

Immunization Divide: Who Do Get Vaccinated in Bangladesh?

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ABSTRACT

This paper examines inequalities in the use of, and access to, vaccination service in Bangladesh by analyzing national and small area-based datasets. The analysis showed that female children had a lower immunization coverage than male children—the difference persists for all antigens and widens against girls for higher doses. The immunization coverage was higher for children whose mothers were more educated. Children whose fathers had a higher-status occupation (salaried employment) were two-and-a-half times more likely to be immunized than children whose fathers held a lower-status job, e.g. day-labourer. The coverage for the poorest quintile was 70% of the well-to-do. Children residing in urban areas were more likely to be fully immunized than their rural counterparts (70% vs 59% for children aged 12-23 months). Within urban areas, the situation in slums was worse. Large differences existed among the various administrative regions of the country. Ethnic minorities in the Chittagong Hill Tracts had a lower immunization coverage than the Bangalees. In Sylhet, children of non-local workers in Bangladesh-owned tea estates had a lower coverage than their counterparts in foreign-owned tea estates. The study identifies children of various disadvantaged groups as having a lower coverage. Managers of immunization programmes must realize that only through removal of such disparities among groups will overall coverage be increased. Affirmative actions in targeting could be effective in reaching such groups.

Key words: Immunization; Immunization programmes; Inequalities; Gender; Socioeconomic status; Education; Slums; Ethnic groups; Bangladesh

INTRODUCTION

Inequality in health refers to differences in health (outcome or other measures) among different groups in the population. Not all inequalities are, however, unacceptable. Inequality that is deemed 'unfair', 'unacceptable', or 'avoidable' is called inequity (1). In other words, inequity is a subset of inequality. In recent years, there has been an increased discourse in the scientific literature on health equity and inequity (1,2). Most of

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these analyzed, for very practical reasons, the health outcome (mostly mortality) as a marker of inequities between and within nations. Healthcare-seeking behaviour or access to healthcare has received less attention. It is argued that a mere increase in access itself may not be enough for improving health outcomes since the status of the individual in terms of host factors and background characteristics is an important determinant. Nevertheless, access to healthcare is a key element for sustained improvement in health outcomes. Whereas controversy may arise about the level at which a difference in outcome is considered 'fair' or 'unavoidable', there may not be any such controversy in access as any difference in access within a geo-political entity is avoidable, and is within the reach of human capacities. This paper is an attempt to review inequalities in access

to healthcare, focusing on vaccination services in Bangladesh as a case.

Immunization in Bangladesh

Vaccination against some of the most fatal and debilitating diseases is one of the most cost-effective interventions of modern times. Smallpox, which historically caused so much death and suffering, is now a thing of the past. Poliomyelitis, another disabling disease, is now set to be eradicated. The single intervention that has made these to happen is vaccination. Recent studies have also documented the positive health-equity effects of vaccinations. Analyzing longitudinal data on mortality and measles immunization from Bangladesh, Koenig *et al.* demonstrated that it was the most vulnerable children (in terms of socioeconomic status) whose differential mortality risk was mostly reduced by vaccination (3).

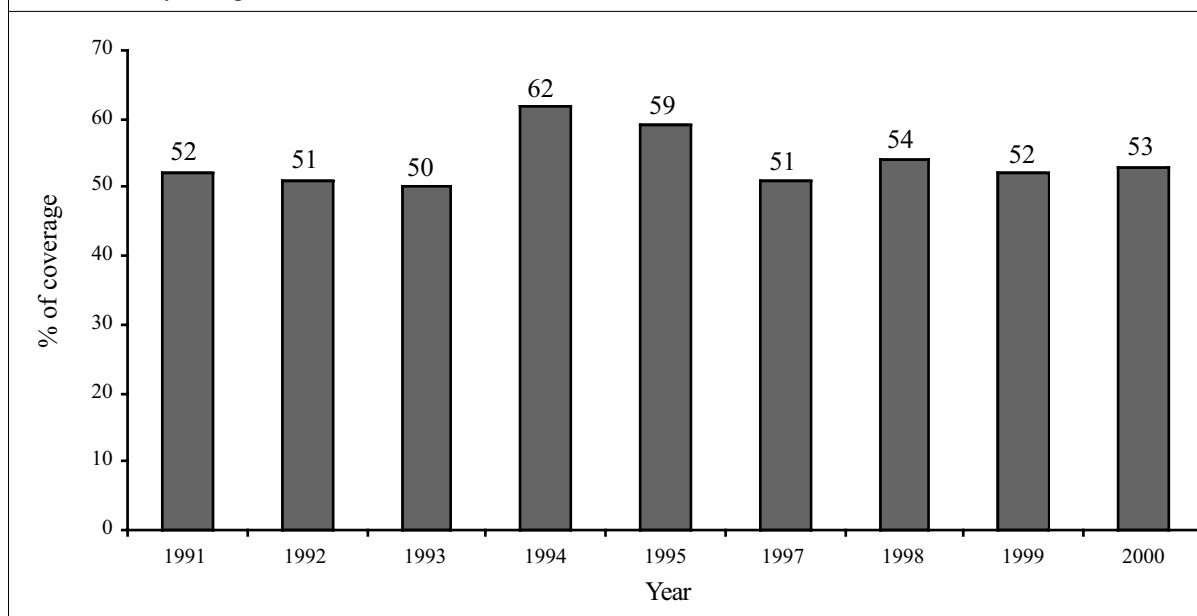
Bangladesh has a long history of vaccinating its population. British colonial papers suggest that variolation or inoculation, the predecessors of vaccination, was in practice in this part of the Indian Sub-continent as far back as 1731; Tikadars, a group of professional inoculators, provided inoculation against smallpox for a fee (4). The modern Expanded Programme on Immunization (EPI) was launched in 1979 but intensified

