An integrated child nutrition intervention improved growth of younger, more malnourished children in northern Viet Nam*

Dirk G. Schroeder, Helena Pachón, Kirk A. Dearden, Tran Thu Ha, Tran Thi Lang, and David R. Marsh

Abstract

*Integrated nutrition programs are widely used to prevent and/or reverse childhood malnutrition, but rarely rigorously evaluated. The impact of such a program on the physical growth of young rural Vietnamese children was measured. We randomized six communes to receive an integrated nutrition program implemented by Save the Children. We matched six communes to serve as controls. Our sample consisted of 238 children (*n *= 119 per group) who were 5 to 30 months old on entry. Between December 1999 and December 2000, we measured weight and height monthly for six months and again at month 12. Principle outcomes were weight-for-age Z score (WAZ), height-for-age Z score (HAZ), and weight-for-height Z score (WHZ), and the changes among these measures. As expected, anthropometric indicators relative to international references worsened as the children aged. Overall, children in the intervention communes who were exposed to the integrated nutrition program did not show statistically significant better growth than comparison children. Intervention children who were younger (15 months or less) and more malnourished (less than –2 Z) at baseline, however, deteriorated significantly less than their comparable counterparts. Between baseline and month four, for example, intervention children who were malnourished and less than 15 months old at entry lost on average 0.05 WAZ while similar comparison children lost 0.25 WAZ (*p *= .02). Lack of overall impact on growth may be due to a lower than expected prevalence of malnutrition at baseline and/or deworming of comparison children. Targeting nutrition interventions at very young children will have the maximum impact on growth.*

Key words: child, nutrition, growth, diet, Viet Nam

Introduction

Integrated nutrition programs are widely used to prevent and/or reverse childhood malnutrition, but are rarely rigorously evaluated. Malnutrition, as measured by poor anthropometric growth, has been widespread in Viet Nam. During the 1990s, 42% of Vietnamese children were stunted [1].

Since 1990 Save the Children has implemented integrated nutrition programs, designed around the positive deviance approach. This program has had various formulations and names, but will be referred to as the community empowerment and nutrition program or CENP in this paper. A previous formulation, called poverty alleviation and nutrition program and evaluated using internal monitoring data, reduced severe childhood malnutrition among children less than three years of age by 75% [2]. In addition, this improvement in children's nutrition was rapid (within the first year of implementation) as well as long lasting. Mackintosh et al. [3] found that children who participated in the program were significantly better nourished than children who did not, two years after Save the Children

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*The ViSION (Viet Nam study to improve outcomes in nutrition) project evaluated the implementation and impact of an integrated nutrition program on the nutritional status, morbidity, diet of, and care for children 5 to 25 months old at baseline in rural Viet Nam, through a partnership among Save the Children/US (Hanoi and Westport, Conn., USA), the USAID-funded LINKAGES Project (Washington, D.C.), Emory University's Rollins School of Public Health (Atlanta, Ga., USA), and the Research and Training Center for Community Development (Hanoi).

left the program area. In addition, the younger siblings of these children, born after the program ceased, were significantly better nourished than the younger siblings of children from comparison communities.

The success of the CENP in reducing malnutrition, quickly and sustainably, led us to seek to better understand how this integrated nutrition program worked. We thus undertook a large and much more methodologically rigorous evaluation of the CENP in northern Viet Nam using a randomized, prospective design. The research effect is referred to as the Viet Nam study to improve outcomes in nutrition (ViSION) project. We report here the effects of Save the Children's CENP intergrated nutrition program, as implemented within the ViSION project, on the growth of children.

Methods

The CENP intervention—as generally implemented

The CENP program is presented in detail elsewhere [4]. In summary, the CENP program incorporates three main elements: growth monitoring to identify malnourished children, a positive deviance informed approach to identify local foods or behaviors that are associated with better growth, and intensive feeding based on the "hearth model" [2]. These are briefly described below.

