Utilization of positive deviance analysis in evaluating community-based nutrition programs: An application to the Dular program in Bihar, India

F. James Levinson, Jessica Barney, Lucy Bassett, and Werner Schultink

Abstract

Background. *Positive deviance is increasingly employed in international development activities to permit the utilization of proven local solutions. Including positive deviance methods in evaluation analysis, particularly in places like Bihar, India, where the rates of child underweight hover at 55%, can help identify project activities and household characteristics that affect key outcomes. These can, in turn, inform decision-making regarding the intensification of particularly promising activities.*

Objectives. *To apply positive deviance analysis to the Dular program in Bihar, a community-based nutrition program that seeks to improve the impact of India's Integrated Child Development Services on young children.*

Methods. *In order to assure that desired program outcomes were not dependent on higher economic status, the analysis isolated a subset of program beneficiaries—the poorest children with the best nutritional outcomes—and examined the behavioral and project factors that may have brought about positive results in this subgroup. The data for this analysis were drawn from a 2005 program evaluation with a sample of 1,560 children.*

Results. *The analysis found that positive deviant children with normal nutritional status in the poorest 50% of Dular households were introduced to complementary food more than 2 months earlier (7.18 vs. 9.02 months of age) than severely malnourished children, were more than twice as likely to use soap for handwashing after defecation (25.0% vs. 11.8%), and were more than seven times as likely to have literate mothers (25.0% vs. 3.5%).*

Conclusions. *The analysis suggests that programmatic efforts relating to these activities have been particularly effective and may well be deserving of increased investment.*

Key words: Evaluation, nutrition intervention, positive deviance

Introduction

Positive deviance is increasingly being used in international development activities to permit the utilization of proven local solutions in problem-solving and as a means of generating local involvement in addressing these problems. The principle normally involves identifying—generally with active community participation—practices or characteristics associated with positive outcomes and then using these as the basis for scaled-up programs. Problems addressed by positive deviance approaches have included malnutrition [1], female genital cutting [2], inadequate exclusive breastfeeding [3], and inadequate educational outcomes in the United States [4]. Positive deviance has also been applied to household maternal and newborn care in Egypt [5]. Although positive deviance is usually thought of as a formative research tool to enhance program design, the positive deviance approach also can be used in the assessment of survey data to identify promising intervention paths, as indicated in this paper.

A recent project in Bihar State in India offers an example of the value of positive deviance analysis. For the past 30 years, India's flagship child development and nutrition intervention, the Integrated Child Development Services (ICDS), has targeted child malnutrition. But, because progress remained slow and unacceptably high malnutrition rates persisted in many of the poorest states, the Government of India and several state governments—with the assistance of UNICEF—have been introducing programmatic "overlays" onto the ICDS in areas of Bihar, Jharkhand, Madhya Pradesh,

F. James Levinson and Lucy Bassett are affiliated with the Friedman School of Nutrition Science and Policy, Tufts University, Boston, Massachusetts, USA; Jessica Barney is affiliated with the GOAL Ethiopia Rapid Response Program, Addis Ababa, Ethiopia; Werner Schultink is affiliated with UNICEF, previously in New Delhi, presently in New York.

Please direct queries to the corresponding author: F. James Levinson, Friedman School of Nutrition Science and Policy, Tufts University, 150 Harrison Ave., Boston, MA 02111, USA; e-mail: james.levinson@tufts.edu.

West Bengal, and Rajasthan. These efforts have been based on a universal understanding that attention to children under 2 years of age, immediate initiation of exclusive breastfeeding for 6 months, and prolonged breastfeeding, plus the timely introduction of adequate complementary food (at 6 months), treatment of diarrhea, complete immunization, and micronutrient provision will significantly improve child survival, reduce child morbidity, and decrease early childhood malnutrition.

Best known among these initiatives is the Dular program in Bihar and Jharkhand States, which has employed an effective service delivery model utilizing, in addition to the ICDS Anganwadi workers (AWWs), groups of neighborhood-based volunteers called local resource groups (LRGs). These groups consist of, on average, four to five village women who have demonstrated motivation and interest and who are socially connected with a particular section of the community. Supporting an often overworked AWW, LRGs assist with food preparation, education, and household visits and prove instrumental in identifying households with pregnant and lactating women. With more personal contact than AWWs, LRGs spend considerable time talking to women in an effort to educate them on new practices and thereby increase contact between villagers and Dular program services as well as providing additional culturally appropriate nutrition education.