in 1986. With government commitment, donor support, and involvement of non-governmental organizations (NGOs) and civil society, the programme attained spectacular success quickly. Within a few years, the coverage in terms of children fully immunized increased from 2% in 1986 to 62%. In Rajshahi, one of the six administrative divisions of the country, the coverage reached 80% (5,6). This feat, however, was not unique for Bangladesh as similarly rapid improvements were experienced in several other countries in the developing world. The story that unfurled itself afterwards was disquieting, however. Except for 1994 when it reached its peak, the rate has plateaued at around 50% (Fig. 1).

Bangladesh was never able to achieve the target of Universal Child Immunization of 80%, and the plateauing of the coverage rate is even more frustrating. Researchers have looked at the reasons for such plateauing in coverage and have identified factors, which are related to both demand and supply (6,8,9).

In a recent field-level review of routine EPI in northern Bangladesh, participants representing the government and development partners identified the challenges facing the programme. Routine EPI is distinguished from the others interventions, such as National Immunization Days; whereas the former is a

Fig. 1. National trends in coverage (fully immunized) of children aged less than 12 months, by year of survey, Bangladesh, 1991-2000*



* These are based on 'valid doses' (as defined in the text)

Source: Bangladesh. Ministry of Health and Family Welfare. Directorate General of Health Services (7)

regular monthly activity that provides vaccination against the six diseases, the latter is a campaign done twice a year for eradicating a specific disease, such as polio.

Most of the problems identified were supply-related. For example, in one of the 'sessions' attended by one of us (AMRC), the vaccinator did not turn up. It was discovered later that, of the previous four scheduled sessions, only two were held.

MATERIALS AND METHODS

This paper draws data from various secondary sources, including the authors' own, as available in 2001. For clarity, these sources are briefly described. The studies used two different age groups in reporting coverage. The official age for vaccination is from birth to one year infants. Infants crossing this age are not refused for vaccination in a field situation. As a result, the coverage for 12-23 months old children is higher than that for 0-11 month(s) old infants.

Coverage evaluation survey

From the early 1990s, coverage evaluation surveys were carried out regularly in Bangladesh. Done with technical assistance from the World Health Organization (WHO), United Nations Children's Fund (UNICEF), and the Immunization and Other Child Health (IOCH) Project, the Government of Bangladesh, in association with selected NGOs carried out the surveys. Using the '30-cluster technique' (10), the surveys were done separately for each of the administrative divisions, viz. Dhaka, Chittagong, Rajshahi, Khulna, Barisal, and Sylhet. Unfortunately, differences among different groups in the population, such as gender or socioeconomic status, are unavailable or not analyzed in these studies because of small sample size. Under the 30-cluster methodology, coverage information is collected on 210 children—seven from each cluster (10). It has the advantage of being simple but is not free from limitations. IOCH, a donor-funded project that works to improve immunization coverage in urban areas, has conducted over 60 coverage surveys in various municipalities since 2000 using the 30-cluster methodology. It provides useful information on coverage, availability of EPI cards, missed opportunities, proximity to vaccination centres, reasons for non- or partial immunization, and the polio-eradication campaign.

Demographic and health survey

This is part of the multi-country surveys done with USAID support. These surveys collect various demographic and maternal and child health (MCH)-

related information, including immunization status, on a representative sample of the country. The latest of the three demographic and health surveys (DHSs), carried out in 1999-2000, reached 10,268 households (11). Two previous rounds were carried out in 1993-1994 and 1996-1997 (12,13).

BRAC studies

Bangladesh Rural Advancement Committee (BRAC), a national NGO, has carried out a large number of studies on immunization in Bangladesh. This paper draws data from three of their studies as described below:

Coverage survey: BRAC has carried out a number of independent surveys on immunization coverage. One of these, conducted in 1995, visited 10 districts and used the 30-cluster technique to estimate coverage rates for each district.

