preschoolers are leaked to adolescents who are calorie-deficient, the food poverty index declines. The latter assumption is clearly unrealistic due to the high vulnerability of infants to undernutrition and its severe consequences for them. If we had built this into the objective function, the curve in example 3 would have been much higher.

Under these conditions, the costs of making the wrong assumption on food sharing (i.e., assuming there is no food sharing even when food sharing does take place) are virtually zero, since, due to leakages, age is no longer closely associated with the delivery of calories to those who need them most.

Conclusions

In the context of a stylized targeting experiment, we have shown how optimum age eligibility cut-offs depend on the availability of intra-household data on food intake. Second, we provided some quantitative estimates of the value of this information and of knowledge of the process of intra-household allocation of calories. For our sample, age proved to be a good indicator of individual food poverty. However, this was not the case with household-level calorie adequacy, which rendered age apparently less useful as a targeting instrument, at an often considerable calorie cost. Food sharing within the household, on the other hand, truly rendered age impotent as a targeting instrument because of within-household leakage. This effect was strengthened because each household contained at least one preschooler. Therefore, getting the age "wrong" in the context of the stylized food transfer had few consequences in terms of calorie costs. If age is to be used as an effective eligibility criterion for a food transfer, the implementation of that transfer has to ensure minimal leakage to other household members.

This type of exploratory analysis is one step toward quantifying the usefulness of intra-household data in the design of nutrition interventions. Possibly the costs of collecting the data outweigh the benefits, but the experiments presented here begin to answer questions about the costs of not collecting them.

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Evaluation of the impact of a food-based approach to solving vitamin A deficiency in Bangladesh

Ted Greiner and S.N. Mitra

Abstract

The impact of the third year (March 1992–March 1993) of a Worldview International Foundation project to increase the production and consumption of high-carotene foods in Gaibandah district, Bangladesh, was evaluated. The mothers of more than 2,500 children age one to six years, representative of Gaibandah, were interviewed at one-year intervals and compared with a similar sample in a geographically adjacent non-project area of equal size. A 24-hour recall was done regarding green leafy vegetables, yellow fruits and vegetables, oil-rich foods, and non-carotene-rich vegetables.

This project was multidimensional and was based on community participation. It used women volunteers, health assistants, and schools to spread knowledge, skills, and encouragement for growing carotene-rich foods and feeding them to young children. Modern and traditional mass media reinforced the messages. Seeds for mainly local varieties of high-carotene foods were distributed free or in certain cases sold by a network of trained women volunteers.

Knowledge of the problem and its causes increased in response to the communications. Home production of the targeted high-carotene foods increased remarkably in both the project and the non-project areas. Consumption patterns changed markedly but predictably toward more expensive foods during the study year due to an unprecedented drop in the price of rice.

Children's consumption of all but the non-carotene-rich vegetables increased significantly in Gaibandah. In the non-project area, consumption of yellow fruits and vegetables increased as much as in Gaibandah, oil-rich foods less than in Gaibandah, and non-carotene-rich vegetables much more than in Gaibandah. However, consumption of green leafy vegetables decreased significantly in the non-project area and increased significantly in Gaibandah. In March 1993, 26% and 52% of children, respectively, had eaten green leafy vegetables the day before the interview.

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Introduction

The impact of the third year of implementation of the Worldview International Foundation (WIF) Nutritional Blindness Prevention Programme (NBPP) in Gaibandah district, Bangladesh, was evaluated. The 1991 population of Gaibandah was estimated to be 1,856,000, divided into seven subdistricts (*thanas*). The NBPP began by testing various communication approaches to solve vitamin A deficiency in a pilot project in one thana in 1984–1986. This was evaluated by Helen Keller International (HKI) [1]. The recommendations for this evaluation were followed by NBPP and greatly influenced the design of the programme and how it was run during the next five years. Several additions were made in 1991 and 1992, as detailed below. To date, the programme has been implemented throughout four districts in northern Bangladesh with a total population of about 5 million.

In Gaibandah district, NBPP was funded by the Swedish International Development Authority (SIDA), which also funded this evaluation. Although the authors have had a close relationship with NBPP for several years, no NBPP personnel were involved in any stage of this evaluation and analysis. The NBPP staff did not know which areas were to be sampled in either the pretest or the post-test surveys, or where the control areas were.