With this structure in place, important behavioral change has taken place, most significantly relating to practices in the first hours and days of life, and in particular hygiene practices. For example, in Jharkhand, Dular mothers are 82% more likely to give colostrum to their newborns than mothers in the regular ICDS program [6].

Such behavioral change and the special attention given to targeted children have had significant effects. In Jharkhand, after 3 years of program operation, the prevalence of severe underweight in Dular areas is roughly half that in areas with the regular ICDS program. In Bihar, where about 2000 villages are now included in the program, the prevalence of underweight among Dular children is now 10 percentage points lower than among those in the regular ICDS program (55% vs. 65%), the prevalence of severe underweight fell by more than two-thirds in 3 years (from 19.6% to 4.3%), and the prevalence of wasting among young Dular children is less than two-thirds that of children in the normal ICDS program (9.3% vs. 14.2%).* Despite these advances, however, the malnutrition problem continues to be grave. Even in Dular areas in Bihar, fully 55% of children 12 to 36 months of age are underweight, while a disturbingly high proportion (67%) is stunted.

* Abbott S, Barney J, Bassett L. Dular final evaluation report. UNICEF, India: 2005 (unpublished).

In an effort to identify program activities deserving particular attention in the future, a 2005 evaluation of the program in Bihar included in its analysis a positive deviance assessment, examining the characteristics of those young children (and their households) who, despite constraints inherent in rural Bihar, were able to achieve positive nutritional outcomes. This paper presents that analysis as a useful means of utilizing survey data to shape future program design.

Methods

The Bihar study collected data in the summer of 2005 from 10 villages participating in the Dular program and 10 ICDS villages without the Dular overlay to serve as controls. In order to facilitate longitudinal comparison of malnutrition rates, the 2005 evaluation used the same 10 Dular villages that had been randomly selected from the Vaishali District for evaluations in 2003 and 2004. Ten new non-Dular villages were randomly selected from the nearby Patna District to be control villages, thereby ensuring that these villages were unaffected by past evaluations. All study villages exhibited similar socioeconomic, demographic, and geographic indicators.

A list of 195 villages (exclusive of the 10 control villages from 2004) served as the sampling frame for the control group, from which 16 villages (10 villages and 6 alternates) were randomly selected. The sample size for this study was calculated to provide sufficient data to conduct comparisons of proportions of malnutrition rates between Dular and non-Dular villages. A sample size of 376 was determined by PC-Size software ($p \leq .05$, power .80) to detect a change in malnutrition rates of 10%. A design effect of 2 was assumed, so the sample size was doubled to 750 for Dular and non-Dular villages. In each of the 10 villages, at least 75 children were measured, for a total sample size of 1,560 children (785 Dular and 775 non-Dular) and 1,330 mothers (659 Dular and 671 non-Dular). The number of mothers is less than the number of children because some siblings were measured and some mothers were not present during the survey.

The 2005 evaluation focused on both quantitative and qualitative research to identify nutritional status and explore attitudes and beliefs regarding caring practices and health. Both qualitative and quantitative data collection tools were pretested and refined. All changes were back-translated to maintain consistency. The research was conducted with approval from the Tufts–New England Medical Center Institutional Review Board and with informed oral consent from the parents of the children participating in the study.

Locally trained enumerators measured the height and weight of children under 3 years of age in order to calculate underweight (weight-for-age more than

–2 SD below the mean), stunting (height-for-age more than –2 SD below the mean), and wasting (weight-for-height more than –2 SD below the mean). These enumerators also conducted interviews with the children's mothers one at a time, collecting information about socioeconomic status, child-feeding practices (specifically, use of colostrum, exclusive breastfeeding, and timely introduction of complementary food), prevalence and management of diarrhea, hygiene and sanitation conditions and practices, and contact with local health and nutrition workers.