Study in Chittagong Hill Tracts: For over two decades, the Chittagong Hill Tracts (CHT) had been a scene of armed conflict between local insurgents representing 11 local ethnic groups and the Government of Bangladesh. Through an agreement signed between the two parties in 1997, peace was restored, and the region was opened up for development activities. BRAC started development activities soon afterwards, but an absence of useful information on various development indicators was encountered. To circumvent this, BRAC's Research and Evaluation Division carried out an extensive survey in 1998. Covering various indicators of development, such as demography, socioeconomic status, health, and environment, the survey covered five of the region's major ethnic groups, including the Chakma, the Tripura, the Marma, and the Mru. Bangalees, who were settled in the region during the previous two decades and constituted about half the total population, were also covered as a separate group. As part of the health module of the questionnaire, the survey collected information on the immunization status of children aged less than 24 months, separately for the five ethnic groups (14).

Social Science and Immunization Project: In 1997, a cross-country study was launched to study immunizations from a social science perspective. Called Social Science and Immunization (SSI), the project was implemented in several countries, including Bangladesh, India, the Philippines, Malawi, Ethiopia, and the Netherlands (15). Depending on the local situation and need, the countries selected their own themes, and the one in Bangladesh looked at the sustainability of the immunization programme in the country. The Bangladesh part of the study was carried out jointly by BRAC and ICDDR,B:

Centre for Health and Population Research. A major thrust was to study the demand and supply sides of the programme. Using both qualitative and quantitative techniques, primary data for the study were collected from several villages and urban areas of Bhairab sub-district in Kishoreganj district (6). The choice of the district was purposive as it was intended to study a low-performing area and a previous study had found Kishoreganj to be in this category (16). This study is referred to in this paper as the 'Bhairab study' to indicate the sub-district in Kishoreganj where most data collection was done.

BRAC-ICDDR,B studies in Matlab

The main field site of ICDDR,B is located in a sub-district called Matlab. Since 1992, BRAC and ICDDR,B have been collaborating to study the impact of BRAC's non-health interventions, such as women's empowerment, micro-finance, and children's education, on health (17,18). Various research methods were used over the years, including a baseline survey (1992), a series of in-depth studies, and a follow-up survey in 1999. Both 1992 and 1999 surveys collected information on immunization coverage for three groups: children whose mothers were from poorer families and joined BRAC's poverty-alleviation programme, children whose mothers were from poorer families but did not join BRAC, and children whose mothers were neither poor nor joined BRAC. The data allowed examination of the changes happening between the two periods (1992 and 1999) in immunization coverage for each of the three groups. The ICDDR,B field area in Matlab is divided into two parts: intervention area (where all the MCH-FP interventions are carried out by ICDDR,B) and comparison area (where only the 'normal' government programme exists). The analysis presented in this paper is based on data from the 'comparison' area only.

In this paper, we have examined equity issues for the following stratifiers:

- Gender
- Socioeconomic status
- Urban-rural residence
- Geographic (division/district) residence
- Ethnicity
- Supply-related factors, e.g. proximity to health facilities, and
- Other factors, e.g. small village vs large village

An important dimension, which has not been covered due to lack of data, is disability.

An important concept, which has been used frequently in the analysis, is 'children fully immunized' (FIC). This, unless otherwise indicated, is defined in the following way: "A child is considered fully immunized if s/he has received all doses of the vaccines against the six diseases. This means all 3 doses of DPT and OPV, the BCG, and measles." The term 'fully vaccinated child' is also used synonymously for FIC.

If the child received all doses at the appropriate age (e.g. BCG at birth, DPT1/OPV1 at six weeks, DPT2/OPV2 at 10 weeks, DPT3/OPV3 at 16 weeks, and Measles at 38 weeks), the coverage was called 'valid'; otherwise it was called 'crude' (19). Except for Figure 1 that provides 'valid' estimates, all others cited below are crude estimates, unless otherwise stated. Another concept reported here is the 'vibrancy index'. Based on the distance from the village to the sub-district headquarters, family planning centre, satellite clinic, and NGO health centre, a score was given. A high score or 'high vibrancy' indicated easy access to these facilities. More details on this have been reported elsewhere (20).

Table 1. Children, aged 12-23 months, who were fully immunized, by sex and years

Survey year	Boy		Girl		Girl/boy ratio
	No.	%	No.	%	
1999-2000	693	63.4	623	57.1	0.900
1996-1997	563	55.8	520	52.2	0.935
1993-1994	591	62.1	580	55.6	0.893

Sources: Bangladesh demographic and health survey, 1999-2000 (11), 1996-1997 (13), and 1993-1994 (12)

When one looks at the coverage by antigens, the advantage for boys persists for all antigens too (Table 2). A study based on the 1993-1994 Bangladesh Demographic and Health Survey had found that female children were 30% less likely to be immunized compared to male children (8). In Matlab, however, the coverage was found to be more for girls than boys (see later in this paper).

Table 2 also shows that the girls' disadvantage increases as the higher doses are given. This is supported by data from the intensive Bhairab study which showed that the girls' disadvantage tends to increase as the children gain in age (Table 3).