Description of the NBPP

The NBPP attempted to achieve a cost-effective and sustainable solution to the problem of vitamin A deficiency in Bangladesh. It combined incentives for growing selected vitamin A–rich foods with education and encouragement to increase consumption of them and other high-carotene foods among young children. Early during the evaluation year, the third year of the programme in Gaibandah, a message was added encouraging the use of increased amounts of fat in young children's diets.

The NBPP worked through modern and traditional mass media and through a network of women volunteers (WVs) recruited from the villages, two in each union, a total of 165 in the district. The WVs, who had a minimum of 10 years of education, were given a three-day training course at the beginning and monthly one-day orientations thereafter. They worked nearly full time and received an honorarium of 600 taka (US$1 = 38 taka) per month. WVs were expected to visit 25 households daily, five days a week, according to a planned schedule. Late in 1991 a sixth day was added, and their honorarium was increased accordingly. The WVs were supervised by thana officers who had university degrees.

The following description of the programme includes data obtained from NBPP's own records for 1992 as well as from reviews done for SIDA by one of the authors (TG) in 1992 and 1993.

Methods to increase production of vitamin A–rich foods

During the evaluation period in Gaibandah, five activities were pursued to achieve the goal of increasing production of foods that are high in carotene or fat and are therefore likely to improve vitamin A status.

Twenty schools in each of the eight subdistricts were chosen based on their interest in and prospects for gardening (land and water availability). The headmaster and one teacher were trained in relevant skills and provided with funds to purchase the inputs necessary for a school garden focusing on carotene-rich vegetables and fruits. The subsidy was 1,000 taka for the first year, 500 for the second year, and none for the third year; however, it was decided to stop the subsidy midway through the project. The schools had not been prepared for the stopping of the subsidy, and 60% of the school gardens disappeared within a few months. Seed was provided free to about 15 highly motivated students per school who wanted to begin gardening at home, for a total of about 2,400 student gardens throughout the district.

Free vegetable seed and other assistance were provided to families of all children in the project areas found to be night-blind. (According to 1992 project statistics, 1,768 new individuals with night-blindness were identified. Of these, 828 were cured during the year, but the disorder reappeared in 208 of them.) Three types of seeds were distributed to all households in the district: bottle gourd, sweet pumpkin, and climbing beans. All of these crops grew on vines that crept up onto rooftops and into trees, thus providing carotene even for landless families.

In late 1991 the WVs became involved not just in nutrition education but also in production. They formed "green banks," consisting of demonstration gardens at their own homes and items for sale, such as seedlings, saplings, manure, and sometimes insecticide. This was intended to encourage other women in the communities to view the WVs as a source of easily available input and expertise for doing their own gardening, and thus to add sustainability to the project after it was phased out.

During 1992 the WVs began forming women's groups, usually consisting of four landholding and five landless women. These groups were given one-day training seminars in subjects ranging from horticulture to management skills. A total of 615 women's groups were formed that year, 3.7 per WV. A group garden was then started, with the harvest to be shared equally, although the landless women provided nearly all the labour. Although this was problematic to negotiate and sustain in many cases, it did provide many landless families with an increased supply of carotene-rich foods and some income. An evaluation of this approach in another district, Lalmonirhat, showed that it was successful in targeting the landless: 46% of women's group members were landless, compared with 36% of non-member households in the same area [2].

Nutrition education programme

Nutrition education in Gaibandah had six components geared toward increasing demand for these foods, especially for feeding to young children. A mass media campaign was developed to increase consumption of vitamin A–rich foods. Two different short spot advertisements were broadcast every day from the Rangpur radio station (which reaches Gaibandah). Earlier, NBPP had broadcast short spots on national television a few days a month on average. By 1992 this had become too expensive to continue, but HKI had started doing it by that time. In Bangladesh, radio reaches much of the poorer segment of the population, and television was believed to reach leaders, decision makers, and so on. The NBPP also paid for short vitamin A advertising spots to be shown continuously in local cinemas. Earlier, NBPP funded the production of a professional-quality 33-minute film in traditional melodrama-comedy style that included messages relevant to the programme. Using portable generators, this was shown outdoors at night 1,125 times in the villages in Gaibandah in 1992, attracting large audiences.