All z-scores, including weight-for-age (WAZ), height-for-age (HAZ), and weight-for-height (WHZ), were calculated in Epi Info according to the National Center for Health Statistics/World Health Organization (NCHS/WHO) 1978 standard. This reference standard was used in previous studies of the Dular program and is considered by WHO to be a more appropriate reference to assess the growth patterns of infants following international feeding recommendations [7]. Frequencies and means for WAZ, HAZ, and WHZ (for all ages, under 12 months, and 12 to 36 months) were calculated by SPSS, version 14.0. Crude differences between mean z-scores were examined by the *t*-test. Analysis of covariance (ANCOVA) with Bonferroni adjustments for post hoc comparisons between means was used to examine differences in adjusted means between groups. SAS was used for logistic regression to calculate odds ratios. In the analysis, any subject with a missing value for any variable being analyzed was omitted from the analysis of that variable. Dummy variables were created for each WAZ category, and cross-tabs, chi-square, or analysis of variance (ANOVA) analyses were carried out where appropriate.

Focus group discussions and key informant interviews addressed the following practices: use of colostrum, breastfeeding practices, complementary feeding, diarrhea prevention and treatment practices, and hygiene. The focus groups were homogeneous and consisted of the following populations: mothers of children 0 to 36 months of age, mothers-in-law, fathers or husbands, and LRG members. Four focus groups of each type were conducted in Dular and non-Dular villages. Key informant interviews were conducted with a total of 10 AWWs, 5 in Dular and 5 in non-Dular villages.

The positive deviance analysis sought to compare the characteristics of "positive deviant" young children (and households)—in this case children with "normal" or satisfactory nutritional status (better than –2 SD below the mean weight-for-age)—in comparison with mildly, moderately, or severely malnourished children.

The analysis was conducted on the entire sample and on a separate subset composed of the poorest households in both Dular and control areas. This subset was identified based on indicators of economic status, including size of landholding (ownership of less than 1 acre [0.4 hectare]), and participation in agricultural or other informal day labor by the household head. (Identification of the poorest subset—often the poorest 50%—of a population is frequently used in positive deviance analysis to remove from consideration the less easily replicable income-based positive deviance characteristics while still maintaining reasonably large sample sizes.) Two further subdivisions, drawn from the poorest subset, represent the poorest Dular and non-Dular households. By using the poorest Dular subdivision, it becomes possible to ask what is arguably the most important question in this analysis: "What is it that certain households have been able to do, despite low income *but with intensified programmatic assistance,* that has resulted in healthy growth and hence normal nutritional status?"

Results

In the positive deviance analysis using the entire sample (Dular and non-Dular and all income groups), the primary characteristics associated with well-growing young children are, not surprisingly, reflections of higher socioeconomic status **(table 1)**.

Households with normal children own nearly five times more land than households with severely malnourished children, are twice as likely to have electricity, are half as likely to live in a poorest-quality dwelling, are 60% more likely to have a hand pump, are 3.5 times more likely to have a private toilet, and are 50% less likely to belong to a scheduled caste or scheduled tribe. (Scheduled castes and tribes are posi-

TABLE 1. Income- and class-dependent positive deviance characteristics (total sample)

Nutritional status[a]	*N*	Landholdings (acres)	Poorest-quality dwelling	Electricity in dwelling	Personal hand pump	Private toilet	Scheduled caste or tribe[b]
Normal	209	3.604	12.4%	25.4%	58.9%	34.5%	42.6%
Severely underweight	424	0.749	24.6%	12.8%	35.3%	9.6%	63.0%
p		< .001	.002	.001	.001	.001	.001

a. Normal nutritional status is defined as a weight-for-age z-score (WAZ) of –0.9 or above; severe underweight is defined as a WAZ of –3.0 or below.

b. Scheduled castes and tribes represent the bottom of the caste system in India and generally have the least access to services.

tioned at the lowest levels, literally outside of the caste system in India, and generally have the least access to services.) It is, in fact, the recognition of this primary effect of household income (a variable not influenced by shorter-term behavioral change efforts) on positive health-related outcomes that has led many positive deviance programmatic efforts to focus analysis on lower-income households.

