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Factors Affecting Childhood Immunisation in Bangladesh

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This study has examined the coverage of childhood immunisation and tried to identify the factors affecting the acceptance of immunisation practice among children in Bangladesh using the data from Bangladesh Demographic and Health Survey (BDHS) 93-94. Results from multinomial logistic regression analysis indicate that education, occupation, household economic condition, mother's age at birth, sex of child, mother's TT immunisation acceptance, mother's health facility visit, health worker's visit to mothers, and contraceptive use are the independent variables that have statistically significant association with immunisation acceptance. The most important variable identified is the health worker's visit to mothers.

INTRODUCTION

The Expanded Programme on Immunisation (EPI) of the WHO consists of vaccination against six childhood disease: polio, measles, pertussis, tetanus, diphtheria, and tuberculosis. Although the campaign to immunise the children against life threatening disease was started in 1979, Bangladesh seriously considered the EPI effort only after 1985 when it made its commitment at the United Nations to reach child immunisation by 1990. In the first phase, EPI commenced in 8 *thanas* and then to 190 *thanas*, and increased gradually. EPI in Bangladesh is implemented through various clinic-based and outreach activities. Immunisation motivation and education are provided during household visits by health workers and family planning field workers while vaccination services are available at outreach centres like EPI spot and satellite clinics (both static and mobile). There are also private doctor's clinics for immunisation vaccine in the country. The achievement of immunisation in Bangladesh has been impressive. In the recent past, TT immunisation acceptance increased more than ten-fold, from 6 percent in 1984 to 67 percent in 1993-94, and full immunisation among children 11–23 months old

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increased from a negligible proportion of 2 percent to almost 60 percent [Huq and Cleland (1990); De Silva *et al.* (1991); Mitra *et al.* (1994)]. From a nationally representative survey, Islam *et al.* (1996) found that 54.4 percent of last child aged 12–23 months received all the doses of immunisation where about 19.6 percent received immunisation partially and 26 percent did not take any of the vaccines.

In an in-depth study of rural area of Bangladesh, Rahman (1982) has shown that the main reason for non-acceptance of immunisation was the obstruction created by husbands and mothers-in-law because of the children's crying at the time of immunisation. A large portion of women reject the acceptance of TT vaccine for fear of harming the foetus exacerbated by village rumours and failure to inform the women sufficiently early during pregnancy. The reason given by the women who fail to have the second dose of TT was temporary migration of the women from their usual residence for confinement in their parents' home and also lack of awareness on effective measures of immunisation against immunisable diseases [Chakraborty (1987)]. Studies also found that the death rate among the vaccinated children is 46 percent, less than that among the children not vaccinated. Maternal education is positively related to the immunisation level and with the practice of other health services. It has also been found that proximity to health facility, frequency of health worker's visit, mother's mobility, education, age, gender of child, ownership of radio, economic condition of household, and region of residence have a statistically significant association with the acceptance of immunisation [Koeing *et al.* (1990); Quinley *et al.* (1991); Majumder *et al.* (1994); Bhuiya *et al.* (1995)].

Although the achievement of the programme is increasing but it is still some way from the target of over 90 percent coverage or 'health for all by 2001' [Bangladesh (1993)]. The EPI coverage evaluation survey estimated that about 65 percent of children aged 12–23 months were fully immunised [EPI, MHPW (1993)]. An understanding of the factors related to the acceptance of immunisation services is of considerable relevance to planners and policy-makers to bridge the gap between the immunisation potential and actual performance of the programme. The specific objectives of the study are to estimate the levels and coverage of childhood immunisation and to identify socio-demographic, economic, and health programme factors that are associated with the acceptance of immunisation.

DATA AND METHODOLOGY

The data used for this study was derived from the 1996-97 Bangladesh Demographic and Health Survey (BDHS) conducted under the auspices of the National Institute of Population Research and Training (NIPORT). The survey was based on a two-stage probability sample design and was selected from the integrated Multi-purpose Master Sample (IMPS). For this each of the five divisions was

stratified into three groups, (i) Statistical Metropolitan Area (SMA), which is an extension of the division headquarters, (ii) Municipalities with primary sample Mahalla, and (iii) Rural areas with primary unit Mauza. The Primary sampling units in the IMPS were selected with Probability proportional to the size from the 1991 census form and the units for the BDHS were sub-selected from the IMPS with equal probability. A total of 304 primary sampling units were selected for the BDHS (30 in SMAs, 40 in municipalities, and 234 in rural areas). The number of households selected for the sample were 9681. A total of 9640 ever-married women below 50 years of age from the selected households were successfully interviewed. This study used the immunisation status of last child of age range 12 to 59 months and the sample size was 3060.