The NBPP messages were designed in the mid-1980s by a local group of experienced non-government organizations, scientists, and international agency representatives to reflect the lessons learned during the previous decade or more of efforts to solve vitamin A deficiency problems in the country. These messages were modified over the years in response to four earlier project evaluations; however, they were still somewhat general. The NBPP did not use social marketing methods to tailor messages to the needs of different target groups or to identified resistance points. For example, they did not address popular beliefs such as the belief that consumption of leafy vegetables during breast-feeding causes diarrhoea. However, this was a minor component of the WIF communication effort.

Messages were conveyed through the 160 cooperating schools. In addition, the WVs (according to their own records) made 781,600 home visits. On average, each household would have been reached 2.1 times in 1992 if these visits had been evenly distributed. The WVs also gave talks to groups using a flip chart and handed out 52,560 posters during the year after giving the talks.

The WVs promoted increased production and consumption of the following special foods: 19 high-carotene vegetables consisting of 12 types of dark green leafy vegetables plus carrots, tomato, pumpkin, sweet potato, beans, arum/chara root, and cabbage; 3 types of fruit (papaya, jack fruit, and mango); 2 types of locally common fish; and 2 oil-containing foods (peanuts and mustard seeds). The NBPP had earlier chosen this message in response to a local research project that, apparently using incorrect methods, arrived at the conclusion that these fish were very high in vitamin A, especially the heads. It was later reported that the pigment responsible for this finding did not have vitamin A activity. In any case, our observations suggest that few people in Bangladesh eat either the heads or the innards of fish, meticulously removing the latter from even small fish. The NBPP never dealt with production of fish or any other animal foods.

WVs also promoted the use of colostrum and continuation of breast-feeding for two years, with dietary supplements only from five months of age. The WVs made a total of 185,000 follow-up home visits to children with night-blindness to encourage their continued receipt of these special foods.

A team of four traditional folk singers was recruited and trained for each of the eight subdistricts. They put on outdoor shows in the villages that attracted large audiences. They conveyed messages about vitamin A by singing and chanting in the local dialects, illustrating their act with flip charts. Their own estimates of audience size suggest that about 750,000 people, 40% of the population of the district, witnessed their 3,631 performances during 1992, that is, 208 per performance.

A series of one-day awareness-raising seminars was given three times a year to a total of 200 village leaders. Finally, about twice a month the WVs did home visiting together with local government health assistants (HAs), providing information on dietary sources of vitamin A, the need to boil drinking water for children, and the use of oral rehydration for diarrhoea. Enough of these visits were made in 1992 to have covered about half of the households in the district. The 383 health assistants in the district were also paid 100 taka per month if they attended monthly meetings where they received relevant messages.

Even though the range of activities was wide, the entire three-year programme in Gaibandah cost only Swedish kronor (SKr) 4.5 million, approximately SKr 0.8 (under US$0.13, based on an estimated 1992 population of 1.9 million for Gaibandah and an exchange rate of SKr 6.2 = US$1) per capita per year.

The evaluation

Evaluations have been conducted by the Institute of Nutrition and Food Science, Dhaka University, of the other three districts in which NBPP has been implemented (although the components have differed somewhat in each). In Lalmonirhat there was no baseline study. In Rangpur and Dinajpur questions about food consumption were asked in a different way than they were for the baseline, and thus changes could not be evaluated. There were no control areas, so it was difficult to know if the other changes found were specific to the areas in which NBPP was working. These latter evaluations found that after three years of programme implementation, about twice as many households grew key vegetables and fruits high in carotene. Night-blindness levels, as reported by mothers to interviewers, were reduced by about half from baseline, when about 5% to 6% of households had a member with the disorder. The prevalence of night-blindness as reported by mothers was found to be a useful and reliable indicator of vitamin A status in Bangladesh [3]. It is the only practical indicator to use in a grass-roots project on the scale at which the NBPP is implemented.

