Thirty-Five Years Later: Evaluating Effects of a Quasi-Random Child Health and Family Planning Program on Labor Market Outcomes and Migration in Bangladesh

***EXTENDED ABSTRACT ****

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1. INTRODUCTION

Improving health and nutrition of mothers and young children is important not only for their immediate well-being, but also because it is believed to reduce poverty in the long-run through improved human capital and labor market opportunities for the child (Strauss & Thomas 2008, Heckman 2006). Economic theories of human capital development rely on this postulated link and are part of the rationale for important programs in the US (e.g. Head Start) and in developing countries (e.g. Conditional Cash Transfer (CCT) programs). Despite the global spread of programs such as CCTs, there is limited longer-run evidence of effects of early childhood health, nutrition, or family planning programs, for example on labor market outcomes including migration in adulthood. It is important to investigate longer-term effects since evidence from some early childhood nutrition and health interventions is mixed as to whether their benefits continue (Pollitt et al. 1993) or fade out (Garces et al. 2002). The issue of fade-out is particularly pertinent in developing countries, where many competing health and environmental risks and a greater frequency of shocks are coupled with limited ability to smooth consumption.

Programs intended to improve health and nutrition of young children are common in the developing world. Few, however, have been introduced in designs that permit full assessment of their impacts. Even when evaluation is built in, long-term follow-up is rare, so most existing evaluations are limited to the short or medium term. Specifically, opportunities to study longer-term consequences of disease prevention and family planning interventions are extremely unusual. Matlab, Bangladesh, is one of the few settings in the world that combines quasi-randomization of interventions, availability of pre-intervention data, and long duration of follow-up (over 30 years).

In 1977, icddr,b (formerly the International Center for Diarrhoeal Disease Research, Bangladesh) introduced the Matlab Maternal and Child Health and Family Planning (MCH-FP) program in half of a study area, the treatment area, leaving the other half as a comparison area. Treatment and comparison areas were chosen to be economically and socially similar. Mortality and contraceptive rates and most household, household head, and individual characteristics were
similar prior to the program. Program interventions were phased-in starting with family planning and tetanus toxoid vaccines for pregnant women. Intensive child health interventions began in 1982 with measles vaccination. Starting in 1985, the project expanded to include child health interventions such as vaccinations against tetanus, pertussis, polio, and tuberculosis. Preventing these diseases improves health and nutritional status of these children. It also reduces chances of cognitive impairment from these diseases either directly or indirectly, for example through nutrition. Similar interventions were introduced in the comparison area in the late 1980s, thus providing approximately a 10-year experiment period to help evaluate the program.

This paper takes advantage of the MCH-FP program quasi-random design and phasing-in of interventions to address shortcomings in the literature. Our overall program is intended to investigate if a well-implemented program that led to improvements in health status in the short-term led to improved labor market outcomes including migration for work for those who born during the experimental period.

Given the long-term nature of this study and the relationship between better health in childhood and cognitive development, education, health, and migration, it was paramount to our study to minimize attrition. Consequently, great efforts were made to track migrants throughout Bangladesh, to interview international migrants when they returned for holidays, and to implement a short phone survey for international migrants that we could not interview in person in Bangladesh. This extensive tracking was a key component of the design of this study and was highly successful. 35 years after the start of the program we were able to interview more than 90 percent of men age were born during the experimental period and are the group with the highest migration rates in the study.\(^1\) Response rates for females and other age groups were even higher. These rates of attrition are remarkably low compared to other impact evaluation studies covering similar populations, as well as to many longitudinal studies that cover much shorter periods.

2. BACKGROUND

2.1 Past Evidence on the MCH-FP Program in Matlab, Bangladesh

Previous research on the short-run effects of the MCH-FP program used the demographic surveillance data and program receipt data to show that the MCH-FP program was effective in reducing child mortality and fertility (Phillips et al. 1982, 1984; Koenig et al. 1990, 1991). Studies using the 1996 MHSS1 show improvements in cognitive functioning, anthropometrics, and education in late childhood and adolescence for children exposed early in life to the MCH-FP program. Joshi and Schultz (2007) found an increase in schooling for boys aged 9-14, but no effect for girls. Chaudhuri (2005) reported that girls younger than 14 experienced improved weight-for-age and boys were significantly less stunted. Barham (2012) found that the MCH-FP program led to a 0.39 standard deviation increase in cognitive functioning and a .02-0.25 standard deviation increase in height and years of education attained for children ages 8-14. Barham and Kuhn (\(^2\))

2.2 The MCH-FP Program

\(^1\) Such tracking was the primary objective and use of the funding provided by 3ie, with the main data collection supported by NIA.
The MCH-FP program was initiated in a rural area of Bangladesh, Matlab, in October 1977 by icddr,b. It started as a demonstration project to help the government design their national family planning program. Treatment and comparison areas were built into the design of the program and covered about 200,000 people in 149 villages with the population split fairly evenly between the two areas (Figure 1). The program included integrated family planning (FP) and maternal and child health (MCH) services. Service delivery was intensive as interventions were administered in the house of the beneficiary during monthly visits made by local female health workers hired and trained by the program, and services were free of charge (Bhatia et al. 1980). Usual government health and family planning services were available in the area, but there was limited or no home delivery of services. In addition, many of the program interventions, such as childhood vaccinations and the array of family planning options, only became readily available from the government after 1988, providing us with an experimental period between 1978-1988 to evaluate the program. Evaluation of the program is also aided by the rolling out of the program services over two main periods: 1977-81 and 1982-88.

