Does a health program reduce excess female child mortality in a son-preferring society?

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In most of the societies of the world, couples have a preference for the sex of their children. Some prefer more sons, some prefer more daughters, some prefer an equal number of sons and daughters and some even prefer sons and daughters in a specific birth order. While these preferences as such may not have any demographic significance, they often influence couples' behavior and thus affect both fertility and mortality. The literature on fertility impact of sex preference for children is quite large (Sheps, 1963; Bairagi and Langsten, 1986; Chowdhury and Bairagi, 1990; Rahman and DaVanzo 1993; Chowdhury, Bairagi and Koenig, 1993). Some recent studies suggest that this preference is not a big constraint on fertility transition of a population (Arnold, 1987; Bairagi, 1993). While this provides us some comfort, the effect of sex preference of children on mortality and abortion creates a serious problem in some societies. With the availability and accessibility of the facilities of sex detection of the fetus and subsequent abortion, the sex ratio at birth has reached an abnormally high level in China, Korea and some other countries as a result of son preference (Gu and Ping, 1994; Hong, 1994; Cho and Kim, 1994).

In Bangladesh, son preference is quite strong (Ahmed, 1981; Bairagi and Langsten, 1986) and leads to discrimination against female children. Here food distribution and use of health care facilities were found to be biased in favor of male children (Chen et al., 1981). This discrimination aggravates during food crises (Bairagi, 1986). Bhuiya and Streatfield (1991) and Bairagi (1986) pointed out that higher socioeconomic status and higher mother's education did not help to reduce discrimination, although these variables helped to improve the mortality and nutritional status of children. Muhuri and Preston (1991) observed that this discrimination against female children was selective: Girls who had sister(s) at the time of their birth were discriminated against more than the girls who did not have a sister. Das Gupta (1987) and Amin (1990) showed similar results in Punjab, India. It is also observed that a decline in both fertility and mortality did not help to reduce this discrimination (Alam and Bairagi, 1994).
Excess female child mortality is the ultimate consequence of discrimination against female children. By excess mortality we mean the mortality due to discrimination. There may be different interventions such as educational programs, women’s empowerment, and employment opportunities for girls for reducing this excess mortality. This paper examines whether a maternal and child health and family planning program can be of any help in this regard.

Matlab MCH-FP project

The data for this study came from Matlab, the well known field station of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B). Matlab has become legendary for population and health scientists, planners and policy makers of the world. It is a rural and a low-lying deltaic floodplain intersected by canals and branches of two big rivers of Bangladesh. It is about 50 kilometers southeast of Dhaka, the capital of the country. Its communication with Dhaka is still very poor and, in Matlab itself, travel between villages and the market town is on foot or by country boat during the rainy season when except for raised household courtyards most of the area goes under water. Floods, which occur quite frequently, create havoc in the area. Farming is the main occupation, but 40% of families are landless. Seventy-five percent of adults are illiterate. Eighty-five percent are Muslims and the remaining are Hindus.

Matlab, always a cholera-prone area, was chosen in 1963 as the site for the vaccine field trials of the Cholera Research Laboratory (CRL), the precursor of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B), which was established in 1978. Because the efficacy of a vaccine may depend on age, sex, pregnancy, etc., the Matlab field station initiated the recording of such demographic data and tracking of movements (marriage and migration) of households and individuals. Within a couple of years, the scientists of the then Pakistan-SEATO Cholera Research Laboratory were struck by the value of demographic findings obtained from the 132 villages studied, such as patterns of fertility and mortality by age and sex. That excitement subsequently led to the initiation, after the 1966 census, of a comprehensive surveillance system covering 233 of Matlab's villages and so the Demographic Surveillance System (DSS) formally came into existence.