In connection with a consultant visit by one of the authors (TG) to Bangladesh in January 1992, SIDA decided to fund a study that could determine more precisely the impact of NBPP in Gaibandah district. He was responsible for overall study design, interpretive data analysis, and writing this report; the other (SNM), through Mitra and Associates, conducted the field survey interviewing, coded and entered the data in a computer, compiled the data, and was responsible for the statistical analyses.

The two surveys were conducted in March 1992 and March 1993. In both years, all interviews took place during the Islamic month of Ramadan, when most of the population (93%) fasts during daylight hours. In addition to Gaibandah, a non-project comparison area was chosen consisting of seven geographically adjacent subdistricts in the districts of Joypurhat and Bogra. It was assumed that their geographical closeness would ensure that they were similar to Gaibandah, although it was recognized that NBPP activities were likely to influence such nearby areas.

The NBPP started its operations in Gaibandah in early 1990 and actual field operations began in April 1990. The programme continued until mid-1993. Thus this evaluation covered changes that occurred in the third and final year of the programme's field activity. The changes occurring during this one year were compared with those taking place in the non-project area. No baseline study had been done at the beginning and no further evaluation was done at the end. Therefore, this evaluation does not report on the full impact of the NBPP in Gaibandah. Nor can it be generalized to the other three NBPP districts where the set of activities that took place was slightly different and, in the case of Dinajpur and Lalmonirhat, the period of implementation was longer, up to six years.

Survey methods

Interviews were conducted only with households having at least one child age one to six years. Questions were asked of the mother or other guardian most involved in caring for young children. Four attempts were made on other days to obtain interviews with families not at home or unavailable at the first visit. Respondents were assured of confidentiality. Interviewers were instructed to advise parents of children with night-blindness to take them to a health worker.

The sample was chosen to be large enough that a difference of one percentage point in rates of night-blindness among children between one and six years of age over time or between the project and the non-project area would be statistically significant at the 95% level. This required a sample of 2,500 children in each area for each survey. The final resulting sample sizes for children and for respondents (mothers of the children in 97% of the interviews) are given in table 1. The interviews were conducted in private and took on average 53 minutes to conduct.

The two surveys were conducted on separate samples and were not repeat visits to the same households or even to other households in the same clusters. This ensured that any change in attitude or openness toward acquiring relevant new knowledge that might have been occasioned by the first survey had no influence on the results of the second one. (The random selection of clusters for the repeat surveys resulted in 1 of the 70 being chosen again. However, selection of households within that cluster resulted in few, if any, repeat visits.) A description of the sampling method used can be obtained from the authors.

Statistical analyses were performed on only a few key relationships and are reported in all cases in which they were performed. Student's two-tailed *t* tests were performed using standard errors.

Results and discussion

Characteristics of the sample populations

Results are presented here for both surveys and for project and non-project groups, for a total of four cells. The exact sample sizes were 2,559 and 2,522 for the project area in 1992 and 1993, respectively, and 2,529 and 2,518 for the non-project area. The mean age of about 42 months in all four cells was about the same as the median age. However, the tendency was toward heaping of reported ages in all four cells at five years of age. Ages are difficult to determine in Bangladesh, because they are not recorded and growth monitoring is uncommon. Therefore local calendars were used. Almost 52% of the children in all cells were boys.

The samples of respondents (their guardians) were 1,615 and 1,530 in 1992 and 1993, respectively, for the project area, and 1,733 and 1,599 for the non-project area. Over 99% of the children in all four cells lived at home with one or both parents. There were about 1.5 target children per respondent in all four cells.

The proportion of respondents who were non-Muslim (mainly Hindu) varied from about 6% to about 8% among the cells. The average age of the respondents was also similar, 28 years in the project area and 27 years in the non-project area. Despite their geographical proximity, clear socio-economic differences existed between the two areas. The educational level was lower in the project area, where 76% had never attended school, compared with 66% in the non-project area. The project area also was poorer than the non-project area. Average land holdings were somewhat smaller in the project area, with 44% of the respondents landless, compared with 37% in the non-project area. About 40% of the houses in the project area and 60% of the houses in the non-project area had metal rather than straw