Identification of malnourished children and growth monitoring

At initiation of the program, local health volunteers weighed all children in the community less than three years of age. The objectives of this step are to identify malnourished children who need rehabilitation and to find positive deviant children who are growing well despite the fact that their families are poor. After the initial weighing, all children less than three years of age participate in growth monitoring and promotion sessions every other month for two years.

Positive deviance approach and inquiry

The central premise behind the positive deviance approach is that in every community there are some families who are able to raise healthy children despite their economic poverty. These are referred to as positive deviant families and their offspring as positive deviant children. The objective of the positive deviance inquiry (PDI) is to identify feeding, caregiving, and health-seeking practices which allow positive deviant families to raise well-nourished children [5]. By design, the PDI includes interviews with just four positive deviant families. The validity of the PDI method has been evaluated and presented elsewhere [6].

Nutrition education and rehabilitation program (NERP)

Information gathered through the PDI informs the content of two-week long NERP sessions that are modeled after the hearth approach originally developed in Haiti [2]. The NERP intervention is described in detail elsewhere [4]. In brief, caregivers of malnourished children are invited to attend daily intensive nutrition rehabilitation sessions that last two weeks every month.

Other elements of the CENP intervention

Messages promoted at both the growth monitoring and at the NERP sessions include feeding children "good foods" (i.e., positive deviant foods) identified during the interviews with positive deviant families, and educating mothers in good caretaking practices based on UNICEF's Facts for Life. All children are dewormed once during the first six months of the program.

Study setting, enrollment and randomization

This study was carried out in a rural province northwest of Hanoi, which is characterized by subsistence farming and poverty. Details on selecting the study setting and carrying out enrollment and randomization are provided elsewhere [4]. We identified 12 communes with minimal geographic contiguity, and group matched them on potential confounders, e.g., rice production, altitude, percent malnourished. We randomly assigned one group as the intervention group and the other as a comparison group. Within each commune, we then ranked the hamlets by proportion of malnourished children and selected those with the highest rates of malnutrition. Within these "high malnutrition" hamlets, we randomly selected 120 children age 5 to 25 months from the intervention communes and another 120 children from the comparison communes.

The CENP—as studied

The CENP we studied was as similar as possible to the CENPs implemented elsewhere in the country. There were, however, a few notable differences between the "typical" CENP and the CENPs implemented within the ViSION project. These modifications were due to unexpectedly low rates of malnutrition in the study communes, attempts to isolate the effects of specific elements of the multifaceted intervention, and ethical and logistical considerations.

Although the official statistics on the rates of malnutrition were quite high in study communes, we found fewer children than we expected who met the NERP enrollment criteria—age 5 to 25 months, no serious illness, and severe malnutrition (local reference channel "C" or "D," i.e., less than –3 WAZ). In this implementation of the CENP, Save the Children enrolled children who were less than –2 weight-for-age Z score (WAZ), but greater than –3 WAZ (channel "B") in NERP sessions. Of note, the Save the Children programmers had been considering such a modification apart from the objectives of the ViSION project with the aim of shifting the CENP to be more effective at preventing malnutrition rather than just rehabilitating children who had already become severely malnourished.

We dewormed all comparison as well as intervention children for ethical reasons and to isolate the other elements of the CENP intervention from the effects that may be due to deworming. As described elsewhere [4], universal deworming of children is a Vietnamese national policy.

Measurement of outcomes

Beginning in December 1999, we used a longitudinal, prospective design to gather anthropometry on children at baseline, monthly between months 1 to 6, and again at month 12 of the study. Data collection spanned the rainy and dry seasons (February to July and August to January, respectively).

We also gathered information on diet, illness, care, internal determinants of behavior (knowledge, beliefs, and attitudes including perceived advantages and disadvantages of the behavior, self-efficacy, norms, and skills), and external determinants of behavior (time, father's role, and maternal nutritional status). Children who were severely ill were referred to the local health center. We developed all questionnaires in English, translated them into Vietnamese, trained field workers in their use, pilot-tested them in similar, non-study communities, revised them, re-trained field workers, and back-translated them into English for accuracy.

