EXPANDED PROGRAMME ON IMMUNIZATION AND NUTRITION OF UNDER-FIVE CHILDREN: EXPERIENCES FROM MATLAB, BANGLADESH

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ABSTRACT

This cross-sectional study explores the association of immunization with under-five children's nutritional status in Matlab – a rural area of Bangladesh. MUAC, height and weight of 992 children of one to five years were measured and socioeconomic information collected from their mothers. Analysis reveals significant association of immunization status with MUAC in 'poor' households compared to 'better-off' households. For Ht/age, both bi-variate and multi-variate analysis identified mother's education and number of dwellings in household to be significant associated factors in case of the poor children. Completely immunized children from better-off households were found to have significantly better anthropometric indices. Girls from better-off households were much less likely to be completely immunized, and more likely to be acutely malnourished. It can be said that immunization has some beneficial, if only marginal, effect on the acute nutritional status of poor children but has no effect on their chronic nutrition, for which socioeconomic factors seems to play a greater role.

Indexing Words : Immunization, under-five children. Mid Upper Arm Circumference(MUAC)

INTRODUCTION

In Bangladesh, under-five Children make up less than 19% of the population but account for 57% of total deaths[1]. It is estimated that around one out of every five death is caused by an immunizable disease[2]. Immunization is recognized as a cost-effective, convenient and easy way of improving under-five child survival. The coverage of the Government's Expanded Programme on Immunization (EPI) against six major childhood diseases (tuberculosis, diphtheria, pertussis, tetanus, polio, and measles) has reached 30% in 1993[3].

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Undernutrition is a major risk factor for under-five child mortality in Bangladesh[4].

A recent survey found that about 8% of children are severely malnourished (weight/age<60% of National Centre for Health Statistics, NCHS median) and 55% are moderate-to-severely malnourished (weight/age<75%)[5]. Also, infectious diseases are more common and run a more severe course in children who are nutritionally deprived. Since undernutrition is closely related to infection, programmes like EPI may have some beneficial effect on nutrition. Barua et al. in a retrospective study found that, of the 312 severely malnourished under-five children, 50.6% received BCG; 13.7% DPT-3; 10.5% OPV-3 and, only 0.64% had measles vaccine[6]. Koenig et al. singled out

immunization against measles (which precipitates Protein Energy Malnutrition, PEM) as the most effective intervention in reducing the mortality of children aged 1-4 yr.[7]. Another study was conducted in India to see the effectiveness of immunization against measles on diarrhoea and malnutrition-related mortality. At the end of 2 years after a second round of immunization against measles, child mortality reduced significantly among 1-4 years age group in the study area in contrast to the control areas[8].

This paper draws on data from the 1992 Matlab Baseline Survey undertaken in the first phase of the BRAC-ICDDR,B joint research project. This project was established in 1992 to examine prospectively the relationship between socio-economic development, and health and well being of the rural poor[9]. BRAC targets the poorest of the poor with special emphasis on improving the socio-economic condition of the women and children through its Rural Development Programme (RDP). While beneficial effects of immunization in reducing child mortality have been well documented, no published report is available as of yet on the effect of immunization on the nutritional status of the under-five children in Bangladesh. This paper aims to provide information on this relatively unexplored field using a set of cross-sectional baseline data.

MATERIALS AND METHODS

Sampling

Anthropometry was done on a random sub-sample of 2,400 households from the 11,343 baseline households in ICDDR,B's Demographic Surveillance System (DSS) area surveyed in 1992. Thus, the survey identified 992 children between the age of one to five years from 860 households and included them in the analysis. The exact date of birth was obtained from DSS records of ICDDR,B.

Anthropometry

The weight of the child either with light or no clothing was obtained using a Salter scale with a precision of 100g. The recumbent height of children was measured using a locally constructed, two-track length board with a precision of 1 mm. Mid-upper-arm-circumference (MUAC) was measured using Teaching Aids at Low Cost (TALC) numeral insertion tape to the nearest millimeter. Anthropometric measurements were converted to standard deviation scores ("Z score") using NCHS standards; from these the nutritional indicator 'height-for-age (Ht/age)' was constructed. The level "-2 Z scores" selects children below the generally accepted normal range and is used internationally as a cut-off point as recommended by World Health Organisation (WHO).

