Health intervention and health equity: Evidence from Matlab, Bangladesh

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Summary:

The study examined socio-economic and gender inequality of under 5 mortality using data from Matlab Demographic Surveillance System of ICDDR,B. Two birth cohorts were followed in two adjacent areas (ICDDR,B-service and govt-service) with difference in health services .

The under 5 mortality declined more overtime in the ICDDR,B-service than in the govt.-service area and the same is true for infant but 1-4 years, mortality decline was almost similar. Over the period, poor-rich ratio of under 5 mortality had widened in both the areas while it is also true for infant but for 1-4 years, the difference reduced slightly in the ICDDR,B-service area. Under 5 mortality was higher for girls than boys in the earlier cohort but such difference disappeared in the recent cohort. More boys died during infancy than girls in both the areas but for 1-4 years, more girls died than boys in the earlier while such difference disappeared in the recent cohort

Introduction:

Bangladesh witnessed a remarkable decline in mortality since middle of last century, the crude death rate declined from 45 to 8.7[1] (per 1000 population) (UN 2000). However, substantial decline in mortality is observed among under-5 years of age, particularly in recent decades. In fact, such improvement in mortality had happened when the economy of the country was poor (per capita GDP US$ 280), with about 80% people living in rural areas, and about 60% were illiterate. Malnutrition is widespread and with about 40% of babies born annually classified as low birth weight (less than 2.5 kg), however, success in family planning resulted in a decline in total fertility rate, from 6.5 in the early 1970s to 3.4 in the mid-1990s.

To improve health of the general people, the government of Bangladesh has undertaken different programs since Alma Ata Conference in 1978, however, emphasis was often given to improve health of the mother and child. In half of the Matlab Demographic Surveillance System (DSS) area, the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has been maintaining a Maternal Child Health and Family Planning (MCH-FP) intervention (ICDDR,B-service area) since late 1977, while the other half of the area is provided with usual government service (Govt-service area). However, these interventions were made available to all people, not targeting to the poor.

In the past (early 1980s), few studies documented lower mortality levels among children of higher socioeconomic than lower socioeconomic status, and higher mortality among girls than boys. Using Matlab DSS data, D'Souza and Bhuiya (1982) documented a negative relationship in mortality between children aged 1-4 and various socioeconomic factors. An examination of cumulative life-table probabilities of mortality by sex for the cohort born during 1973-75 in Matlab area revealed that in ages 1-4, mortality for girls exceeded that for boys by 59% (Koenig and D'Souza 1986).

In recent years (since mid-1990s), a few studies have examined the effect of health interventions on socioeconomic inequality in mortality but results are not conclusive. Using Matlab DSS data, Muhuri (1995) reported that the health intervention program had a greater effect on the risks of child death (1-4 years) of uneducated mothers than mothers with at least some education. But following re-analysis of Matlab data for the same period, Razzaque (2002) did not find such educational effect on child mortality. In another study in Matlab, Bhuiya et al. (2001) reported that the poor-rich difference in 1-4 years mortality had declined over time (1982-96).

The objective of the study is to examine socio-economic and gender inequalities in under 5 mortality in the ICDDR,B-service and govt-service areas of Matlab, Bangladesh. These two areas are of similar socioeconomic condition but differ in quality of health and family planning services. Specifically, the study examines whether health intervention programs reduce socio-economic and gender inequalities in under 5 mortality and whether the inequalities changed overtime.

Data and Methodology:

Setting:
Data for this study come from Matlab *Upazila* (sub-district) where the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has been maintaining a field station since 1963. Matlab is a rural area located about 55 km south-east of Dhaka. The area is low-lying deltaic plain intersected by the tidal river Gumti and its numerous canals. The major modes of transport within the area are walking, country boat and in some cases small steamer or launch. Farming is the dominant occupation, except in a few villages where fishing is the means of livelihood. Most of the farmers are in marginal situations with less than two acres of land, and 40% of them are landless. For many families sharecropping and work on others' land on a daily wage basis have become the main sources of livelihood. Some people also work in mills and factories in different towns and cities but their families live in the study area. Rice constitutes the staple food and is harvested three times annually. Rates of illiteracy are high and increase with age.

In Matlab study area the ICDDR,B has been maintaining a Demographic Surveillance System (DSS) over 200,000 population since 1966. The DSS collects information on births, deaths, migration, marriages, divorce and household splits. The DSS events are collected by the Community Health Research Worker (CHRW) through monthly household visits and Field Research Supervisor (FRS) are supervisor (in the past, CHRW recorded events through fortnightly household visits and FRS accompanied by the CHRW visited the household every six weeks to complete the registration form). The DSS also maintains cross-sectional socioeconomic data and such data is available for 1974, 1982 and 1996.