Field workers repeated each anthropometric measurement three times at each follow-up period. We used digital reading tare SECA scales (UNICEF, electronic scale 890, SECA Ltd., Birmingham, UK), precise to 100 g for weight; four-color mid-upper arm circumference tapes, precise to 1 mm for mid-upper arm circumference; and Shorr infant/child/adult height measuring Boards (Shorr Productions, Olney, Md., USA), precise to 1 mm recumbent child lengths. Cold weather precluded fully undressing children between December and February. Consequently, we weighed representative clothing items, inventoried the subject's clothing, calculated the total weight of the clothes, and subtracted this from the otherwise tared children's weight (mother with partially dressed child versus the mother alone). In a separate validation study, we found this methodology to provide excellent results [7]

The field workers and supervisors, affiliated with the Research and Training Center for Community Development (RTCCD) in Hanoi, were bachelor's level physicians and sociologists with previous health data-collection experience in rural Viet Nam. Every evening, the field workers reviewed forms for completeness and accuracy. Supervisors reviewed all forms and discussed any discrepancies. If necessary and logistically feasible, households were re-visited to reconcile these discrepancies.

Data were entered and cleaned by the RTCCD in Hanoi using Epi Info [8]. Further checks were run at Emory University and shared with the RTCCD staff who reviewed original forms and updated the data as needed.

Variable creation

Outcomes

The three primary outcomes of interest were weight-for-age Z scores (WAZ), height-for-age Z scores (HAZ), and weight-for-height Z scores (WHZ). Z scores were based on the child's gender, height, weight, and age (in months) and were created using Epi Info 6.04d [8]. Given some differences in baseline Z scores between intervention and comparison children, we also calculated the change in WAZ, HAZ, and WHZ between entry and each follow-up point. We compared the differences over time for each indicator for both the intervention and comparison children.

Covariables

Diet 3

The child's dietary intake was ascertained via the caregiver's 24-hour recall of what the child consumed in the previous day [9]. The 1972 version of the Vietnamese food composition table was used to convert the food items into energy and nutrient intake, such as the amount of kilocalories, protein (grams), and vitamin A (micrograms of retinol equivalent). Vitamin A supplementation was not being regularly implemented by governmental or non-governmental organizations in the study communes during the study period.

Morbidity

Caregivers were asked to recall what illnesses the child experienced in the previous two weeks. The morbidity variables considered for the multivariate analyses were the number of days with diarrhea, slight anorexia, slight fever, or any respiratory illness (includes cough, difficult/rapid breathing, chest in drawing, bronchopneumonia, throat infection, sore throat, bronchitis, runny nose, or stuffed nose). These variables were chosen because more than 5% of the children reported these illnesses. These data were analyzed as continuous variables ranging from 0 to 14 days.

Other covariables

Additional independent variables considered for multivariate models were maternal age in years (continuous), parity (less than 2 vs. more than 2 live births), household income (categorized by baseline data quartiles), home roof material (categorical), and home floor material (categorical). A composite socioeconomic status variable was created using factor analysis that included interviewee's self-reported standard of living, electricity access, house construction material, and interviewer's assessment of the family's socioeconomic status.

Potential effect modifers

The child's sex as well as age and nutritional status at baseline were considered as effect modifiers. Age was dichotomized as less than or equal to 15 months versus older than 15 months, the approximate mean age of the sample population at entry, while nutritional status was dichotomized as –2 or less WAZ versus more than –2 WAZ at baseline.

Statistical analysis

Linear regression was used to determine whether the intervention had an effect on the outcomes of interest (WAZ, HAZ, and WHZ), while controlling for potential confounders. Effect modification was examined between the study group and age dichotomized at 15 months and –2 WAZ by examining whether the regression lines were parallel and/or had the same y-intercept. The regression coefficients of the interaction terms were examined for significance.

Pearson's correlation coefficients were used to determine whether the independent variables were correlated. Variables were determined to be correlated if the Pearson's correlation coefficient was greater than 0.50 and statistically significant. Further, the variables were examined for gross violations of linear regression assumptions.