TABLE 1. Proportion of households growing different types of foods

Types of foods	NBPP action	Project area 1992	Project area 1993	Non-project area 1992	Non-project area 1993
Green vegetables					
bottle gourd leaves	1	94.4	95.2	78.1	87.5
beans (green; on vine)	1	84.0	89.5	79.5	83.3
sweet pumpkin leaves	1	83.7	88.9	69.3	81.8
pui shak (a local vine)	2	60.8	73.6	53.4	64.1
radish leaves	2	45.5	53.8	41.1	46.5
red amaranth	2	37.9	53.6	33.7	40.6
local spinach	2	23.4	37.9	21.5	29.0
cabbage	2	4.8	9.1	8.2	6.5
kang kong	2	4.4	4.8	3.6	5.2
colocasia leaves	3	32.2	46.6	27.0	30.2
colocasia shoots	3	21.1	33.7	14.8	21.3
jute leaves	3	41.5	46.1	35.7	36.5
sajna ("drumstick" tree leaves)	3	12.9	23.9	14.2	22.5
chinese cabbage	3	1.7	5.3	3.4	2.9
mint	3	2.0	3.0	0.6	0.3
amaranth	4	52.3	64.1	43.3	51.4
lafa shak (local shrub)	4	22.8	30.4	1.1	4.2
watercress	4	2.5	8.6	2.9	3.6
others	—	8.2	9.1	6.6	9.7
Yellow vegetables and fruits					
sweet pumpkin	1	84.4	90.3	71.0	81.6
tomato	2	18.0	53.3	19.5	58.6
papaya	2	30.9	44.5	18.7	27.6
carrot	2	3.5	9.7	0.9	1.6
mango	3	71.8	78.1	61.2	68.3
jack fruit	3	57.6	64.3	53.6	58.5
sweet potato	3	22.3	34.5	24.0	27.5
palmyra palm fruit	4	6.4	10.0	26.2	26.6
Other vegetables and fruits					
banana	5	81.6	86.9	60.2	69.6
potato	5	49.0	49.9	64.8	66.1
eggplant	5	46.2	50.5	34.3	43.6
pineapple	5	14.6	20.3	14.9	17.2
dates	5	9.3	15.3	25.1	22.0
cauliflower	5	5.5	9.7	9.2	7.1
wood apple	5	4.6	7.2	14.8	16.8
others	—	9.3	10.5	13.8	9.6
Oil-bearing foods					
mustard seed	3	31.0	36.0	43.0	44.9
peanuts	3	3.2	7.8	3.3	3.3
sesame	4	10.0	18.7	14.5	16.4
soya beans	4	0.1	0.6	0.1	0.2
others	—	4.0	2.7	2.0	1.5
Number of respondents	—	1,615	1,530	1,733	1,599

1 = distributed by NBPP to all households in Gaibandah district.
2 = distributed by NBPP only to people with night-blindness and student gardeners.
3 = not distributed, but promoted by NBPP.
4 = special food, but not promoted by NBPP.
5 = not a special food (i.e., not high in carotene or fat) and not promoted by NBPP.

roofs. About 4% of the project houses and 10% of the non-project houses had electricity.

Production of special foods

It is not possible to determine how much overall impact the project had on production of foods. Furthermore, it is clear that the NBPP influenced production in geographically adjacent areas, not just the project area. There were no baseline data, and as discussed below, of the various project activities undertaken by NBPP, production of special foods is perhaps the one most likely to have made substantial progress during the first two years of the project, 1990 and 1991.

Table 1 presents data on the percentage of households growing various foods, in relation to NBPP activities in promoting them, divided into five categories. Interpretation of the results is facilitated by keeping in mind that the table records the results of the third year of a three-year process of change, gradually increasing acceptance of the promoted foods during the course of the project. As could be expected, the universal distribution of seed (category 1) appeared to have the greatest effect on the proportion of households growing them. This probably was true also for the adjacent non-project subdistricts. Universal seed distribution appeared to have reached a saturation level by 1992. Thus the incremental increase during the third year was relatively smaller in the project than in the non-project area.