The description of the Matlab MCH-FP Project is available in several places (Haaga et al., 1993; Phillips et al., 1984). The Matlab family planning program has proved the hypothesis that a carefully designed family planning program without any intervention to or change in socioeconomic situation can bring a substantial change in fertility in a poor society. The Matlab family planning program, with doorstep distribution of pills and condoms was started in Matlab in 1975. Although there was an initial increase in contraceptive prevalence within a year from a CPR of less than 5% to about 20%, it came down to 10% by the second year of the project. This worried the project people and they felt the necessity of an alternative delivery and supervision system. Since then, many modifications were implemented and several interventions introduced in
the program at different stages with a major change in the program in 1977, when the project was modified to include a wide range of contraceptives among which injectables administered by workers who are female, young, married, educated, resident in the locality, from elite families, and practicing family planning themselves. Only one half of the Matlab DSS area has been receiving services from the MCH-FP project. The other half of the DSS area, called the comparison area, has been receiving the same governmental services as other rural areas of Bangladesh. Each area had about 100,000 population in 1994. At the beginning of the MCH-FP project, both areas had the same socioeconomic and demographic situations. But the two areas had more than 20 percent points difference in contraceptive prevalence rate (CPR) in 1990 and one child difference in total fertility rate (TFR) (3.8 vs 2.8) in 1994. The 1982 household socioeconomic survey provided information on socioeconomic status of households.

Data and methods

As we mentioned earlier, MCH-FP services have improved in an incremental fashion in the Matlab MCH-FP area (Table 1). Initially, this area was divided into four blocks. Each block received many of the interventions at different times. For example, measles vaccination was started in blocks A and C in 1982, and was extended to blocks B and D in 1985. It should be noted that although there was no intervention in the comparison area from ICDDR,B, some interventions or services were provided in this area by the government program. EPI services, which were intensified in Bangladesh in 1989, covered more than 60 percent of children of the country including the Matlab comparison area for tetanus toxoid (TT) and DPT over a period of 2 years.

Socioeconomic variables for the entire Matlab DSS population after 1982 are not available. A recent study based on a sample showed that the Matlab MCH-FP project did not bring about any change in the possession of items such as radios and watches, although there was an almost three fold increase in these items in each area of Matlab (Razzaque et al., 1996). However, this project was successful in improving children's education. Data on mothers' education and religion were obtainable from birth records of children and were used in this study. This study considered only the mortality of children 1-4 years of age. Infant mortality is heavily influenced by biological factors and is relatively insensitive to familial behavior. By contrast, the mortality of 1-4 year-old children is very responsive to variations in parental and household characteristics. There are about 3,000 births and 1,000 deaths each year in each area (MCH-FP and Comparison) in Matlab.
Table 1. Interventions in MCH-FP, Matlab, Bangladesh, 1978-1990.

<table>
<thead>
<tr>
<th>ICDDR,B Intervention</th>
<th>Date</th>
<th>MCH-FP BLOCKS</th>
<th>Comparison area</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>Family Planning</td>
<td>October 1977</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tetanus toxoid to pregnant women</td>
<td>March 1978</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ORT</td>
<td>January 1979</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tetanus toxoid to all women</td>
<td>December 1981</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>December 1985</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Measles vaccine</td>
<td>March 1982</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>December 1985</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Antenatal care</td>
<td>September 1982</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>January 1986</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Iron/folic acid to Pregnant women</td>
<td>January 1985</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>January 1986</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Oral cholera vaccine trial</td>
<td>May 1985</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>EPI Immunizations (BCG, DPT, polio)</td>
<td>March 1986</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nutritional rehabilitation</td>
<td>September 1988</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Vitamin A distribution</td>
<td>January 1986</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Maternity care</td>
<td>March 1987</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>ARI</td>
<td>April 1988</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>July 1991</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Dysentery</td>
<td>April-December 1989</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Results

In Matlab, CPR increased and the total fertility rate (TFR) declined gradually between 1978 and 1994 (Figure 1). In fact, fertility started to decline in both areas in the mid '70s and mortality in the mid '80s. The increase in CPR and decrease in TFR and IMR and child mortality were much faster in the MCH-FP area than in the Comparison area. The success of the Matlab MCH-FP project in improving CPR and decreasing TFR and infant mortality is quite clear in Figures 1 and 2. This success has proved the hypothesis that a carefully planned MCH-FP project without any socioeconomic intervention can bring about a change in population control.