The Matlab HDSS (DSS named as HDSS after integrating with health data) area consists of ICDDR,B-service (population 107,369) and govt-service (population 112,383) areas. Most of the ICDDR,B-service area was exposed to a contraceptive distribution program during 1975-77 and has been exposed to the Maternal Child health and Family Planning services since October 1977 (for details, see Bhatia et al. 1980). In the ICDDR,B-service area, MCH-FP services have been provided by the CHRWs through fortnightly home visits until December 1999 and then from fixed site clinics. In fact, the intervention began with the family planning services and all other health services have gradually been added over a period of time. These health services are: tetanus toxoid vaccination to mothers; measles, DPT and polio vaccination to all children; diarrhoeal disease management by *bari* mothers; vitamin A and beta-carotene supplementation; maternity care and antenatal check-ups; ALRI detection and management with penicillin and oral cotrimoxazole; education intervention to reduce ALRI mortality; reproductive tract infections detection and management; and health centre assisted deliveries.

During the household visit (until December 1999) in the ICDDR,B-service area, the CHRW asks mothers about their menstrual status, contraceptive use, contraceptive-related side-effects, pregnancy, breastfeeding and morbidity. The CHRWs are used to provide contraceptives and basic medicines to mother and child and referred patients with complications to sub-centre clinics. Currently services are being provided from the fixed sites (residence of CHRWs). In the ICDDR,B-service area there are four sub-centres that also provide MCH-FP services. In addition, ICDDR,B has a free 60-bed diarrhoea treatment centre in Matlab town and the facility is used not only by Matlab people but surrounding districts.

In the non-ICDDR,B-service area (govt-service area), the government supported health service was available mainly in the urban areas until mid-1970s. The services were more curative than preventive in nature. The government of Bangladesh accepted the primary health care concept as national health objective in 1978. Since then, the health care system was reoriented to provide essential health care to the general mass. In fact, the government significantly increased the funding of health sectors from early 1980s. The facilities include Maternal and Child Welfare Centre in urban and sub-urban areas, Upazila Health Complex at Upazila level and the Family Welfare Centre at union level (DGHS, 1990). The government has also made primary health service facilities available at Rural Dispensaries and Satellite Clinics. In Matlab town, the government runs a 30-bed free general hospital along with few union-level health facilities. In addition, the government has been promoting oral rehydration therapy for diarrhoea management, and the immunization program against six major childhood diseases (Huq 1991). In fact, immunization against childhood diseases is mainly delivered through satellite clinics (since mid-1980s) while family planning services are delivered at the door-step until recently.

As health services are added gradually both to the ICDDR,B-service and Govt-service areas, two birth cohorts (1983-85 and 1993-95) under study benefited differently from these interventions. For example, measles vaccination to all children started in 1982 in two blocks of the ICDDR,B-service area while such vaccination started in 1985 in other two blocks. So, the earlier birth cohort (1983-85) benefited less from these interventions than the subsequent birth cohort (1993-95). On the other hand, health services were also been added gradually in the govt-service area, however, such service is less intensive than the program of the ICDDR,B-service area.

Data:

The study used HDSS data from both the ICDDR,B-service and Govt-service areas. Two population-based birth cohorts of 10 years apart (1983-85 and 1993-95) were selected for analysis. The HDSS system registered 20,665 births for cohort 1983-85 and 16,925 births for cohort 1993-95 and these births were followed for five years for death and out-migration to ascertain survival and migration status respectively. The birth cohort of 1983-85 was matched with the socio-economic data of 1982 and birth cohort of 1993-95 was matched with socio-economic data of 1996 to copy the socio-economic data in the birth file.

The socio-economic status is defined here in term of assets, rather than income or consumption. The asset information was collected through the household questionnaire administered during the censuses. These questions include ownership of a number of consumer items (radio, watch, etc), dwelling characteristics (wall and roof material), type of drinking water and toilet facilities, however, more consumer items were collected in

1996 than in 1982 census. Data on causes of death were collected and coded by the FRS until 1986 and since then it is being collected by the FRS but coded by the medical assistant using modified version of ICD-9 codes (until 2002).

Economic status of the household is measured by constructing a wealth index using asset ownership as validated by Filmer and Pritchet (1998). Each household asset for which all information collected was assigned a weight or factor score generated through principal components analysis. The resulting asset scores were standardized in relation to a standard normal distribution with a mean of zero and a standard deviation of one. Each household was assigned a standardized score for each asset, where the score differed depending on whether or not the household owned that asset.