An interesting result in Table 2 is the difference between overall BCG and measles coverage. The higher coverage of the former represents the capacity of the system ('programme access'), and the lower coverage of the latter represents the failure of the (supply) system to carry out the immunization programme effectively. Nearly

Table 2. Percentage of children, aged 12-23 months, by sex and doses of different antigens* (1999-2000)

Vaccine dose	Boy (n=693)	Girl (n=623)	Girl/boy ratio
BCG	92.5	89.3	0.965
DPT1	90.7	87.0	0.959
DPT2	83.8	79.2	0.945
DPT3	75.9	67.8	0.893
OPV1	94.5	93.8	0.992
OPV2	86.6	83.6	0.965
OPV3	74.8	68.3	0.913
Measles	73.2	68.2	0.931
All	63.4	57.1	0.900

* Doses of DPT and OPV given at the same time. In this table, however, the corresponding rates are not the same since the above are 'crude' estimates and are based on cards and/or history
 Source: Bangladesh demographic and health survey, 1999-2000 (11)

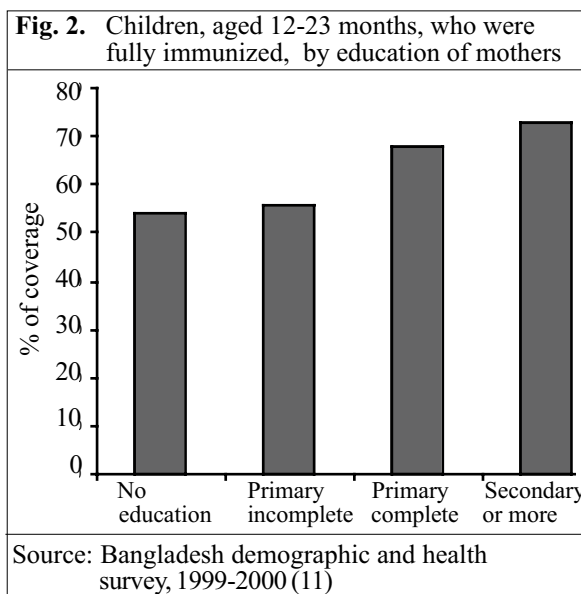


Table 3. Immunization coverage in Bhairab by antigen, age, and gender (1997)

Gender	DPT (3rd dose)				BCG				Measles			
	0-11 month(s)		12-23 months		0-11 month(s)		12-23 months		0-11 month(s)		12-23 months	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Girl	41	21.5	89	39.9	93	48.7	146	65.8	9	4.7	71	32.0
Boy	44	22.4	106	45.9	97	49.5	176	76.2	12	6.1	95	4.1

Source: Aziz KMA *et al.* (23)

90% of girls received BCG, while this dropped to less than 70% for measles. The major challenge for the Bangladesh programme is how to reduce the dropouts.

Socioeconomic inequality

Immunization coverage among children by the educational level of their mothers is given in Figure 2, as available from the BDHS 1999-2000 (11).

Children whose mothers had attended secondary school or higher had nearly 40% higher coverage rates than those whose mothers had not attended school. The occupation of the major breadwinners of the households (in most cases fathers) also played a significant role in the immunization of their children. Table 4 shows that children whose fathers had salaried jobs were two-and-a-half times more likely to be immunized than those whose fathers were day-labourers (considered a low-status occupation).

In the absence of a reliable or valid estimate of household income in Bangladesh, a proxy indicator often used for household economic status is the 'self-rated

Table 4. Percentage of children (n=145), aged 12-23 months, fully immunized, by source of household income in Bhairab, Bangladesh (1997)

Source	Percentage
Service*	64
Business	31
Day-labour	27
Others	37

* Salaried employment in any government or non-government or private institution (mostly white collar)
 Source: Bhairab survey, 1997 (Unpublished data)

food security status'. Through this, households are asked to rate their perceived status as one of three (or four) pre-coded groups: Surplus, Balance, or Deficit (21). Studies have validated this method as a good proxy approximation for household income (22). Table 5 shows that the children who belonged to 'surplus' households had a nearly 50% higher immunization coverage than those who belonged to chronically 'food deficit' households. This is supported further by data from the BDHS 1996-1997.

Table 5. Percentage of children (n=145), aged 12-23 months, fully immunized, by self-rated annual household food security status in Bhairab (1997)

Food security status	Percentage
Surplus	42
Balance	30
Deficit	29

Source: Bhairab survey, 1997 (Unpublished data)

Table 6 shows the coverage for different wealth quintiles as found from the latter data; the difference between the lowest and the highest quintiles is very similar to that between the 'Deficit' and 'Surplus' group of Table 5. In the Bhairab study, religious minorities had a lower coverage than the more dominant Muslims. Further examination of the data and consultation with researchers indicated that the minorities in this area represented the lower-caste Hindus who were also socioeconomically disadvantaged.