Final multivariate regression models were selected using a backward selection procedure. Least significant variables were dropped from the model until all remaining variables were at least significant at the 0.10 level. Study group, age, and gender variables were retained in the models regardless of significance level. All analyses were performed using SAS 8.0 (SAS Institute, Cary, N.C., USA).

Results

Sample characteristics

Two hundred and forty-one children were enrolled in the study at baseline, including two children younger than five months and one child older than 25 months who were excluded from these analyses (table 1). Of the remaining 238 participants, five dropped out during the course of the study. At month six, there were a total of 232 children with complete data (114 in intervention communes and 118 in comparison communes).

At baseline, children were 15.5 months old on average, most were breastfeeding, and more than one-third were stunted (table 1). Study mothers were about 26 years old, almost one-quarter of them were malnourished, about half did not complete secondary school, and most had two or fewer children and were farmers. Despite matching of communes and random selection, the intervention families were somewhat better off on a number of characteristics, although this differential only reached statistical significance for child wasting (2 or about 2% of children less than –2 WHZ in intervention communities versus 12 or about 10% of children less than –2 WHZ in comparison communities, $p < .001$). Although the actual number of wasted children was small in each group, and therefore did not likely have much impact on the overall results, we controlled for initial WHZ in multivariate models. Potentially more problematic, the mean WAZ for children in the intervention group was –1.51 Z (SD: 0.91) on entry while in the control group, it was –1.68 Z (SD: 0.87) ($p = .14$). In order to understand the impact of the intervention on growth, we primarily examined the change in Z score values from baseline to various points at follow-up; we also controlled for WAZ in the multivariate models.

About half (45%) of intervention children participated in NERP sessions; attending children were enrolled in NERPs an average of 4.5 months, i.e., from 4.5 two-week sessions.

Overall impact on growth

As expected, anthropometric indicators relative to international growth references worsened as the children aged (fig. 1). Overall, children in the intervention communes did not show statistically significant better growth than comparison children at any time as indicated by the parallel nature of the lines in figure 1. Key anthropometric outcomes did not differ between intervention and comparison children at six months of follow-up (table 2).

However, both age and nutritional status at baseline significantly modified the effects of the intervention on growth. Intervention children who were younger

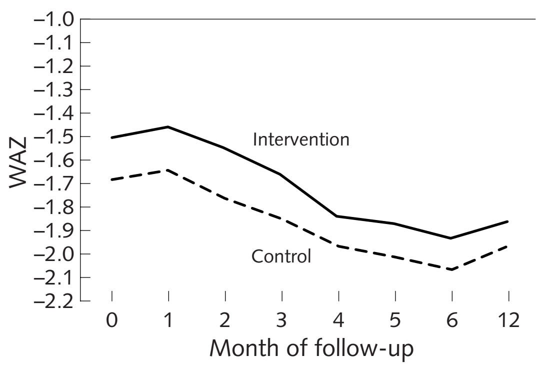

FIG. 1. Mean WAZ- intervention versus control

TABLE 1. Characteristics of the sample at baseline

Characteristics	Intervention[a] ($n = 119$)	Comparison[a] ($n = 119$)	p values if $p < .05$
Age (mo)	14.9 (5.1)	15.1 (5.1)	NS
Females (*n*, %)	52 (43.7)	59 (49.6)	NS
Weight (kg)	8.3 (1.3)	8.2 (1.3)	NS
Height (cm)	73.4 (5.1)	73.4 (4.7)	NS
Weight-for-age Z	–1.51 (0.91)	–1.68 (0.87)	NS
Weight-for-age < –2 Z (*n*, %)	36 (30.3)	42 (35.3)	NS
Height-for-age Z	–1.65 (0.97)	–1.67 (1.05)	NS
Height-for-age < –2 Z (*n*, %)	42 (35.3)	51 (42.9)	NS
Weight-for-height Z	–0.66 (0.76)	–0.90 (0.84)	.03
Weight-for-height < –2 Z (*n*, %)	2 (1.7)	12 (10.1)	< .01
Currently breastfeeding (*n*, %)	86 (72.3)	78 (65.5)	NS
Mother's age (yr)	26.2 (4.7)	26.9 (5.4)	NS
Mother's body mass index < 18.5 (*n*, %)	29 (24.4)	28 (23.5)	NS
Mother did not complete secondary school (*n*, %)	56 (47.1)	68 (57.1)	NS
Mother with 2 or fewer children (*n*, %)	104 (87.4)	93 (78.2)	
Mother a farmer (*n*, %)	111 (93.3)	114 (95.8)	NS
Family's yearly income, x 1000 dong[b]	6,527.0 (7109.5)	6,777.7 (6391.9)	NS
Family's socioeconomic status	–0.01 (1.03)	0.04 (1.15)	NS
Ever attended a NERP (*n*, % yes)	53 (44.5)	NA	NS
No. of months NERPs attended ($n = 53$)	4.5 (1.7)	NA	NS