The equity gap can be measured in absolute (difference) or relative (ratio) scales. Use of absolute scales may often lead to apparent reductions in inequity gaps, because baseline rates that are already low (for rich) are unlikely to decrease in absolute terms as fast as those are already high (for poor). Ratio scales, on the other hand, take into account the different baseline levels, and are thus more appropriate for examining time trends. In this study, ratio scale was used to examine the inequalities. Life table mortality rates were calculated for infant, 1-4 years and under 5.

Results:

Table 1 shows mortality rates by cohort, study area and age. Over the study period, under 5 mortality declined significantly in both the areas, but the decline was more marked in ICDDR,B-service than the govt-service area (46% vs 36%). The differential decline of under 5 mortality between the two areas is due to difference in infant mortality (42% vs 27%) while for 1-4 years, mortality decline was almost similar in these two areas (57% vs 55%).

The level of mortality was lower in the ICDDR,B-service than in the govt-service area for each age categories in both the cohorts (Table 1). In the earlier cohort, mortality rates were 19%, 13% (NS) and 30% lower in the ICDDR,B-service than in the govt-service area for under 5, infant and 1-4 years respectively while comparable figures for the recent cohort were 32%, 31% and 34% (NS). In fact, mortality difference between the two areas has widened over time for under 5 (19% to 32%) and infant (13% to 31%) but the difference remain almost same for 1-4 years (30% to 34%).

In the earlier cohort, cumulative proportions dying at different ages were almost similar in the ICDDR,B-service area for the three bottom wealth index categories but for the top two categories, it varies (Fig 1). In the govt-service area, cumulative proportion dying at different ages vary for the three bottom wealth index categories but almost similar in the top two categories. Mortality rates were higher for poor than the rich in both the areas for each age group. In the ICDDR,B-service area, poor:rich mortality ratios were 1.12 for infant, 2.13 for 1-4 years and 1.33 for under 5 while comparable ratios in the govt-service area were 1.24, 1.73 and 1.39 respectively (Table 2).

In the recent cohort, cumulative proportions dying at different ages were almost similar in the ICDDR,B-service area for the three bottom wealth index categories, as found in the earlier cohort, but for the top two categories, it vary (Fig 2). In the govt-service area, cumulative proportion dying differ for the three bottom wealth index categories but almost similar for the top two categories. Mortality rates were higher for poor than the rich in both the areas for each age group. In the ICDDR,B-service area, poor:rich mortality ratios were 1.54 for infant, 1.89 for 1-4 years and 1.61 for under 5 while comparable ratios in the govt-service area were 1.54, 2.26 and 1.70 respectively (Table 3).

In the ICDDR,B-service area, poor-rich difference of under 5 mortality exist in both the earlier and recent cohorts (Table 2 and 3) and the poor:rich ratio has widened overtime (1.33 to 1.61) while a similar pattern also existed in the govt-service area, poor-rich mortality ratio has widened overtime (1.39 to 1.70). In the ICDDR,B-service area, the increase in poor-rich ratio of under 5 mortality is mainly due to increase in difference of infant mortality. In fact, poor-rich ratio of infant mortality increased from 1.12 to 1.54 while poor-rich ratio of 1-4 years mortality declined slightly (2.13 to 1.89). In the govt-service area, the increase in poor-rich ratio of under 5 mortality is due to increase in poor-rich ratio of both infant and 1-4 years mortality. In fact, poor-rich ratio of infant mortality increased from 1.24 to 1.54 while poor-rich ratio increased from 1.73 to 2.26 for 1-4 years mortality.

In the earlier cohort, cumulative proportion dying was higher during infancy for boys than the girls in both the areas, thereafter girl mortality exceeds those of boys (Fig 3). In the ICDDR,B-service area, the boy:girl mortality ratios were 1.09 for infant, 0.53 for 1-4 years and 0.91 for under 5 while comparable ratios in the govt-service area were 1.04, 0.56 and 0.85 respectively (Table 4).

In the recent cohort, cumulative proportion dying was higher during infancy for boys than the girls in both the areas, thereafter the pattern maintain particularly in the govt-service area, while it was close in the ICDDR,B-service area (Fig 4). In the ICDDR,B-service area, the boy:girl mortality ratios were 1.05 for infant, 0.84 for 1-4 years and 1.0 for under 5 while comparable ratios in the govt-service area were 1.11, 0.89 and 1.05 respectively (Table 5).