Figure 1. Contraceptive Prevalence Rate (CPR) and Total Fertility Rate (TFR) in Matlab, Bangladesh, 1978-94.
Figure 3 presents the percentage of women using contraceptives according to the number of living sons and living children in the Matlab MCH-FP area, and Figure 4 presents the percentage of women giving birth in 3.5 years (1982-86) according to the number of living sons and living children. Contraceptive use was lowest and fertility was highest for those women who did not have any son. On the other hand, contraceptive use was highest and fertility was lowest for those women who had sons as well as a daughter. This trend was observed in other years in Matlab and in other areas in Bangladesh (Rahman and DaVanzo, 1993; Mozumder et al., 1995). It suggests that CPR and fertility depends on sex composition of existing children. Couples in Bangladesh prefer sons but also like to have a daughter. Let us examine whether this preference has any effect on mortality.
Figure 3. Contraceptive Prevalence Rate (CPR) according to number of living sons and living children (Roman numerals) in MCH-FP area, Matlab, Bangladesh, 1990.

Figure 4. Fertility of women (percent giving birth in 3.5 years) according to number of living sons and living children (Roman numerals) in MCH-FP area, Matlab, Bangladesh, 1982-1986.
It is well known that the female is more capable than the male of surviving because of biological reasons. So for any age group, the sex ratio of child mortality (M/F) should be more than one. In developed countries, the sex ratio of mortality of 1-4 year-old children is more than 1.25 (UN, 1987). It is more than one at any level of mortality in the Model Life Table (Coale and Demeny, 1983). But as we can see in Figures 5 and 6 for the MCH-FP area and the comparison area respectively, female child mortality was always higher than male child mortality. This excess mortality of female children is nothing but the result of discrimination.

**Figure 5.** Mortality rate of children aged 1-4 years by sex in MCH-FP area, Matlab, 1978-94.

**Figure 6.** Mortality rate of children aged 1-4 years by sex in comparison area, Matlab, 1978-94.
It may be noted that the difference in male and female child mortality did not start to narrow in the MCH-FP area until 1983 and in the comparison area until 1988 (Figures 5 and 6). This phenomenon is clearer in Figure 7, in which three-yearly moving average of the sex ratio of child mortality in two areas is given.

![Figure 7. Three years moving average of sex ratio (M/F) of child deaths between ages 1 and 4, Matlab, 1978-94.](image)

There was a substantial decline in fertility and infant mortality in both areas by the late '80s in comparison with 1978. Initial results as reported by Alam and Bairagi (1995) suggested that this decline was not associated with an egalitarian sex ratio of child mortality. However, with the passage of time, this ratio started to increase, first in the MCH-FP area and then in the comparison area with a lag time of about five years.

The discrimination against female children is likely to have two components, one social and the other intentional. Social discrimination means that society as a whole may feel that a girl does not need as much nutritional, medical or other care as a boy does. On the other hand, intentional discrimination means that in addition to the usual neglect of a girl, she may be neglected at the household level. In the latter case, the neglect is expected to be specific for some of the girls. Since Matlab women like to have a daughter also, the only girl is expected to have lower mortality than a girl with sisters. Tables 2 and 3, in which the results of three birth cohorts are presented, supports this point.
Table 2
Mortality rates (per 1,000) between ages 1 and 4 in males and females and female to male mortality ratio, according to sibling sex composition, comparison area, Matlab, Bangladesh 1977-92.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Birth Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1976-77</td>
</tr>
<tr>
<td>Older siblings</td>
<td>M</td>
</tr>
<tr>
<td>None</td>
<td>12.9</td>
</tr>
<tr>
<td>Only brothers</td>
<td>18.0</td>
</tr>
<tr>
<td>Only sisters</td>
<td>10.5</td>
</tr>
<tr>
<td>Brothers &amp; Sisters</td>
<td>17.5</td>
</tr>
<tr>
<td>All</td>
<td>15.5</td>
</tr>
</tbody>
</table>

Table 3
Mortality rates (per 1,000) between ages 1 and 4 in males and females and female to male mortality ratio, according to sibling sex composition, MCH-FP area, Matlab, Bangladesh 1977-92.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Birth Cohort</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1981-82</td>
</tr>
<tr>
<td>Older siblings</td>
<td>M</td>
</tr>
<tr>
<td>None</td>
<td>15.2</td>
</tr>
<tr>
<td>Only brothers</td>
<td>16.3</td>
</tr>
<tr>
<td>Only sisters</td>
<td>15.5</td>
</tr>
<tr>
<td>Brothers &amp; Sisters</td>
<td>15.2</td>
</tr>
<tr>
<td>All</td>
<td>15.5</td>
</tr>
</tbody>
</table>

Child mortality was strongly influenced by sex composition of older siblings in families. Mortality was higher for girls than for boys. The girls with sisters experienced even higher mortality compared to the girls with brothers only in each area in all birth cohorts. This finding is consistent with the results from previous studies (Das Gupta,
Similarly, mortality of a boy with only brothers was higher than the mortality of a boy with only sisters.