NS, not significant. NA, not applicable.
a. Numbers in parentheses are mean ± SD unless indicated (*n*, %) in column 1.
b. 1US$ = 14, 025 Vietnamese dong.

TABLE 2. Key anthropometric outcomes at six months of follow-up by study group

Characteristics-coding	Sample size	Intervention group n=114	Comparison group n=118	p value
Child's gender				
Male, *n* (%)	231	64 (56.1%)	59 (50.4%)	0.38
Female, *n* (%)		50 (43.9%)	58 (49.6%)	
Weight-for-age (WAZ) z-scores				
Mean (SD)	232	–1.92 (0.78)	–2.06 (0.79)	0.19
Height-for-age (HAZ) z-scores				
Mean (SD)	232	–1.66 (0.94)	–1.66 (0.88)	0.96
Weight-for-height (WHZ) z-scores				
Mean (SD)	232	–1.25 (0.67)	–1.39 (0.68)	0.12
Wasting				
<–2 WHZ score: *n*%	232	17 (14.9%)	15 (12.7%)	0.63
≥ –2 WHZ score: *n* %		97 (85.1%)	103 (87.3%)	
Stunting				
<–2 HAZ score: *n*, %	232	41 (36.0%)	39 (33.1%)	0.64
≥ –2 HAZ score: *n*, %		73 (64.0%)	79 (67.0%)	
Underweight				
<–2 WAZ score: *n*, %	232	53 (46.5%)	66 (55.9%)	0.15
≥ –2 WAZ score: *n*, %		61 (53.5%)	52 (44.1%)	

(15 months or younger) and more malnourished (less than –2Z) at baseline deteriorated less than their counterparts who were matched for age and nutritional status (fig. 2). Between baseline and month four, for example, younger, more malnourished intervention children lost on average 0.05 WAZ relative to reference values; whereas, younger, malnourished comparison children lost 0.25 WAZ during the same period ($p = .02$). The benefits of the intervention ranged from 0.15 WAZ to 0.21 WAZ in months two through five. The difference at months 6 and 12 were somewhat attenuated and not statistically significant.

A similar pattern was seen among this more malnourished, younger group for the onset of stunting. The HAZ scores of children in the intervention group had deteriorated 0.3 HAZ up to 0.65 HAZ less than comparison children at the various follow-up points (fig. 3). No significant benefits among younger, more malnourished children were seen for WHZ.

Multivariate models of these outcomes, controlling for potential confounders, confirmed the significant modifying effects of age and nutritional status (table 3). A three-way interaction among intervention, age, and WAZ at entry was highly statistically significant ($p < .005$).

Discussion

Overall, rural children exposed to Save the Children's integrated nutrition program in northern Viet Nam did not show better growth than comparison children. However, children who were younger (less than 15 months old) and more malnourished (less than –2 WAZ) at baseline had significantly better growth than similarly young, malnourished comparison children. These effects were strongest during the most intensive first six-month period of the intervention and became attenuated and non-statistically significant three months after cessation of the feeding program.