The results of the qualitative case studies collected by the Bhairab study also documented differential behaviour of health workers. In one incident, the study mentioned, "the health workers behaved differently with different people....A health worker gave a syringe and a measles vaccine vial to the porter, just before closing the session. The porter and the health worker then went to a house on the other side of the road. To explain this, the vaccinator said that they went to vaccinate a child in that house. The house owner was a rich man and the parents did not want to come to the session" (23:73). The study also documented the advantages of the well-to-do people in accessing vaccination services: "The mothers complained that males could walk long distances, but not females. So they needed money to hire transport, which the poor cannot afford. In the urban areas, most mothers with a good economic status went to the centre by rickshaw" (23:70).

Table 6. Children, aged 12-23 months, fully immunized, by wealth quintile (1996/1997)

Wealth quintile	Immunized	
	No. of households visited during survey	%
Poorest	8,635	47.2
Second	9,809	43.7
Middle	8,965	60.8
Fourth	9,254	58.8
Richest	9,157	66.7
All	45,820	54.1
Poor/rich ratio	0.708	

Source: Gwatkin D *et al.* (24)

Residence

Urban children in Bangladesh are more likely to complete the immunization schedule successfully than rural children. The coverage of urban children aged 12-23 months is 70% compared to 59% in the rural area (11). However, the situation in urban slums is worse. The 2001 coverage evaluation surveys show that the coverage in Dhaka slums is 80% of overall city coverage. IOCH found the (valid) rates to vary widely (35% in Mongla to 78% in Jhenaidah).

There is a big difference among the various administrative regions of the country as reported by the coverage evaluation surveys conducted by the Government. Figure 3 shows that the 'valid' coverage for rural children aged less than 12 months in Sylhet division is the lowest with only 23%. On the other hand, the highest coverage rural areas is found in Khulna division with 65%. There were also wide differences within a division. A 1995 survey looked at the immunization coverage in 10 of the 64 districts of the country. Table 8 shows that there is a huge range in coverage for children aged 12-23 months among districts. Kishoregonj had a coverage of 27.7% which is less than a third of Kushtia (93.8%). Kishoregonj, Manikgonj, and Jamalpur are all in Dhaka division but differ widely in their coverage rates. It should, however, be remembered that the results presented in Figure 1 and Table 7 represent two time periods, 2001 for Figure 3 and 1995 for Table 7.

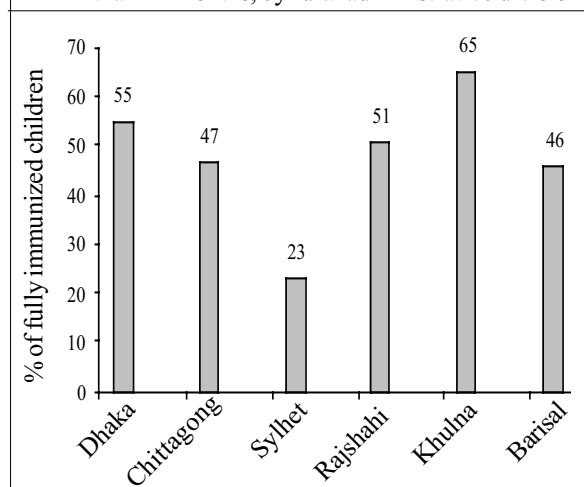
There is also a big intra-district difference found in immunization rates in Bangladesh. Kishoregonj, being the lowest-performing district, was studied more closely. It was found that, although the total coverage in the district was nearly 28%, there were pockets which had a coverage as low as 5%. These were the low-lying and

Table 7. Percentage of children, aged 12-23 months, fully immunized, by district (1995)

District	Immunized	
	No.	%
Kishoregonj	94	27.7
Lalmonirhat	124	74.2
Moulavi Bazaar	136	75.0
Cox's Bazaar	119	78.2
Jhalakathi	112	81.3
Manikgonj	136	83.1
Joypurhat	106	85.8
Jessore	122	87.7
Jamalpur	90	93.3
Kushtia	145	93.8

Source: Hadi A *et al.* (16)

Fig. 3. Immunization coverage of children, aged less than 12 months, by rural administrative division



Source: Coverage evaluation survey 2001 (Unpublished)

Table 8. Immunization coverage of children, aged 0-23 month(s), living in particular geographical pockets

Characteristics of pockets	Immunized	
	No.	%
Low-lying villages	26	5
Chittagong Hill Tracts	141	29
Tea estates		
Foreign-owned	210	56
Bangladeshi-owned	198	27

Source: Aziz KMA *et al.* (23), Karim F, Begum S (20), Bhuiya A *et al.* (25)

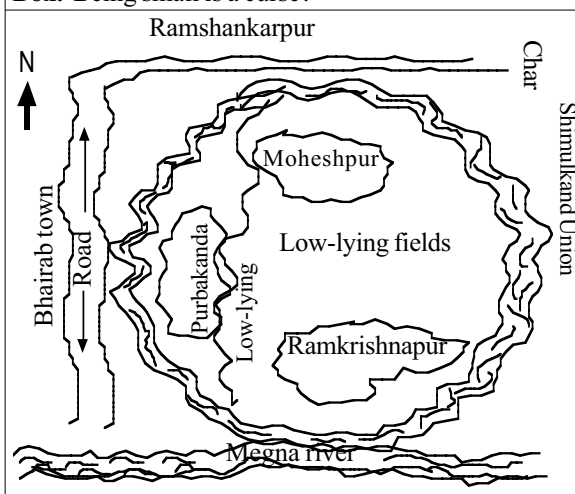
small villages that remained marooned by floodwaters for most of the year (Box).