To explore further this pattern, a logistic regression of child mortality between ages 1 and 4 was carried out, including sex of child and numbers of brothers and sisters as independent variables in the analysis. The coefficients of the interaction terms between the sex of the index child and the sex of the siblings in the multivariate analysis are consistent with these findings: girls with sisters had higher mortality than the girls without sisters, and boys with brothers had higher mortality than the boys without brothers. However, the effect of the existence of sisters on female child mortality was much more acute than the effect of the existence of brothers on male child mortality. Higher mortality risk of a girl without any sister compared to a boy without any brother could have been due to generalized sex bias against girls. Higher mortality risk of a girl with sister(s) compared to a girl with brothers or higher mortality risk of a boy with brothers compared to a boy with sisters might have been due to selective discrimination against those children. However, these results are available for the birth cohorts only up to 1986-87. The data for later cohorts are yet to be analyzed.

Discussion

It may be noted that this study is based on the largest, longest and most accurate demographic data-set of the developing world. A number of important findings of this study should be underscored. First, fertility started to decline in the mid '70s, but infant and child mortality did not start to decline before the mid '80s in the Matlab area. This is the exact opposite of the well-known European demographic transition, in which mortality decline was followed by fertility decline. This difference in Matlab, and perhaps all over Bangladesh, is most likely the result of the Bangladesh family planning program, which initially placed emphasis on increase in contraceptive use and decrease in fertility. Unlike Europe, demographic transition in Bangladesh is not the result of a transformation from agrarian to industrialized society. Second, the success of the Matlab MCH-FP project in reducing fertility and infant and child mortality is quite apparent. Third, the reduction in infant and child mortality was followed by a reduction in sex ratio of child mortality, first in the MCH-FP area and then in the comparison area. Any improvement in survival was found to be relatively more in female than in male in the world (Coale and Demeny, 1983). Sex ratio of mortality of children remained at the level of 0.70 in the '90s in Matlab, whereas it is about 1.07 in the Model Life Table at the current level of mortality with 60 years of life expectancy at birth in Matlab. It means that about 35 percent ((1 - 0.70/ 1.07) x 100) of deaths of 1-4 year-old female children were due to discrimination against them. In the '70s this excess female child death was more than 40 percent.

Sex ratio of child mortality started to improve in the MCH-FP area in 1983 and in the comparison area in 1988. It was consistently higher in the MCH-FP area than in the comparison area for the period 1984-91. Since 1992, the difference between the two areas has become negligible. This finding reemphasizes the importance of the continuation of the Matlab Demographic Surveillance System (DSS). Analyzing the data up to the birth cohort of 1986-87, Alam and Bairagi (1995) concluded that fertility
and mortality decline is not a factor to bring about a change in sex ratio of child mortality. We find here that this ratio responded to mortality decline in Matlab immediately after that study period.

We may hypothesize a number of mechanisms, demographic and non-demographic, by which this change in sex ratio of child mortality was possible. A reduction in fertility may affect it positively or negatively. Because a small family is less likely to have children of the desired sex, there may be more discrimination in a declining fertility situation. On the other hand, discrimination against female children is found to be greater for higher birth order children (Muhuri and Preston, 1991). Further investigation is needed to measure the contributions of these opposite forces in Matlab.