Recognizing the dependence of positive nutritional outcomes on income, the more important policy and program-driven analysis (**tables 2–6**) considers characteristics that are much less dependent on resources and thus examines the positive deviant characteristics of poorer households.

Although attention from LRGs is supposed to be concentrated on the neediest children (those suffering from more serious malnutrition), **table 2** indicates either that this is not the case or, more optimistically, that those children who did receive attention from volunteers fared better as a result.

Potentially more important are the findings on the introduction of complementary food. In the poorest Dular households, normal children were introduced to complementary foods more than 2 months earlier, on average, than in the low-income Dular group as a whole (7.18 months vs. 9.02 months). This finding indicates that even among poor households, improved complementary feeding habits are possible, but that attention to assure the timely introduction of complementary food needs to be further intensified.

Surprisingly, no relationship was found between diarrhea prevalence reported by the mother and malnutrition rates **(table 3)**; this may be a result of inadequately sensitive indicators but is also probably explainable by the fact that the data on diarrhea prevalence were collected during the pre-monsoon season

The effect and initial effectiveness of hygiene counseling in the Dular households, however, is clearly evident in **table 4**, with Dular mothers using soap more frequently after they defecate and after the child defecates than non-Dular mothers. Since soap requires a financial expenditure, its usage is higher in the population as a whole than among the poorest subset of households. But among the poorest households, soap usage is higher among mothers of normal children than among mothers of severely malnourished children. The effect of soap becomes yet more significant when it is recognized that most women use mud for handwashing.

Hygiene counseling and the resulting cleanliness

TABLE 2. Percentage of mothers reporting contact with local resource groups (LRGs) in the previous month

Nutritional status[a]	Poorest subset of Dular households ($N = 303$)[b]	Remaining Dular households ($N = 158$)
Normal	40.6%	34.5%
Mildly underweight	33.3%	34.5%
Moderately underweight	37.3%	24.1%
Severely underweight	33.8%	6.9%
p	.853	.908

a. Normal nutritional status is defined as a weight-for-age z-score (WAZ) of −0.9 or above; mildly, moderately, and severely underweight children are defined as those with WAZ values of −1.0 to −1.9, −2.0 to −2.9, and −3.0 and below, respectively.

b. The poorest subset of Dular households are defined as those owning less than 1 acre of land and headed by a day laborer.

TABLE 3. Prevalence of diarrhea in the previous 2 weeks

	Poorest subset of all households ($N = 712$)[a]	Poorest subset of Dular households ($N = 301$)	Poorest subset of non-Dular households ($N = 411$)
Nutritional status[b]	% (no.)		
Normal	56.7 (34)	54.8 (17)	58.6 (17)
Mildly underweight	60.2 (97)	59.8 (49)	60.8 (48)
Moderately underweight	64.5 (160)	63.6 (65)	64.2 (95)
Severely underweight	68.7 (167)	69.2 (59)	70.1 (108)
p	.191	.462	.413

a. The poorest subset of households are defined as those owning less than 1 acre of land and headed by a day laborer.

a. Normal nutritional status is defined as a weight-for-age z-score (WAZ) of −0.9 or above; mildly, moderately, and severely underweight children are defined as those with WAZ values of −1.0 to −1.9, −2.0 to −2.9, and −3.0 and below, respectively.

TABLE 4. Percentage of mothers who reported using soap to wash their own and their children's hands after defecation

Nutritional status[b]	Poorest subset of all households[a]		Poorest subset of Dular households		Poorest subset of non-Dular households	
	Mother's hands (N = 718)	Child's hands (N = 672)	Mother's hands (N = 304)	Child's hands (N = 283)	Mother's hands (N = 414)	Child's hands (N = 389)
Normal	22.2%	19.6%	25.0%	25.9%	19.4%	13.8%
Mildly underweight	16.5%	12.8%	23.8%	18.4%	8.8%	6.8%
Moderately underweight	14.5%	14.0%	22.3%	21.6%	8.2%	8.0%
Severely underweight	6.2%	7.3%	11.8%	15.7%	3.5%	2.9%
p	.032	.015	.202	.793	.105	.137

a. The poorest subset of households are defined as those owning less than 1 acre of land and headed by a day laborer.
b. Normal nutritional status is defined as a weight-for-age z-score (WAZ) of −0.9 or above; mildly, moderately, and severely underweight children are defined as those with WAZ values of −1.0 to −1.9, −2.0 to −2.9, and −3.0 and below, respectively.

of some children is also associated with better child growth, as indicated in **table 5**. According to the observations of the evaluation team, normal children in the poorest Dular households were more than twice as likely to have clean nails than severely malnourished children, about 30 percentage points more likely to have clean hands, and about 25 percentage points more likely to have a clean face.