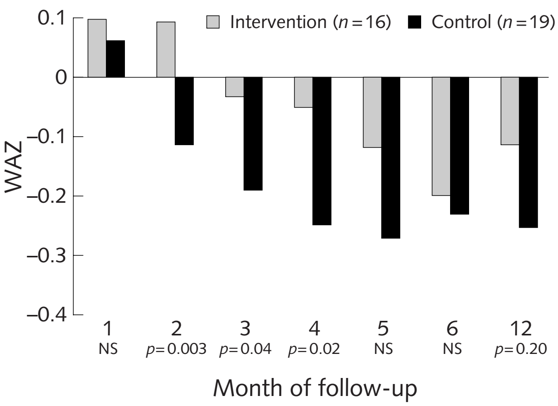

FIG. 2. Difference in WAZ between follow-up month and baseline children less than 15 months of age and less than –2 WAZ at baseline (intervention, n = 16, control, n = 19)

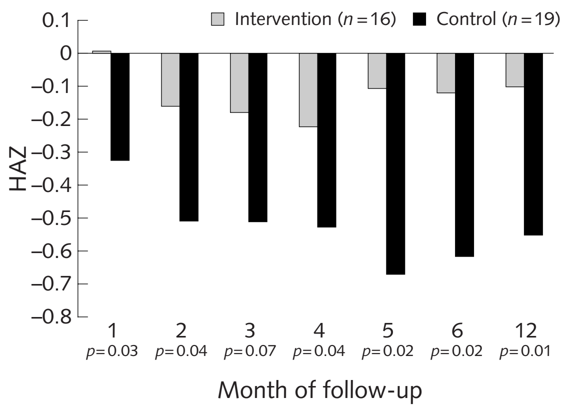

FIG. 3. Difference in HAZ between follow-up month and baseline children less than 15 months of age and less than –2 HAZ at baseline (intervention, n = 16, control, n = 19)

TABLE 3. Results of multiple variable analysis of the effects of the CENP intervention on change in weight-for-age Z-score (WAZ) between baseline and four months of follow-up

Variable	Label	Parameter estimate	Standard Error	Pr > |t|	95% confidence limits	
Intercept	Intercept	–0.01	0.07462	0.8935	–0.15704	0.13704
age15	Age ≤15 mo =1 age >15 = 0	–0.24263	0.11095	0.0298	–0.46125	–0.02401
wazneg2	WAZ > –2 =1 and WAZ < –2 = 0	–0.23886	0.09208	0.0101	–0.42031	–0.05741
intvgrp	Study groups (intervention vs. control)	–0.162	0.10942	0.1401	–0.37761	0.05361
age_grp	Age at baseline * intervention group	0.35776	0.16346	0.0296	0.03567	0.67984
age_unwt	Age at baseline * WAZ at baseline	–0.0482	0.13821	0.7276	–0.32054	0.22413
grp_unwt	Intervention group * WAZ at baseline	0.28794	0.13419	0.033	0.02352	0.55236
agegrpwt	Age at baseline * intervention group * WAZ at baseline	–0.56836	0.1998	**0.0049**	–0.96205	–0.17466
R-square 0.2674						

Notably, the largest effects coincided with the months March-April, which immediate precede the May-June rice harvest.

There was no overall effect on growth in spite of the fact that the intervention was successful at improving dietary intakes and reducing morbidity among this same sample counterparts [9, 10]. Intervention children consumed more positive deviant foods and energy than their comparison counterparts [9]. Dietary intakes of youngest, most malnourished children in the intervention communes were significantly improved as compared to younger, malnourished comparison children. We found significantly fewer respiratory infections among the CENP group overall. Notably, rates of diarrheal disease, which has been most consistently associated with poor growth, were very low in both groups.

The finding that younger children benefited most from the intervention is consistent with other studies that have examined the effect-modifying role of age with nutritional interventions. In an efficacy study from Guatemala, researchers found that for each additional 100 kcal per day of dietary supplement, length growth per year was 9 mm, 5 mm, and 4 mm greater for one-year-olds, two-year-olds, and three-year-olds, respectively [11].