In this paper a child of age 12–59 months was considered fully immunised if he or she had received all of the vaccinations—BCG, three doses of DPT and Polio (which usually starts from the one and half months of child's age), and Measles (which starts from 9 months of age) at the time of survey.

Information about childhood immunisation was collected from both mother's information and vaccination card of the child. Mothers of all children (born after April 1990) were asked to show the interviewers the vaccination card of these children and the interviewer copied the date from cards. If a child's date of birth was misreported, the child would appear to have received vaccination at an older age. This may cause the lower proportion of children receiving various vaccination in the appropriate age range. Being an under-developed country Bangladesh has no complete vital registration system. Besides, most of the people are illiterate and are not conscious of the importance of census and survey. So various types of errors could occur in any survey data such as misreporting, digit preference, or age heaping, etc. Error in age data for interviewed women results in low reporting of age for all women except widows and divorces. Moreover, there was some evidence of age heaping or digit preference in the reporting of age data. The preference for digits 0 and 5 was notable. These irregularities were not visualised when the age of mothers was converted to the age of mother at birth of the index child. Most irregularities in single year age data were eliminated when the data were grouped in five-year age groups. Moreover, these irregularities were not visualised when the age of mothers was converted to the age of birth of the index child.

Coverage and differentials in the immunisation status of last child with different characteristics of respondent were investigated by cross tables and multinomial logistic distribution. The dependent variable immunisation status of the last child was categorised into three categories: not-immunised=0, fully immunised=1, and partially immunised=2. Important independent variables (Table 1) in relation to the risk of full immunisation were first identified by examining

bivariate tabulations, and subsequently forward stepwise logistic regression analysis was carried out. Independent variables that were significant in both bivariate and in multinomial logistic distribution are defined in Table 1. Economic status of respondents was defined by the possession of consumer durable goods like an almirah (wardrobe), table/chair/bench, watch/clock, cot/bed, radio, television, bicycle, etc.

Table 1
Selected Exploratory Variables and Their Categories

Variable	Categories	Freq (%)
Mother's Education	0=No Education ^(b)	1738 (56.8)
	1=Primary education	850 (27.8)
	2=Secondary and higher education	472 (15.4)
Mother's Occupation	0=House wives ^(b)	2632 (86.0)
	1=Work at home	151 (4.9)
	2=Work outside of home	277 (9.1)
Father's Occupation	0=Agricultural work ^(b)	1233 (40.3)
	1=Service	406 (13.3)
	2=Business	694 (22.7)
	3=Others	727 (23.2)
Household Economic Status	0= lower class ^(b) (owns 0-1 articles)	2264 (74.0)
	1= Middle class (owns 2-3 articles)	656 (21.4)
	2=Upper class (owns 4-6 articles)	140 (4.6)
Mother's Age at Birth of Child	0=Low thru 19 ^(b)	760(24.8)
	1=20–29	1723 (56.3)
	2=30 thru High	577 (18.9)
Gender of Child	0=Male ^(b)	1545 (50.5)
	1=Female	1515 (49.5)
Mother's TT Vaccination Status	0=Yes ^(b)	2052 (67.1)
	1=No	1008 (32.9)
Health Worker's Visit	0=No visit ^(b)	1447(47.3)
	1=1-3 visit	1117(36.5)
	2=4 + visit	496(16.2)
Mother's Health Facility Visit in 6 Month	0=Yes ^(b)	770 (25.2)
	1=No	2290 (74.8)
Contraceptive Use	0=Yes	2216 (72.4)
	1=No	844 (27.6)
Division of Residence	0=Barisal ^(b)	321 (10.5)
	1=Chittagong	714 (23.3)
	2=Dhaka	881 (28.8)
	3=Khulna	360 (11.8)
	4=Rajshahi	784 (25.6)

Note: 'b' indicates the base category for multivariate analysis.

RESULTS

Bivariate Analysis

The differential in immunisation coverage of last child among different sub-groups by some selected socio-economic, demographic, and health programme factors is presented by the following eleven figures.