Perhaps the most dramatic positive deviance characteristic of households of low-income normal children was the literacy of their mothers. As indicated in **table 6**, mothers of positive deviance normal children were over seven times more likely to be literate than mothers of severely malnourished children.

TABLE 5. Observed cleanliness of children

Nutritional status[a]	Nails	Hands	Face
Poorest subset of all households[b]			
N	715	716	714
Normal	46.0%	65.0%	76.2%
Mildly underweight	31.2%	55.8%	63.8%
Moderately underweight	25.8%	47.2%	57.7%
Severely underweight	19.9%	36.4%	50.8%
p	< .001	< .001	.001
Poorest subset of Dular households			
N	303	303	303
Normal	53.10%	71.90%	78.10%
Mildly underweight	32.50%	60.20%	65.10%
Moderately underweight	34.00%	59.20%	65.00%
Severely underweight	25.90%	37.60%	51.80%
p	.050	.001	.045
Poorest subset of non-Dular households			
N	412	413	411
Normal	38.7%	58.1%	74.2%
Mildly underweight	30.0%	51.3%	62.5%
Moderately underweight	19.5%	38.4%	50.3%
Severely underweight	16.9%	35.7%	52.4%
p	.013	.026	.042

a. The poorest subset of households are defined as those owning less than 1 acre of land and headed by a day laborer.
b. Normal nutritional status is defined as a weight-for-age z-score (WAZ) of −0.9 or above; mildly, moderately, and severely underweight children are defined as those with WAZ values of −1.0 to −1.9, −2.0 to −2.9, and −3.0 and below, respectively.

Discussion

The positive deviance–based tables proposed here can be considered a useful complement to multiple regression analysis for understanding factors that are important in achieving improved nutritional status, particularly within a programmatic setting. Although the tables utilize only bivariate analysis, they can sometimes help identify the reasons why particular independent variables, which prove to be statistically insignificant in multiple regression analysis, indeed appear to be important influences on nutritional status. It would be helpful, for example, to identify a factor that facilitates moving children from severe to moderate malnutrition even if it fails to be significant in explaining changes across the entire range of nutritional status (i.e., including changes from moderately to mildly malnourished and from mildly malnourished to normal).

Particularly valuable is the opportunity to look at these positive deviance factors with and without project intervention. In the case of explanatory behaviors discussed in this paper, some of those that emerge

TABLE 6. Percentage of women who were literate[a]

Nutritional status[b]	Poorest subset of all households ($N = 718$)	Poorest subset of Dular households ($N = 304$)	Poorest subset of non-Dular households ($N = 414$)
Normal	20.6%	25.0%	16.1%
Mildly underweight	15.8%	20.2%	11.3%
Moderately underweight	12.9%	16.5%	10.1%
Severely underweight	5.8%	3.5%	6.9%
p	.001	.003	.397

a. The poorest subset of households are defined as those owning less than 1 acre of land and headed by a day laborer.
b. Normal nutritional status is defined as a weight-for-age z-score (WAZ) of −0.9 or above; mildly, moderately, and severely underweight children are defined as those with WAZ values of −1.0 to −1.9, −2.0 to −2.9, and −3.0 and below, respectively.

as only mildly significant in control areas (i.e., where households may have come upon them through trial and error) become much more pronounced when they are explicitly highlighted in project counseling.