Ethnicity

A lower-than-average coverage was found in many pockets and geographic areas, such as the tea estates of Sylhet district (in north-eastern Bangladesh) and the Chittagong Hill Tracts. Bangladesh has a large number of tea estates. The estate workers are ethnically different, and were brought to the area from other parts of India in the early 19th century during the time of British occupation. Bangladeshis now own many of these estates, but a few are still retained by foreign companies. Children living in locally-owned estates had a much lower coverage than those who lived in foreign-owned estates (Table 8).

CHT in general is a very low-performing region (29% compared to the national average of 54%). Nevertheless,

Box. Being small is a curse?



In Bhairab, a traditionally low-performing area, an intensive study using qualitative and quantitative methods looked at the coverage for 'immunization in-depth'. The study identified pockets of villages where the coverage was significantly lower (as low as 5%) than other villages. One reason for such poor coverage is the sheer size of the village and poor transportation. The three villages shown in the figure (Ramkrishnapur, Purbakanda, and Moheshpur) are separated from other areas by a big river and low-lying fields. These remain isolated from the mainland for about eight months by floodwaters. Being very small, no one from these villages gets elected to the local union council and, thus, they are politically unimportant. The villages are far from the nearest health centres, and health workers seldom visit them. The villages do not have enough children to set up separate vaccination centres; for the same reason of small size, no NGO is active in these villages. There is no public school, and only recently BRAC has set up a non-formal school. For every development activity, the villagers are neglected. In Bangladesh, there are many such villages.

when the coverage rate for various ethnic minorities within CHT is examined, significant ethnic differences emerge. Rate for the Bangalees who settled there from the plains was the highest but still short of the national average. The range in coverage for the ethnic minorities varied from a low of 9% for the Mrus to 18% for the Tripuras (Table 9).

Another survey, however, found no difference between the Bangalee and ethnic minorities in the border areas of

Table 9. Children, aged 0-23 month(s), fully immunized, by ethnicity in Chittagong Hill Tracts (1998)

Ethnic group	Immunized	
	No.	%
Bangalee	63	42.6
Chakma	14	12.3
Marma	21	19.3
Mru	12	8.9
Tripura	31	18.2
Total	141	29.5

Source: Karim F, Begum S (20)

Mymensingh district (Claquin P. Personal communication, 2003).

Proximity to health centre

Proximity to health facilities is also closely related to immunization coverage. A study by Jamil *et al.* found that children in areas where outreach clinics were not within 'close proximity' were 30% less likely to be immunized compared to those who lived in communities where outreach clinic sites were nearby (8).

As part of the study in CHT, Karim and Begum computed a 'vibrancy index' based on the existence of health infrastructure and facilities, the higher the index the more the vibrancy (see Materials and Methods section for the definition of the index) (20). It was found that the coverage in high-vibrancy areas was 50% higher than that in low-vibrancy areas.

Table 10. Children, aged 12-23 months, fully immunized, by 'health vibrancy' in Chittagong Hill Tracts (1998)

Ethnic group	Immunized	
	No.	%
Low	22	30
Medium	25	41
High	33	47

Source: Karim F, Begum S (20)

Trend in equity in immunization coverage

Data from the BRAC-ICDDR,B Project in Matlab allowed comparison of the immunization coverage for different socioeconomic and gender groups over time. All the MCH-FP interventions, including immunizations, are carried out by ICDDR,B in the intervention area. In the comparison area, no ICDDR,B intervention is provided but services, including immunizations, are provided through regular government programmes. As the situation in the comparison area reflects more the situation existing in the rest of the country, only data

from the comparison area are reported here. Table 11 shows the coverage rates for children aged less than 12 months for 1992 and 1999 for different socioeconomic and gender groups. The coverage declined for all groups but the magnitude of the decline was less for girls than for boys and for poorer children than for non-poor. Interestingly, the decline was much less dramatic for the poor who joined BRAC (which is a third of the decline for the group of the poor who did not join BRAC). The coverage for girls is higher than for boys, which is in contrast to other results presented earlier.