The fact that the greatest effects of intervention programs are consistently seen among the youngest children is due to three related factors: growth rates (e.g., weight gain per month) are highest in early infancy and decline significantly through childhood, growth faltering is highly concentrated during the period 6 to 15 months of age, and it is easier to prevent growth faltering than to reverse it. In regards to the first point, children gain more weight per month, relative to their body weight as well as in gross terms, during the first year of life as compared to the third. A dietary deficit or disease episode during the first year of life will thus have a greater relative impact on expected growth rate during infancy than during later childhood. In a separate analysis of programmatic data from over 46,000 children in seven developing countries, we found that growth faltering began at approximately three months of age and was essentially complete by 15 months of age across all regions [12]. Finally, it is well established that once a child has become anthropometrically malnourished, he/she requires much more intensive feeding and improved health to "catch-up" than if growth faltering had been prevented in the first place [13].

We acknowledge that the above emphasis on prevention is somewhat at odds with our finding in this study that children who were more malnourished on entry benefited more than those who were less malnourished on entry. It is important to reiterate that severe malnutrition was nearly non-existent among this study population. Our comparison is thus mild-moderate malnourished compared to non-malnourished. Other researchers have documented a clear contribution of, for example, mild-moderate malnutrition on mortality [14]. Future research should seek to define the optimal balance between prevention of malnutrition versus targeting of resources towards the more malnourished populations. The relative combination between these two will certainly vary by locale, status of the population, program objectives, and resource availability.

The magnitude of the effects that we found among the younger, most malnourished sub-group, were in line with published efficacy trials. In a review of eight efficacy trials of food supplementation that improved dietary intakes by 65 to 302 kcal per day, infant growth measures were improved by 0.04 to 0.46 of a standard deviation [15]. Thus, the 0.15 SD to 0.6 SD improvements in WAZ we found in this sub-group are in line with the magnitude of effects found in other studies.

There are a number of potential reasons that we did not see an overall effect of the CENP on growth for the whole sample, including lower than expected rates of baseline malnutrition, the study design, and modifications to the CENP and challenges associated with program implementation.

As noted above and explained in detail elsewhere [4], we found significantly lower rates of malnutrition than we had anticipated or than had been observed in previous iterations for the CENP. While positive for Viet Nam, the finding required adapting the CENP model to enroll moderately as well as severely malnourished children in the NERPs. The fewer severely malnourished children attenuated the impact of the project on growth, as supported by the fact that children who were more malnourished on entry benefited most from the program. Additionally, because there were fewer malnourished children, NERPs covered larger geographic areas, caregivers had to travel greater distances to reach NERPs, attendance at NERP sessions was lower than expected, and in a number of cases, PD meals were delivered to the homes of caregivers who could not or did not participate in NERP sessions [16].

Regarding design issues, we dewormed comparison as well as intervention children for ethical reasons to better isolate the effects of the dietary elements of the CENP. Deworming of both groups likely improved diet and growth among the comparison children, which thereby attenuated the differential benefits of the CENP. The deworming of all subjects likely contributed to the lack of effect the program had on growth among older children, who are more likely to bear heavier worm loads [17]. In that the national policy of Viet Nam is to deworm all children, the effectiveness of the CENP should be judged on its impact on outcomes above and beyond that which would occur with deworming alone. The optimal study design, which would have included four groups, CENP and comparison, each with and without deworming, was beyond the resources of this project.

Despite a number of study limitations, there are important strengths as well. These include a clear hypothesis, a randomized design, large sample sizes, repeated measures using validated measurement instrument, well-trained field workers, and careful attention to data cleaning and analysis [18]. In other words, we feel confident that the results we are reporting of this project on growth are robust.

In conclusion, this rigorous evaluation of an integrated nutrition program in Viet Nam did not find the impact on child growth that was expected. The lack of an overall effect on growth is likely due to a combination of relatively low malnutrition rates among subjects on entry and deworming among both comparison as well as intervention children, among other factors. We did, however, find significant protection by the CENP intervention against deterioration of body mass (WAZ) and height (HAZ) among those intervention children who were younger and more malnourished on entry. This finding, along with a growing number of studies conducted elsewhere in the world, strongly suggests that programs that aim to maintain and improve child growth will be most successful if they focus on children less than two-years old.

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