The foods in category 2 were distributed free to target groups and promoted to everyone. Production of these appeared to increase during 1992 in about equal increments in the two areas, with the non-project area being slightly behind in the process. Exotic or new varieties such as carrots and cabbage were exceptions. They appeared to be just catching on after two to three years of promotion, leading to greater incremental increases in the project than in the non-project area.

A rapid qualitative survey of vegetable and vegetable seed salesmen in five cities where NBPP activities could have been expected to have had a cumulative effect over several years found that NBPP-promoted foods were those that had increased most in sales in recent years. Carrots, which had been relatively unknown in the area a few years before, had become one of the most popular vegetables [4].

Production of foods in category 3, which NBPP only promoted, without providing any free seed, could be expected to increase more slowly. Examination of the data suggests that this was indeed the case. Only in this category were the incremental increases in production generally much greater in the project area than in the non-project area. Again, these differences were especially pronounced for new or exotic varieties such as Chinese cabbage and sweet potato. There was also an increase in the number of people who grew traditional or wild foods for which seed need not be purchased, such as drumstick tree leaves and colocacia. Here the mass media may have enhanced the status of these easily available but underappreciated or "poor man's" varieties.

Foods for which NBPP provided free seed appeared to increase more in the non-project areas than those for which NBPP provided only promotional messages. This suggests that the free seed was widely sold to neighbouring areas, especially the seed that everyone received, which would rapidly have lost its market value in Gaibandah district. Information probably diffuses more slowly than something that can be sold. Among foods not promoted by NBPP (category 4), there was great variability in both the areas, with mainly increases in production, often of large magnitude, but also some decreases.

A statistically significant increase was seen in the proportion of households growing green vegetables and yellow fruits in the two areas, but for oil-rich foods only the increase in the project area was statistically significant. This is consistent with the fact that promotion of consumption of these foods started late, and seeds for them were not distributed. There was also a smaller but statistically significant increase in the proportion of households growing non-special foods in both areas (category 5).

Respondents were asked where the family was growing special foods and the size of the areas cultivated. As expected, respondents in the project area had fewer and smaller separate gardens, since more of them were landless. On the other hand, more of them were growing more special foods in strips beside their homes and on rooftops, presumably in response to NBPP encouragement and assistance. An increase in rooftop gardening was probably a year behind in the non-project area, as cheap seeds for vines were presumably coming there from Gaibandah.

Separate gardens are larger and are more likely than the other types to be intended to generate income. They actually seemed to be declining in prevalence and size more in the project area than in the non-project area. Three factors may have contributed to this rather anomalous finding.

First, it might have been partly due to disappointment among the larger vegetable farmers caused by the low prices their produce had obtained the year before. Apparently, NBPP efforts to increase demand had not kept pace with increases in production. Unlike the seed itself, fresh produce is expensive and difficult to transport; the market was not used to handling large quantities of surplus produce; and it cannot be stored. The Bogra portion of the non-project area has a long-established tradition of vegetable production and marketing and may have been better able to find markets for its increased production, especially since the pace of increase was slower.

Second, an unusual storm, including heavy rain and hail, occurred in early 1993 and destroyed over 70% of the NBPP gardens in Gaibandah. This may have had a greater effect on the more exposed separate gardens than on those against walls or on rooftops. Some of the affected gardens may not have been restarted by the time of the March 1993 survey.

Finally, a substitution effect may have been caused by distributing free seed for vegetables suitable for growing on rooftops. Gardens could then be used for other foods instead.

The proportion of sample households not growing any special foods declined in the project area from 6.8% to 2.7% and in the non-project area from 9.6% to 4.3%. In both areas, about 97% of these households gave as the reason that they had little or no land to cultivate. Other reasons mentioned by 5% to 10% were no money and poor yield.