Mother's education, occupation, sex of the child, region of residence, economic status of the household, and health programme factors are factors that were significantly associated with full immunisation among children. Mothers with no education had three times higher chance to have not-immunised their children than those who had secondary and higher education. The non-acceptance of immunisation was the highest among the children of housewives (26.6 percent). The effect of mother's work status on immunisation may depend on the structure of the family and education. The coverage of complete immunisation was consistently higher in the families where husbands were employed in service (64 percent), and the lowest among those who were agricultural workers and others (56.8 percent). Children's complete immunisation was positively related to the household economic status whereas it was not so with the partial and non-immunisation tendency of children.

It was found from figures that mothers of age group 20–29 were more likely to get their children completely immunised (59.1 percent) and the partial attainment was found in a comparatively higher proportion among teenage mothers (17.1 percent). Female children had less chance of being fully immunised as compared to male children. Health facility visit by the mother indicates the consciousness of the mother about her own and her child's health care. This study also found a highly significant association between mother's health facility visits and children's immunisation.

Mothers who had visited the health facility during the last 6 months had seven percent greater coverage to practice full immunisation among their children. The partial attainment or non-immunisation existed at a lower proportion among mothers who had visited the health facility as compared to those who did not. Coverage rate of full immunisation increased as the number of health workers' visits increased. Also the partial and non-immunisation preferences decreased with the increase of health workers' visits.

When the immunisation status of last child was examined by the use of tetanus toxoid during the last pregnancy, a higher coverage rate was found for women who received tetanus toxoid as compared to those who did not. Thus mothers who had made use of health services for themselves had a favourable attitude towards the modern medical care for their child. The present analysis indicated a consistent pattern of higher coverage of immunisation among the users of

contraceptives. The success of immunisation was more prominent in Khulna and Rajshahi than in

Figures

Figures

Chittagong and Dhaka Divisions which means that immunisation programme in the former Divisions had been better able to meet the immunisation needs than in the latter Divisions.

Multivariate Analysis

For multinomial logistic regression analysis, we consider the exploratory variables which show some significant association with dependent variables. The Statistical Package “STATA”—version 2.1 has been used for estimating the coefficient in the model. The non-acceptance of immunisation of last child (IMMST = 0) has been considered as the base category of the dependent variable. Comparisons were made for the rest of the two categories. Results of the multivariate analysis of the relationship between partial and full acceptance of children’s immunisation and some selected exploratory variables are shown in Table 2. Results are expressed through odds ratio for different effects.

Educated mothers were more likely to have their children immunised than mothers who had no education. Mothers with secondary and higher education had a 2.4 times higher chance for full immunisation; partial attainment among mothers who belong to this group was 1.6 times higher as compared to mothers who had no education and who did not have their children immunised. Again, mothers who received primary education had 1.3 times higher probability to practice the full immunisation of their children. The relative chance for practising partial immunisation showed an insignificant association among this group of mothers. Thus, mother’s educational attainment is positively significantly associated with the attainment of immunisation. A significant positive association was also observed between the attainment of full immunisation and mothers who work outside of home.

A negative association was observed between father’s occupational status and children’s immunisation. Fathers who were businessmen were 23 percent less likely to have their children fully immunised than those who were agricultural workers. A significant inclination was observed in middle class families to get their children fully immunised as compared to the lower class. It was observed that children from a middle class family were 1.3 times more likely to be immunised than those who belong to a lower economic class and are not immunised. It was also found that the association between partial attainment of immunisation and household economic status was not significant.

Again, fathers who were neither agricultural workers nor service holders nor businessmen were 24 percent less likely to practice partial immunisation for their children.