Table 11. Percentage of children, aged 0-11 month(s), fully immunized in Matlab comparison area, by poverty status, BRAC membership, and gender, 1992 and 1999

Characteristics	1992	1999	% change
Poverty status			
BRAC member (poor)	26.9	22.2	-17.4
Poor non-member	26.9	12.3	-54.3
Non-poor non-member	33.2	9.1	-72.6
Gender			
Girl	30.0	15.2	-49.3
Boy	27.9	11.7	-58.1

Source: BRAC-ICDDR,B Joint Research Project. Matlab repeat survey 1999 (Unpublished data)

DISCUSSION

Poverty and marginalization are considered the major causes of inequity in health (1). Recent studies have reviewed the inequities in health in Bangladesh (22,24). In the words of the author of one of the reviews: "Although the country has achieved some progress in reducing fertility, mortality and malnutrition in the past decade—as measured by the aggregate trends at the national level—the gap between the poor and the non-poor (however measured) in respect to health indicators remains extraordinarily and unacceptably high" (22). The author, who concentrated on socioeconomic differences, documented extensive disparities in health outcome, healthcare-seeking behaviour, and health coping costs. The present paper concentrates only on one aspect of access to healthcare, i.e. immunization, and describes the inequalities in the coverage for many marginalized groups. In doing so, the paper uses data from various sources generated over the past decade. Some information provided here is based on national-level samples, however, other data come from small-scale studies which may not be representative of the country as a whole. The paper exposes the inequalities that exist in access to immunization services in the country or regions of the country.

Compared to other differentials, the disadvantage for girls is, fortunately, somewhat less dramatic. That this is an important aspect is indicated by its persistence over the years. The differences increase as higher doses are considered and as children move up in age. Such gender-bias against girls is not unique in immunization. Previous studies have documented systematic deprivation of girl children in Bangladesh from healthcare to family allocation of food resulting in adverse health outcomes (26,27).

Education of mothers is popularly used for representing social status in developing societies. The immunization coverage was higher for children whose mothers were more educated. The children whose fathers had a higher-status occupation (such as 'service' in this paper) were two-and-a-half times more likely to be immunized than children whose fathers held lower-status jobs (such as 'day-labourers' in this paper). That socioeconomic status plays an important role is borne out by the coverage reported for different income and wealth categories. The coverage for the poorest is 70% of the coverage for the well-to-do. The reasons for such disparity are not difficult to 'find' or 'see'. It is common knowledge that access to healthcare facilities by the socioeconomically-disadvantaged groups is less than that by the more powerful groups in society (28). This has been termed the 'inverse care law' (29). The study in Bhairab, using qualitative methods as mentioned in the text, collected some interesting cases on how the vaccination sessions are run and who gets priority over others in service provision (23). Two such cases have been reported in the text.

A recent study compiled immunization data generated by demographic and health surveys in 43 countries in relation to inequalities in coverage. In terms of wealth-based indices, Bangladesh was the most equitable South Asian country (30). As was seen in the text, there were inequalities in terms of other stratifiers and, thus, there is much room for improvement, however, and not much to be complacent about.

The urban-rural divide in immunization is well-known and documented. The situation of disadvantaged slum children was also touched on in text, but fortunately, the difference was less than one would have expected. In the slums of Dhaka city, children have an immunization rate which is about 80% of the overall city rate. This improved performance in the slums is due to the work of numerous NGOs. Most of the 3,000-plus

slums of Dhaka city are reached by one or more NGO(s). NGOs traditionally reach the disadvantaged groups more successfully. In the late 1980s and early 1990s when the intensified EPI was implemented, a large number of NGOs, including BRAC and CARE, worked closely with the Government in training and social mobilization in rural areas, which was partly responsible for the spectacular increase in coverage (31). Afterwards, the NGOs withdrew mainly because of fund constraints and withdrawal of donor support. The relevance of NGOs in immunization programmes has not been lost, however. They are good at reaching the unreached and, thus, can contribute positively to removing inequality in access to various services, including immunization (17).

It has been found that the drop in immunization coverage that has occurred in the comparison area at Matlab since 1992 has affected the poor and girls less dramatically than the non-poor and boys. Any drop for any group is unwelcome, but this shows that some are less vulnerable than others when the downward slide happens. This phenomenon of better equity performance has also been documented for other sectors in Bangladesh. A recent analysis of primary school enrollment showed that an increased proportion of girls and children from the poorer families was attending schools than before (32,33).

The Matlab data demonstrate that the coverage rate declined less in children whose mothers had been part of BRAC's development programme. The BRAC programme in Matlab targeted women from poorer families and provided them with various inputs, including consciousness raising, training, micro-finance, and education for their children but did not provide any significant health input. The BRAC programme has had a measurable impact on the survival of the children of its beneficiaries (17,18). In a situation where all groups have seen a decline in coverage (up to 73% in some groups), the children of BRAC beneficiaries have done remarkably well (Table 11). This has occurred without any 'special' input from BRAC on immunization. However, other programmes, such as consciousness raising, may have played an important role here. A targeted intervention by NGOs, which enhances demand and activates the delivery system, can go a long way in increasing coverage for the disadvantaged groups. A previous analysis of the EPI programme in Bangladesh had also recommended targeting women from poorer households as a way of increasing tetanus toxoid (TT) coverage (8).