Simple MUAC without regard to age or height has a satisfactory sensitivity and specificity for detecting low Weight for age (Wt/age) and Weight for height (Wt/Ht)10. A value of less than 125 mm is a good predictor of the risk of dying in Bangladesh and selects 'severely malnourished' children. On the other hand, Height for age (Ht/age) is most appropriate to measure long term nutritional depletion. Children with "Ht/Age<-2 Z scores" are classified as 'stunted'. The anthropometric calculations were done using the NCHS standard package, Anthro.

Socioeconomic information

Socioeconomic information was collected from parents through structured interviews. The analysis considers the socio-economic

determinants of nutrition for households that meet BRAC's eligibility criteria for participation in RDP with those that do not. The eligibility criteria are that the households possess less than 50 decimals of land and at least one member sells manual labour for at least 100 days a year. These households rank among the poorest of the poor (designated as "poor") while the non-eligible households are comparatively better off socioeconomically and include the rural elite as well (designated as "better-off"). Thus, the BRAC eligibility status of the household stands as a proxy of socioeconomic condition in this particular community.

Operational definitions

Occupation of father was defined as the activity in which the person spent major part of his time in a working day. 'Agriculture' designates those persons who have their main income from operation of farmland. The category 'wage-labour' comprises both farm and non-farm day labour, and the category 'service' refers to employment with fixed monthly remuneration. 'Self-employment' includes petty trade and business such as running various types of retail shops and activities like poultry farming, handicrafts, pottery, rickshaw puiling, fishing etc.

Information on immunization status was collected by interviewing mothers and verified by asking whether injection was given at the specific site of the baby's body or oral drops given, as the case may be and were cross-checked with children's Vaccination Cards where found. In Matlab, as any where in Bangladesh, complete vaccination schedule included: BCG at birth, three doses of DPT and OPV at monthly interval beginning from six weeks of birth and Measles vaccination at nine months. DPT3/OPV3 and measles vaccination was taken as indicators of coverage in contrast to DPT1/OPV1 which indicates access to vaccination. Immunization status of the study children was categorized into: 'complete', meaning those who received all doses of the six EPI vaccines; 'incomplete' referring to those who either did not currently receive all the doses of the vaccines or was a drop out; and 'nil' referring to those who did not receive any vaccine at any time.

Analysis plan

For the purposes of this paper, a combination of bivariate and multivariate statistics were used to explore the association of immunization with children's nutritional status. Initial analyses involve bivariate comparisons of the nutritional status of children from the two socioeconomic groups. Following this, the independent effects of socioeconomic and demographic factors on children's nutritional status were estimated using logistic regression. Here, the nutritional indicators (MUAC and Ht/age) were taken as dependent variables and mother's years of schooling, sex of the child, father's occupation, number of dwellings in the household and children's immunization status as independent variables. Significant association was found for these variables during bi-variate analyses. During multivariate analysis, MUAC was categorized into two groups by taking 125 mm as the cut-off point for identifying severe malnutrition. For Ht/age i.e., 'stunting', a value of <-2 Z score was taken as the cut-off point. Results are expressed as odds ratios. Analysis was done with the SPSS/PC+ software package.

RESULTS

The immunization status of the study children (n=992) according to sex and socioeconomic status is shown in Table 1 The difference

between boys and girls in immunization coverage, is significantly pronounced in case of those from better-off households. Table 2 presents the distribution of 'severely malnourished (MUAC<125mm)' and 'stunted (Ht/Age<-2Z)' children by immunization status for specific childhood diseases. The children who received immunization with DPT3 and measles vaccines, were less 'severely malnourished' than those who were not immunized--- irrespective of their socioeconomic status. However, this difference was not statistically significant with the exception of children from better-off households immunized by DPT3 who were significantly less 'stunted' than those who were not immunized ($p<.05$). Completely immunized children from poor households were significantly less 'severely malnourished' than those not so immunized ($p<.05$).

The distribution of 'severely malnourished' and 'stunted' children according to socioeconomic status are presented in Table 3. The percentage of malnourished children decreased in case of mothers with some years of schooling. This trend was significant for MUAC and Ht/age among the better-off and poor households respectively. When father's occupation is considered, the association with MUAC was found to be significant in case of children from better-off households only. Greater proportions of children from poor households were members of 2 room household, significantly so for 'stunted' children. There is a decreasing trend of 'severe malnourishment' and 'stunting' with increased duration of subsistence from crop produced by the household (obtained from own/rented/leased land of household) in case of 'poor' children. This trend was reversed among children from the 'better-off' group.