Table 2

Multinomial Logistic Regression Analysis for Immunisation Status of Last Child

Variables	Full Immunised			Partial Immunised		
	Coefficient	Sd. Error	Odds Ratio	Coefficient	Sd. Error	Odds Ratio
Mother's Education						
Primary Education	0.258**	0.120	1.29	-0.307	0.156	0.74
Secondary and Higher	0.858****	0.217	2.36	0.469*	0.267	1.60
Mother's Occupation						
Work at Home	0.146	0.240	1.16	0.417	0.282	1.52
Work Outside	0.365**	0.177	1.44	0.559****	0.214	1.75
Father's Occupation						
Service	0.062	0.172	1.06	0.063	0.210	1.06
Business	-0.264**	0.131	0.77	-0.233	0.165	0.79
Other	-0.040	0.127	0.96	-0.272*	0.163	0.76
Household Eco. Status						
Middle Class	0.261*	0.153	1.30	-0.030	0.192	0.97
Upper Class	0.011	0.311	1.01	-0.371	0.399	0.69
Mother's Age at Child Birth						
20-29	0.333**	0.146	1.39	0.093	0.182	1.10
30 Thru High	0.439**	0.209	1.55	-0.166	0.265	0.85
Gender of Child						
Female	-0.425****	0.094	0.65	-0.293****	0.119	0.75
Mother's TT Vac. Status						
No Vaccination	-0.0226****	0.099	0.29	-0.980****	0.128	0.38
Mother's Health Faci. Visit						
No Visit in 6 Month	-0.195*	0.114	0.82	0.182	0.150	0.20
Health Worker's Visit						
1 - 3 Visit	0.276***	0.108	1.32	-0.030	0.138	0.97
4+ Visit	0.438***	0.145	1.55	0.034	0.187	1.03
Contraceptive Use						
No	-0.245**	0.112	0.78	-0.037	0.140	0.96
Div. of Residence						
Chittagong	-0.657***	0.193	0.52	-0.207	0.259	0.81
Dhaka	-0.771***	0.188	0.46	0.127	0.248	1.14
Khulna	-0.055	0.226	0.95	-0.239	0.316	0.79
Rajshahi	-0.141	0.199	0.87	0.101	0.265	1.11

Note: * P < 0.10 ; ** P < 0.05; *** P < 0.01; **** P < 0.001.

Independent variables are defined in Table 1. All zero(0) categories of Table 1 are the base category.

Dependent variable: Immunisation status of last child (IMMST) = '0' if the child is not immunised (N=787(25.7 percent)); '1' if the child is fully immunised (N=1775(58 percent)); '2' if the child is partially immunised (N=498(16.3 percent)).

(Outcome IMMST=0 is the comparison group).

Mother's age at the time of children's birth plays a significant role in their immunisation. It was found that middle-aged mothers were more likely to have their children immunised whereas mothers at older ages were more likely to have them fully immunised and less likely to have them partially immunised as compared to teen-age mothers, who did not get their children immunised. Gender preference was found to have a highly significant affect on immunisation. Female children were less likely to be immunised fully or partially as compared to their male counterparts. A positively significant association was found between mothers' TT immunisation acceptance and children's immunisation practice. Results showed that mother who did not receive the TT vaccination during pregnancy were 70 percent less likely to have their children fully immunised and 60 percent less likely to practice partial immunisation than those who received the TT vaccine.

Mother's 'health facility centre visit' increased the probability of their child's immunisation acceptance. Results from Table 2 indicate that there exists a less significant association between mother's health facility visit and children's immunisation. Mothers who did not visit the health centre in the last 6 months were 20 percent less likely to get their children immunised.

The most interesting and policy-relevant result is the positive effect of health worker visits and the immunisation of the last child. Mothers who were visited '1 to 3' times and '4+' times were 1.3 and 1.6 times respectively more likely to accept the full immunisation for their last child than those who had not been visited by health workers.

Mothers who used contraceptive were more likely to get their child immunised. Mothers who did not use any type of contraceptive were 20 percent less likely to have their children fully immunised.

There was a strong regional variation of full immunisation coverage among Divisions. Full immunisation of children from Chittagong and Dhaka Divisions lagged behind the other Division. One plausible explanation of this finding is that in Rajshahi and Khulna Divisions, health programme inputs and mass communication tools have had a greater impact in creating a much stronger demand for full immunisation than elsewhere.

DISCUSSION AND POLICY IMPLICATIONS

The study was designed to make an assessment of the EPI intervention programme and the possible effect of some selected factors that are likely to be associated with the acceptance of the EPI programme, with particular emphasis on child immunisation pattern in Bangladesh. It has documented some findings which are very important from the policy point of view, to ameliorate the existing health status of women and children.

The study represents all women aged 10–49 years, with respondents who had at least one or two surviving children during the last four years preceding the survey. The respondents were mostly young women in their Thirties. Most of them received TT immunisation during pregnancy but were too far from taking any antenatal care. A considerable proportion of women reported that they were not visited by health workers in last six months preceding the survey. Thus, the health care facilities for children provided by the government are not highly acceptable among all children and overall coverage of all preventable diseases is not present.