The boy-girl mortality difference exists in the earlier but such difference had disappeared in the recent cohort for ICDDR,B-service (ratio changed from 0.9 to 1.0) and govt-service (ratio changed from 0.85 to 1.05) areas (Table 4 and 5). The elimination of boy-girl difference of under 5 mortality is due to reduction in boy-girl difference of 1-4 years mortality (ratio changed from 0.53 to 0.84 in the ICDDR,B-service and 0.56 to 0.89 in the govt-service area) while during infancy more boys died than girls (ratio changed from 1.09 to 1.05 in ICDDR,B-service and 1.04 to 1.11 in govt-service area).

Table 6 shows under 5 mortality rates by cause, wealth index and study area. The poor had higher mortality than rich for diarrhoea and other causes in both the areas and in both the cohorts but for pneumonia death, poor-rich difference did not exist in the ICDDR,B-service area while it exist in the govt-service area.

Discussion:

Before interpreting results, the following points should be kept in mind. Measuring impact of health intervention on time trend data is complex because some interventions might reach the poor after a certain period and can reduce the poor-rich difference while at the same time a new intervention might be used more by rich than the poor. Although it is usually believed that the poor would be benefited more than the rich from health intervention, these interventions usually are not targeted to the poor.

Over the last 10 years, under 5 mortality declined substantially in the both the areas, however, it declined more in the ICDDR,B-service than in the govt.-service area. This has widened mortality difference between the two areas and it is mainly due to infant survival. In fact, infant survival improved more in the ICDDR,B-service than in the govt.-service area due to the nature of intervention that affected neonates. In the ICDDR,B-service area the antenatal service is relatively new (since early 1990s) and it benefited the recent cohort.

The cumulative proportion dying for the three bottom categories of wealth index are becoming close overtime particularly in the ICDDR,B-service area while difference remains for the two top categories. This indicates that the services are reaching almost equally to those in the three bottom categories of index (60% population). On the other hand, the richest (20% population) is still benefited more than the others and has strong policy implication while targeting the poor.

The poor-rich difference of under 5 mortality had widen overtime in both the ICDDR,B-service and govt.-service areas and a similar pattern in observed for infant, however , for 1-4 years the poor-rich difference had reduced slightly in the ICDDR,B-service area. The decline in poor-rich mortality difference in the ICDDR,B-service area could be due to intensive health intervention (child immunization) which has been in operation for more than two decades while child immunization program in the govt.-service area is relatively new (over a decade) and less intensive and might have benefited rich more than the poor (ref). Victora et al. (2000) observed in Brazil that a new intervention was initially adopted by the wealthy and increased the mortality gap, but subsequently the gap was reduced when that intervention was adopted by the poor.

Although more under 5 girls died than boys in the earlier cohort in both the ICDDR,B-service and govt.-service areas, such difference had disappeared in the recent cohort. However, girls benefited more over time than the boys among aged 1-4 years, while girls and boys are equally benefited among infants. In recent years, a further decline in desired family size has been observed (4.5 in mid-1970s to 2.5 in mid-1990s) and it had happened after actual fertility started declining. Over the period, motivation for small family size has increased and couple in these days prefers to have quality-children rather than quantity (Razzaque 1996). As desired family size is approaching close to replacement level, preferred number of son is declining and parents probably treating both boys and girls equally as found in the secondary school attendance (Razzaque and Streatfield 2001). However, in the past it was reported that girls were discriminated against in terms of intrafamily food distribution, medical care, education and so on (Chen et al. 1981; D'Souza and Chen 1980).

The under 5 poor children died more from diarrhoea than rich in both the areas, but for pneumonia such pattern exists only in the govt.-service area. The poor-rich differences in diarrhoea death is unexpected because bari mothers (one in 15 households) have been providing free ORS packet to diarrhoea patients since 1978 in the ICDDR,B-service area and the service is expected to reach both poor and rich equally. However, oral saline use during diarrhoea is low in both the ICDDR,B-service and govt.-service areas (45% vs 35%) and poor-rich differences oral saline use did not exist (Razzaque et al. 2002). For pneumonia, poor and rich children died equally in the ICDDR,B-service area and it is probably because of the service provided by ICDDR,B during pneumonia (oral cotrimoxazole since 1990). However, medicine used for pneumonia patient is high in both the areas (about 80%) and poor-rich difference do not exist (Razzaque et al. 2002).

Although under 5 mortality declined overtime in both the areas but poor-rich difference had increased while boy-girl difference had disappeared. The findings of the study are encouraging because mortality is declining in both the areas, along with improvement of gender equity. Moreover, there is an indication that the poor-rich mortality difference in the ICDDR,B-service area might reduce in future once the rich achieves low mortality level. However, it is not possible to maintain such intensive health intervention in a natural environment (government-service area) where poor-rich mortality difference is increasing.