Table 4 presents the Odds Ratios of logistic regression analysis for both the groups. Here, the nutritional indicators (MUAC and Ht/age) were taken as dependent variables and age and sex of the child, mother's years of schooling, father's occupation, number of dwellings in the household and children's immunization status as independent variables. Significant association with nutritional status was found for these variables during bi-variate analyses. Mother's education, sex of the child and father's occupation like wage labour was the most significant variables predicting MUAC of the better-off children. On the other hand, immunization status was the only significant variable predicting MUAC in case of poor children. Again, mother's education and number of dwellings in case of 'poors' and father's occupation like 'self-employment' in case of 'better-offs' emerged as significant variables best explaining variations in Ht/age.

DISCUSSION

This study was based on a set of cross-sectional data collected primarily to record baseline information on selected health and socioeconomic indicators. The proportion of completely immunized (78%), among the study children, was higher than the national average of 62% at the time of survey. This may be due to the intensive health and family planning intervention administered by ICDDR, B in nearly half of the Matlab DSS villages. The sex difference in complete coverage of immunization, especially among the better-offs, may be explained in terms of the cultural and socioeconomic values attached to male children in this community[11,12].

Both bi-variate and multivariate analyses revealed significant association of immunization status with nutritional status in poor households which was not seen in case of better-off households. Again, immunization status appeared not to have any association with 'stunting' i.e., long-term nutrition. When considering long term nutrition, both bi-variate and multivariate analyses identified mother's education and no. of dwellings in the household to be significant associating factors in case of the poor children. Also, completely immunized children from better-off households were found to have significantly better anthropometric indices compared to their counterparts from poor households. These findings, once again, reiterate the important role of socioeconomic factors beyond immunization in affecting the chronic nutrition of the children. Since this study was a cross-sectional study, we cannot assume a causal association between immunization status and under-five nutritional status. To answer this question, we need to do a well designed longitudinal study taking care of the many confounding factors.

One interesting finding in this study is the sex differential seen among the better-off households. Girls in these households were much less likely to be completely immunized, and more likely to be acutely malnourished. This also reiterates our previous findings about the association of immunization with acute malnutrition. However, this may not be the only reason. Further exploration of this issue is necessary to reveal the dynamics of gender discrimination in these relatively better-off households. This study also corroborates previous findings in the literature about the significant role of mother's education for children's well-being[13]

Thus, from the findings of this study, it can be said that immunization against six EPI diseases has made some beneficial, if marginal, impact on acute nutrition of the 'poor' children. On the other hand, socioeconomic conditions are important for influencing long term nutritional status of these children. Of course, EPI is primarily aimed at reducing childhood mortality.

Table 1. Immunization status of study children by sex and socioeconomic status of the households (%)

Immunization Status	Poor			Better off		
	Boy	Girl	All	Boy	Girl	All
Complete	77.4	78.7	78.0	83.5	72.4	78.3
Incomplete	15.2	13.6	14.4	10.8	18.4	14.4
Nil	7.4	7.6	7.5	5.7	9.2	7.3
Total (n)	323	301	624	194	174	368
Significance (X^2)		ns			p<.05	

Table 3. Socioeconomic condition of malnourished study children as percent of < -2 Z-scores by socioeconomic status of the households (%)

	Poor		Better off	
	MUAC<125mm (n=139)	HAZ < -2 (n=366)	MUAC<125mm (n=58)	HAZ < -2 (n=185)
Mother's years of schooling				
None	82.3	83.6	72.4	58.2
Some	17.7	16.4	27.6	41.8
		p<.05	*p<.01*	
Occupation of father				
Agriculture	20.3	20.3	17.2	32.3
Wage labour	28.7	26.7	13.8	5.8
Service	7.0	6.9	25.9	22.2
Self-employment	25.2	26.4	6.9	11.6
Others	18.9	19.7	36.2	28.0
			p<.05	
No. of dwellings in the household	80.4	82.4	51.7	60.8
≤2	19.6	17.6	48.3	39.2
2+		*p<.05*		
Subsistence from land (months)	44.1	44.5	17.5	18.7
0	40.6	41.3	31.6	33.7
1-6	15.4	14.1	50.9	47.6
7-12				

Table 4: Odds Ratios of logistic regression analysis of children's MUAC and Height-for-age by socioeconomic status of the households