Maternal education is positively related to the chance of a child's being fully or partially immunised. Results from the multivariate analysis of immunisation of last child show that more educational attainment of mothers enhances the child's chance to be immunised fully or partially. In fact, mother's education was positively correlated with knowledge of immunisation in this society and elsewhere, and better knowledge on immunisation meant more acceptance [Streatfield *et al.* (1988, 1990)]. Occupational status of the mother gives her special social status. It was also found that their children's full immunisation is positively related with their occupational status. The possible reason for such an attainment is that mothers with an occupation are educated and have the opportunity to get better information about health care. Again, housewives were found to be less likely to participate in the immunisation programme. Therefore, the primary health care strategy should be geared up to produce greater health awareness, based on more reliable information sources for the housewives specially in villages. The study also documents that husband's occupation has some influence on last child's immunisation status. Again, husbands' occupation is highly-related to their educational attainment, which affects the knowledge and aptitude towards immunisation.

The study reveals that children's full immunisation has some positive relation to the economic condition of the household. Higher economic class families have better exposure to mass media services and provide for a higher social status. So the increase of household income could increase the immunisation acceptance.

In spite of almost universal access to immunisation services, sex discrimination against female children exists in seeking full immunisation coverage in the rural areas of Bangladesh. This discrimination was found to be significant in seeking health care—specially immunisation. Similar results were also obtained by Chen *et al.* (1981) and Bhuiya and Streatfield (1991). This is partly responsible for more female child mortality in Bangladesh. Sex discrimination against female children by families is a difficult problem to overcome. However, possible suggestions to minimise this problem include more frequent contacts and greater motivational efforts by service-providers in households that have female children who need to be vaccinated against childhood diseases.

The study shows a strong association between the mother's TT vaccination status and the immunisation of children. This result reflects that mothers who use health facility services are conscious about the vaccination and prepared psychologically, which affects the children's immunisation. This result also reflects the closeness to health facility services, although a sufficient number of health centres are not yet been available in rural Bangladesh. A strong relationship has been found between mother's health centre visit and immunisation. It is very common that in rural community, health centres are lead by unqualified doctors and traditional healers. As these traditional practitioners and the village doctors are well accepted by the community people, they should be integrated with the mainstream health care system, by providing them the full immunisation facility and cover against bad effects of partial attainment through appropriate training.

The underutilisation of childhood immunisation also originates from the lack of proper knowledge or limitation of health worker's visit. Almost half of the respondents reported that they were not visited by the health workers. This implies that health information may fail to reach the 'hard to reach' group, those who are poor, traditional, uneducated, and reluctant to go to clinic for immunisation and other health services. But there is no other way that could effectively educate mothers and gather information to understand their health needs as well as those of their children and develop awareness except through home visit. Government's health planners, policy-makers, and programme managers should give due importance to this point and home visitation by the health workers must be increased. For this, a number of trained health workers may be recruited.

There are marked regional variations with respect to full immunisation status of the last child. Coverage is the lowest for DPT3, Polio3, and measles vaccination [DHS primary report, Mitra *et al.* (1994)]. Since the majority of mothers in rural Bangladesh have no education and belong to the relatively poorer economic class, the health intervention that can improve the chance of children to be fully immunised is the increased visits of health workers to mothers, so that messages will be communicated to the mothers in a way that they will understand the importance of full immunisation, timing of immunisation, and the doses required. Chittagong and Dhaka Divisions should be placed in the limelight, as there is a smaller percentage of fully immunised children elsewhere.

The EPI programme of the Government made considerable impact in the management of child health. To achieve the target of over 90 percent immunisation coverage in the near future, an attempt should be made to promote female education in rural areas. More employment opportunity should be created for women. The venue, date, and time of holding of mobile EPI sessions should be well publicised. Community initiatives for EPI sessions should be duly acknowledged. Traditional practitioners and village doctors should be integrated into the mainstream of the

government health care system. More mobile clinics or satellite clinics should be established in rural areas. Mothers should be motivated to take tetanus-toxoid during their pregnancy. Vaccination cards should be so designed that mothers can tell easily by looking at them when to return for the remaining doses, and it should be easily preservable. Finally, a regular and effective health worker visit should be ensured through proper monitoring and supervision.

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