Consumption of special foods

Respondents were asked to recall the types of foods the household and children age one to six years had consumed during the past 24 hours (tables 2 and 3). No information was requested regarding amounts consumed. Table 4 compares consumption of special foods by households and young children in the two areas. In table 5 the differences in consumption of special foods by children are compared between 1992 and 1993 and tested for statistical significance. The following four factors must be taken into account in interpreting these data:

- The population in the non-project area had a higher socio-economic status than that in the project area. Therefore they were able to consume more expensive foods and less of the cheaper, less desirable foods such as wheat and green leafy vegetables.
- The evaluation was conducted in the third year of the NBPP's field activity. Some of NBPP's com-

TABLE 2. Foods consumed by households (24-hour recall)

	Project area		Non-project area	
Types of foods	1992	1993	1992	1993
Rice	95	99	98	99
Wheat	67	4	46	11
Potatoes	74	86	86	93
Sweet potatoes	11	7	16	12
Meat[a]	8	16	18	23
Fish[a]	43	49	60	60
Eggs[a]	15	13	14	15
Dal (lentils)	20	24	25	25
Green vegetables	46	59	42	31
Other vegetables	72	77	65	74
Oil in curry[a]	90	97	92	99
Other oil/fat[a]	14	31	14	36
Yellow fruits[a]	14	25	11	22
Other fruits[a]	2	2	4	2
Peanuts	0.1	0.9	0.4	0.3
Mustard seed	4	14	4	10
Sesame	0.4	0.6	1	0.8
Coconut	0.9	0.5	0.9	0.4
Soya bean	2	0.6	2.0	0.8
Rice snacks[a]	42	74	55	75
Spices	97	100	97	99
Lemonade, etc.[a]	5	5	12	9
Fresh milk[a]	14	26	28	41
Powdered milk[a]	3	4	5	5
Sugar, molasses[a]	24	29	39	38
Others	0.2	6.4	0.5	15
At least one special food	93	95	87	89
Sample size	1,615	1,530	1,733	1,599

a. Foods probably consumed more than usual during Ramadan.

TABLE 3. Foods consumed by children age one to six years (24-hour recall)

Types of foods	Project area		Non-project area	
	1992	1993	1992	1993
Rice	87	97	90	97
Khichuri (rice porridge)	5	2	11	4
Wheat/bread	57	3	35	9
Potatoes	62	77	74	84
Sweet potatoes	13	6	12	10
Meat[a]	8	12	14	19
Fish[a]	34	39	47	49
Eggs[a]	10	9	10	9
Dal (lentils)	16	19	19	20
Green vegetables	40	52	34	26
Other vegetables	59	65	49	62
Yellow fruits[a]	9	21	7	19
Other fruits[a]	2	1	3	2
Oil with curry[a]	77	91	78	91
Other oil/fat[a]	10	23	10	27
Peanuts	0.8	0.6	0.5	0.5
Mustard seed	3	11	3	8
Sesame	0.4	0.4	0.6	0.6
Coconut	0.4	0.2	0.2	0.3
Soya bean	2	0.2	2	0.1
Rice snacks[a]	36	62	48	64
Spices	91	94	90	93
Sugar, molasses[a]	25	24	32	28
Lemonade, etc.[a]	14	2	14	4
Fresh milk[a]	10	21	18	33
Powdered milk[a]	1	2	3	3
Breast milk	35	36	35	37
Sample size	2,559	2,522	2,529	2,518

a. Foods probably consumed more than usual during Ramadan.

TABLE 4. Consumption of special foods by households and young children

Special foods	Project area				Non-project area			
	Households		Children		Households		Children	
	1992	1993	1992	1993	1992	1993	1992	1993
Green vegetables	45.6	58.8	39.7	52.2	42.8	31.3	33.8	25.9
Other vegetables	72.5	76.5	59.0	64.6	65.3	73.9	48.6	61.9
Yellow fruits	14.0	25.3	9.1	21.1	10.7	21.8	6.6	18.6
Oil-rich foods	6.4	15.0	5.7	11.7	6.1	11.1	4.5	9.1
Sample size	1,615	1,530	2,559	2,522	1,733	1,599	2,529	2,518

These figures represent the percentage of households and children, respectively, who ate at least one item within each respective category (as shown in tables 2 and 3).

munication efforts in the mass media probably had an effect on the non-project area as well as on the project area.

» Bangladesh had an especially large rice harvest a few months before the 1993 survey. In the early months of 1993, rice was selling for 5 taka per kilogram. In the months before the 1992 survey, it had been selling for 9 taka per kilogram. This meant that in early 1993 rice was actually cheaper than wheat (usually eaten in rural Bangladesh only by those who cannot afford rice), an unprecedented occurrence.