While the impact of fertility decline on the sex ratio of child mortality remains unknown, one of the main forces for its reduction is thought to be health interventions in the area. Diarrhoea, measles and ARI are three major causes of deaths of children in Matlab. Sex ratio of child mortality by cause from 1981 to 1992 is given in the 1992 Matlab DSS report (ICDDR, B, 1995). It is shown there that the sex ratio of child mortality by these diseases improved, first in the MCH-FP area and then in the comparison area. It should be noted that interventions for these diseases were given first in the MCH-FP area and then in the comparison area, although on a smaller scale, as a part of the national program. Mortality improvement is expected to be more for female child than male child due to a health intervention and overall mortality decline (Coale and Demeny, 1983; du Loû, Pison, and Aaby, 1995). Of course, the relationship between different MCH interventions and the onset of the improvement in sex ratio of child mortality is not very clear (Table 1 and Figure 7). It leads us to think that the improvement in the sex ratio of child mortality is likely to be the result of some socio-cultural changes in the country in addition to the effect of the MCH-FP programs. If health interventions and reduction in mortality were the only reasons for this improvement, the difference in this ratio between the two areas would remain much higher in 1992 and onwards, because the difference in health interventions and in infant and child mortality between two areas did not show any remarkable decline in the ‘90s. Perhaps a silent revolution, big or small, improving the status of women and female children took place in Bangladesh as a result of different actions taken by the government and non-governmental organizations (NGOs). For example, the Bangladesh government declared 1990 as the "Year of Female Children" and made the first 8 years of education free for girls residing outside of the municipalities. In 1992, the government started giving a monthly stipend and book allowance to girls for 6-10 years of education in rural areas. In addition, mass media, particularly radio, television and daily newspapers and periodicals have been campaigning for women's status, and many national and international NGOs have been promoting empowerment of women in the family and society and building women's social and economic organizations to safe-guard their rights and stop discrimination.

However, this study indicates that an MCH-FP services will lead to more egalitarian sex ratios of child mortality in Bangladesh. Excess mortality of girls, particularly of girls with older sisters, was not only due to unintended discrimination. Public health interventions alone might not be able to improve girls' survival fully without concomitant change in the social, economic and political status of women. Sex bias
in child mortality has been found to be related to female autonomy and kinship structure (Bardhan, 1974, 1982, 1984; Dyson and Moore, 1983). Raising women's status may have been important in eradicating discrimination against females in general.

The mortality consequences of sex preference in Bangladesh are declining and are currently not as serious as in China and Korea where sex ratio at birth is unacceptably high due to sex selective abortion of the fetus (Gu and Roy, 1995). In those countries, discrimination against female children begins before birth. In Bangladesh it begins after birth. Induced abortion without detection of the sex of a fetus was found to be related to the sex composition of the existing children; a mother with sons and a daughter was more likely to have induced abortion for a subsequent pregnancy than a mother with only daughters or with more daughters than sons (Bairagi, 1996).

It may be a serious mistake to assume that the upward trend in the sex ratio of child mortality (Figure 7) will continue and that no further action is necessary to reduce discrimination against female children in this country. What do we learn from China (Gu and Roy, 1995)? It is a son-prefering country. Its sex ratio at birth was much higher than normal in the '30s and '40s as a result of the female infanticide, became normal in the '60s and '70s as a result of the action of the communist government, which tried to modify customs as well as traditional practices that it viewed as harmful, but rose again to abnormally high level in the '80s as a result of sex selective abortion. If no further positive action is taken to eradicate or reduce son preference in Bangladesh, there is a possibility that this country will in the future face the same consequences as in China and Korea once technology for sex identification becomes available. Necessary steps including monitoring of the situation to stop discrimination against female children should be undertaken soon in order to avoid the related problems in the future.

Abstract

Gender preference, particularly a preference for sons, is quite strong in Bangladesh. This study investigated the levels and trends of the effects of this preference on mortality of 1-4 year-old children and examined whether an MCH-FP program could bring about any change in the effects in rural Bangladesh. Data for this study came from the Demographic Surveillance System, Matlab, where an MCH-FP project was started in a 100,000 population in 1977-78, with another 100,000 population retained as the comparison area, in which the government services were available as a part of the national program. Male to female mortality ratio of 1-4 year-old children was used as the main dependent variable in this study. The Matlab MCH-FP program was found to be successful in increasing contraceptive use and decreasing fertility and infant and child mortality. Fertility started to decline in mid '70s and infant and child mortality in the '80s in both areas. Sex-ratio of child mortality started to improve first in the MCH-FP area and then in the comparison area and rose from 0.6 in the '70s to 0.70 in the '90s, when the ratio in both areas was almost equal. The MCH-FP program was probably helpful, as were societal changes in the society took place in
favor of a reduction in excess female child mortality. Yet, 35 percent of deaths of
female children of 1-4 years in the '90s were due to discrimination against female
children in the Matlab area.

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