Using positive deviance considerations in the analysis of evaluation data in the Dular program has enabled project managers to identify programmatic activities not particularly dependent on household resources, which offer promising potential for improving the growth of young children. One of these surely relates to the timely introduction of complementary food and the likelihood, suggested by the data, that behavioral change efforts can help bring about this achievement. At the same time, with recognition that the primary resistance to earlier introduction is often related to a fear of diarrhea that such foods may precipitate, efforts to reduce the prevalence of diarrheal infection are likely to be particularly valuable. The evaluation team discovered that during the preceding year, little oral rehydration solution (ORS) was available in Bihar State for distribution by the ICDS. Addressing the ORS supply problem and intensifying ORS-related counseling would, in all likelihood, reduce the duration and severity of diarrheal infection and improve child growth.

The results also suggest that, even in the absence of improved sanitation infrastructure, diarrheal infection and child malnutrition could be reduced by the increased use of soap by mothers of young children and by intensified hygiene-related counseling, as suggested by **tables 4** and **5**. The need for soap, and the inability of some households to afford it on a regular basis (fewer than 20% of women in Dular program areas utilize soap for handwashing), are consistent with an astute observation by UNICEF staff in New Delhi that the longer-term sustainability of programs like the Dular program may require something more tangible than simply good behavioral-change communication. Beyond longer-term efforts to improve counseling and community outreach, the data suggest the high priority that might be given not only to the ready availability of ORS, as already mentioned, but also to the provision of soap. A third tangible recommended by the evaluation team for consideration in the Dular program is a Sprinkles–type micronutrient sachet for home enrichment of complementary food. Such sachets are now sufficiently inexpensive that they can be provided free to parents of children under 2 years of age at a tiny percentage of total ICDS food costs. These tangibles can both improve child growth and, ultimately, increase program sustainability.

Finally, maternal literacy emerges as a major positive deviance characteristic of normal children in poor Dular households. Female education and literacy, although a tier removed in malnutrition causality, have a consistently major effect on the more immediate determinants of malnutrition and on the improved practices indicated above. A 2004 World Bank report on actions needed in India to attain the Millennium Development Goals cites maternal literacy as the largest potential contributor to reducing malnutrition in the country's poorer states.* This strong association underlines the importance of complementing programs such as the Dular program with simultaneous nonformal education or literacy activities in such areas where female adult literacy is particularly low.

Such use of positive deviance analysis in the Dular program is facilitating ongoing efforts to improve the program qualitatively as it expands and to reallocate resources where they are likely to have the most significant impact.

* World Bank. Attaining the Millennium Development Goals in India: Role of public policy and service delivery. How likely and what will it take to reduce infant mortality, child malnutrition, gender disparities, and hunger-poverty and to increase school enrollment and completion? 2004 (unpublished).

References

1. Sternin M, Sternin J. Sustained childhood malnutrition alleviation through a "positive deviance" approach in rural Vietnam: Preliminary findings. Proceedings of the Technical Meeting on Health Nutrition Model: Applications in Haiti, Vietnam and Bangladesh. Arlington, Va, USA: World Relief Corporation, BASICS, 1997.
2. Babalola S, Vondrasek C. Factors affecting sexual practices in West Africa—A positive deviant approach. Atlanta, GA, USA: American Public Health Association, 2001.
3. Dearden K, Quan LN, Do M, Marsh DR, Schroeder DG, Pachon H, Thi Lang T. What influences health behavior? Learning from caregivers of young children in Viet Nam. Food Nutr Bull 2002;23(suppl 4):119–29.
4. National Staff Development Council. Amplifying positive deviance in schools. 2004. Available at: http://www.nsdc.org/connect/projects/positivedeviance.cfm. Accessed 4 June 2007.
5. Ahrari M, Houser RF, Yassin S, Mogheez M, Hussaini Y, Crump P, Darmstadt GL, Marsh D, Levinson FJ. A positive deviance-based antenatal nutrition project improves birth-weight in Upper Egypt. J Health Popul Nutr 2006;24:1–10.
6. Dubowitz T, Peterman J, Levinson D. Intensifying efforts to reduce child malnutrition in India: An evaluation of the Dular program in Jharkhand, India. Food Nutr Bull 2007;28:266–273.
7. de Onis M, Onyango AW. The Centers for Disease Control and Prevention 2000 growth charts and the growth of breastfed infants. Acta Paediatr 2003;92:413–9.