	MUAC		Ht/age	
	Poor	Better off	Poor	Better off
Age of children (months)	0.99	1.01	1.00	0.99
Mother's years of schooling				
None	1.00	1.00	1.00	1.00
Some	1.08	2.80**	1.53*	1.27
Sex of children				
Boy	1.00	1.00	1.00	1.00
Girl	0.79	0.36**	0.85	1.02
Father's occupation				
Farming	1.00	1.00	1.00	1.00
Wage labour	0.95	0.21**	1.03	2.13
Service	0.87	0.36*	0.76	1.74
Self-employed	0.85	1.09	0.67	2.07*
Others	1.00	0.34*	0.72	1.64
No. of dwellings in household				
≤2	1.00	1.00	1.00	1.00
2+	1.08	0.77	1.57*	1.51
Immunization status				
Complete	1.00	1.00	1.00	1.00
Incomplete/nil	0.47*	0.94	1.13	1.24

N.B. *p<.05 ; **p<.01

Whatever effects it may have on morbidity of the children should be considered as secondary.

Immunization is only one link of a chain of many bio-social factors that influence the nutritional status of children in developing countries. Malnutrition is the result of many interacting economic as well as socio-ecological factors. The problem of malnutrition is not just a health problem that can be solved through bio-medical approach alone, e.g., interrupting the vicious cycle of infection-malnutrition by immunization. It is a 'multi-factorial' problem with roots in many other sectors of development such as education, agriculture and rural development. Sustained improvement in nutritional status of the poor children can be brought about only through an all out offensive against these contextual factors simultaneously.

ACKNOWLEDGMENTS

This study was done under the auspices of the BRAC-ICDDR,B Joint Research Project at Matlab, Bangladesh. The project has been supported by the Ford Foundation, Aga Khan Foundation, and the USAID. The BRAC and ICDDR,B are supported by countries and

agencies which share their concern for the health and development problems of developing countries. The authors are grateful to Alayne Adams of Harvard Center for Population and Development Studies for her comments on an earlier version of the manuscript.

REFERENCES

1. UNICEF. The State of the World's Children 1995 (Bengali Version). Dhaka: UNICEF Bangladesh, 1995.

2. KOENIG, M.A., FAUVEAU, V., WOTJYNIAK, B. Mortality reductions from health interventions : the case of immunization in Bangladesh. Pop Dev Rev 1991;17(1):87-104.

3. United Nations. A fork in the path: Human development choices for Bangladesh. Dhaka : UNICEF, 1994.

4. FAUVEAU, V., BRIEND, A., CHAKRAVARTY, J., SARDER, A.M. The contribution of severe malnutrition to child mortality in rural Bangladesh : implications for targeting nutritional interventions. Food Nutr Bull 1990; 12 : 215-9.

5. Bangladesh Bureau of Statistics. Report of the child nutritional status survey 1989-90. Dhaka: Ministry of Planning, Government of Bangladesh. April 1991.

6. KOENIG, M.A., KHAN, M.A., WOTJYNIAK, B., CLEMENS, J.D., CHAKRABORTY, J., FAUVEAU, V. *et al.* Measles vaccination reduces childhood mortality in rural Bangladesh. In : Huq M, ed. Near Miracle in Bangladesh. Dhaka: University Press Limited, 1991:35-46.

7 BARUS, S.T., RANI, R., LUBIS, N.U., HAMID, E.D., TARIGAN, S. Clinical features of severe malnutrition at the paediatric ward of Dr. Pirngadi Hospital, Medan. Paediatr-Indones 1990;30(11-12):286-92.

8. KAPOOR, S.K., REDDAIAH, V.P. Effectiveness of measles immunization on diarrhea and malnutrition related mortality in 1-4 years olds. Indian J Pediatr 1991;58(6):821-32.

9. AHMED, S.M., MOHSIN, M., BHUIYA, A., CHOWDHURY, A.M.R., RANA, A.K.M.M. Baseline Survey Matlab, 1992: Final Report May 1994. Dhaka: BRAC,1995.

10. TROWBRIDGE, F.L., STACHLING, N. Sensitivity and specificity of arm circumference indicators in identifying malnourished children. Am J Clin Nutr 1980; 33 : 687-96.

11. NAG, M. Sex preference in Bangladesh, India and Pakistan, and its effect on fertility. Demography India 1991; 20 (2) : 163-85.

12. CHOWDHURY, M.K., BAIRAGI, R. Son preference and fertility in Bangladesh. Pop Dev. Rev. 1990; 16 (4) : 749-57.

13. AHMED, S.M., KHANAM, S.T. Female education: key to child survival. Journal of Preventive & Social Medicine, 1991 : 10(2) : 74- 77.