The coverage evaluation survey of 2001 showed a wide range in the percentage of children fully immunized between different administrative divisions. The lowest was in Sylhet division with 23% for children aged less than 12 months and the highest (65%) in Khulna division for the same group of children. Such a difference between Sylhet and Khulna is not unique for immunization. Sylhet is lagging behind in other markers of development, including contraceptive prevalence, education level, and nutritional status (6,11). Sylhet is not considered as one of the poorest regions of Bangladesh, however. Explanations for these low rates include ecology (a large part of the division remains under floodwaters for most of the year), poor staff-population ratio (a large number of field positions remain vacant for years), 'conservatism' leading to less emancipation of women and less adaptation of new ideas, and lower density of NGO programmes. No serious study has been done to examine inequalities and their causes within the division.

Wide differences were also found between districts. A 1995 survey of 12-23 months old children in 12 districts found a similarly wide variation (Table 7). The newly-formed Global Alliance for Vaccines and Immunization (GAVI) recommends taking a district approach to ensure 80% coverage in each district for the countries it supports (34). Bangladesh is a recipient of GAVI support. In a recent paper, Gwatkin suggested some improvement to the GAVI approach (30). He believes that the thrust should be to identify those geographical areas that are poor and underserved through the use of 'poverty maps'. Although this is an excellent proposition, one should not forget, however, that there are 'pockets within pockets' as was seen in Bhairab in Kishoreganj district (Box). Special effort is needed to identify such groups and areas as a necessary first step.

A most frustrating picture emerges when one considers the immunization coverage for different ethnic groups. The situation in CHT and the tea estates of Sylhet are examples. The inter-group differences in CHT and the differences between the foreign-owned and local-owned tea estates are new information and are matters of concern. Results from other areas inhabited by ethnic minorities (i.e. Mymensingh) where higher coverage was attained for them indicate that the differences in coverage as found in CHT is probably partly due to the war. The war in CHT was an embarrassment for the nation (14). Now the time has come to correct all the wrongs done in the past and to provide equal opportunity (if not more) to the ethnic minorities without any prejudice. For this

national commitment of the highest order is a *sine qua non*. For the tea estates, the local owners should be motivated to provide comparable high-quality healthcare facilities for their workers.

As mentioned in the text, EPI in Bangladesh was a 'near miracle' at least in its first few years (coverage shot up to over 60% from a mere 2% in five years) (33). Then it plateaued at about 50% as the 'extra push' given was withdrawn or reduced. Except for the data presented in this paper from Matlab, no other information on the equity dimension of this decline is available. It is not known for Bangladesh as a whole whether the disadvantaged groups suffered a disproportionately higher share of the erosion in coverage.

One of the most important innovations in EPI was the development of the 30-cluster methodology to assess immunization coverage (10). Since the early 1980s, EPI management in most developing countries has extensively used this simple and inexpensive methodology as a monitoring tool. In Bangladesh, several hundred such surveys were carried out at various levels by different agencies. It is not an exaggeration to say that the success of EPI in the late 1980s was greatly facilitated by the wide use and application of the 30-cluster survey. However, the methodology, as now used, is not equity-sensitive. It does not lend itself to analysis according to various sub-groups in the population, primarily because of limitation of sample size. Because of its various advantages, the method has since been adapted for use in other sectors of development, such as basic education. In such cases, however, the method was slightly modified to make it gender-sensitive by simply doubling the cluster size to 14 children instead of 7 (35). Similar adaptation could also be done for immunization coverage, which would allow gender- and other equity-based analyses.

There is a renewed international interest in immunization. The launching of the multi-million dollar GAVI and other vaccine research initiatives are such examples. GAVI is an equity-sensitive initiative since its funds are earmarked for the poorest countries only with a per-capita GNP of less than US\$ 1,000. From an equity perspective, how much of these new resources reach the marginalized unimmunized groups within the poor countries needs to be looked at. It is reported that 90% of the GAVI funds earmarked for the first year went to providing new vaccines, such as hepatitis B, and the remaining 10% will be used for strengthening immunization services. According to Hardon, such a policy increases the

inequity in immunization coverage in the poorest countries rather than reducing it (36). The new vaccines go to those who are already reached by the system. For the majority of the unreached children, the immediate challenge is to help get them the standard EPI vaccines. For this, strengthening the existing channel is critical. Fortunately, the GAVI leaders are aware of these problems and are in the process of developing new strategies to reaching the marginalized groups by addressing 'system-wide barriers' (37).

At the country level, programme managers must realize the need to reach all groups in the population—small or big, powerless or powerful. Immunization is an indicator for the achievement of the child health targets under the Millennium Development Goals. The target of the Millennium Development Goals is meaningfully attained when it is attained for all groups. Reaching the unreached or 'hard-to-reach' is not an easy task. Imaginative interventions are needed. Affirmative actions (or 'positive discrimination') can make a big difference. For selected poverty-alleviation programmes, targeting (the inputs to) the poorest ensured that the inputs reached them with a demonstrable effect (17). Similarly, affirmative action to enroll the poor and girl children in Bangladesh through scholarships, 'food for education', and flexible school-hours have resulted in increased enrollment for these children in a relatively short period (35). The challenge is how such learning can be adopted for health programmes, including immunization, for Universal Child Immunization and the removal of inequities.

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