Program services prior to 1982 focused on family planning and maternal health through the provision of modern contraception, tetanus toxoid vaccinations for pregnant women, and iron and folic acid tablets for women in the last trimester of pregnancy (Bhatia et al. 1980). The health workers brought a wide-array of family planning options to the beneficiary’s home including condoms, oral pills, vaginal foam tablets, and injectables. In addition, beneficiaries were informed about fertility control services provided by the project in health clinics, such as intrauterine device insertion, tubectomy, and menstrual regulation. During these visits the female health workers also provided counseling on contraceptives, nutrition, hygiene, and breastfeeding, motivated women to continue using contraceptives, and instructed women how to prepare oral rehydration solution. These services were supported by a well-developed follow-up and referral system to ensure management of side effects and continued use of contraceptives (Phillips et al. 1984, Fauveau et al. 1994).

Between 1982 and 1988, the types of interventions provided were expanded, especially for children under age five. These interventions were rolled out over time in the treatment area starting with measles vaccine in half the treatment area in 1982. Starting in 1985, preventive services were provided to children under the age of five in the entire treatment area. These services included vaccines for measles, DPT, polio, and tuberculosis, and vitamin A supplementation. By 1988, coverage rates for children aged 12-23 months living in the treatment area were 93 percent for BCG, 83 percent for all three doses of DPT and polio, 88 percent for measles, and 77 percent for all three major immunizations (HDSS 2007). Curative care such as nutrition rehabilitation and acute care for respiratory infections was also introduced late in the period. In addition, the tetanus toxoid immunization was expanded to all women of reproductive age, and safe delivery kits were provided to pregnant women.

The program is still running today, but differences between the treatment area and the rest of the country, including the comparison area, diminished after 1988 as the lessons of the Matlab success were incorporated into national plans (Phillips et al. 2003, Cleland et al. 1994). In particular, Bangladesh greatly increased the number of family welfare assistants to deliver in-home contraceptive and immunization services throughout the country. Expanding the number of family welfare assistants reduced the client-worker ratio from 1 per 8000 in 1987/88 to 1 per 5,000 in 1989/90 (Cleland et al. 1994). The ratio was still lower in the treatment area at 1 per
1,300 in 1990. Improvements in supply chains, products, and management were also rolled out in 1988 and 1989 (Cleland et al. 1994).

2.3 Program Targeting and Take-Up
The comparison group was built into the design of MCH-FP (Faveau 1994) but the treatment and comparison villages were not assigned randomly. Instead, the treatment and comparison areas are contiguous geographic areas (Figure 1) that were viewed as socially and economically similar and geographically insulated from outside influences at the time (Phillips et al. 1982). Assigning treatment status to geographic contiguous areas was used to reduce potential contamination of the comparison area from the family planning interventions (Huber & Khan 1979), and was also important for reducing spillovers from the positive externalities generated by vaccination. Past research shows that the treatment and comparison areas are similar with respect to potential targeting outcomes including rates of mortality and fertility (Koenig et al. 1990; Menken & Phillips 1990; Joshi & Schultz 2013). This is important since it means the program was not placed first in areas that had poor child health or high fertility. Most pre-interventions household and household head characteristics were also similar (Barham 2012, Barham & Kuhn 2014). Two exceptions are religion and access to tubewell water. The difference in access to tubewell water is a result of a government program so does not reflect household income, propensity to drill a tubewell, a household’s concern about child health, or potential unobservable characteristics. In our analysis, we examine heterogenous program effect by pre-intervention access to tubewell water and religion. Lastly, Barham (2012) shows that cognitive functioning was similar between the treatment and comparison area in 1996 for those whose cognitive functioning was not likely to have been affected by the program.

Figure 1: Map of Matlab Study Area

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A direct comparison of the client-worker ratio between the areas is difficult because the health workers in the treatment area had more responsibilities, for example, the collection of regular demographic surveillance data. The national plan was based on cost-effectiveness analysis from other demonstration projects in Bangladesh (Phillips et al. 2003), so it is unclear how much difference there is in access to services based on the ratios alone.
Program implementation followed the planned timeline and uptake was rapid. For example, Figure 2 shows that the contraceptive prevalence rate (CPR) for married women 15-49 was similarly low prior to the program (< 6%) in both areas. There was a large increase in the CPR to 30% in the treatment area during the first year of the project. After that, there was a steady increase in the CPR with it reaching almost 50% by 1988. Due to availability of contraceptives from government services, the CPR did increase in the comparison area over time, but not as quickly, and rates remained below 20% in 1988. There was still a 20% difference in the CPR rate between the two areas in 1990.

As also shown in Figure 2, the measles vaccination rate rapidly increased to 60% in 1982 after it was introduced in half of the treatment area (treatment area 1), and in 1985 when it was introduced in the other half (treatment area 2). Vaccination rates in the comparison area are not available for this time period, but are believed to be near zero. Government services did not regularly provide measles vaccination for children until around 1989, so the comparison area was viewed as largely an unvaccinated population (Koenig et al. 1991). Nationally, measles vaccination for children under the age of five was less than 2% in 1986 (Khan and Yoder 1998), and was below 40% in the comparison area in 1990 (Fauveau 1994). As the national program scaled up, these differences narrowed substantially.

**Figure 2:** Trends in Contraceptive Prevalence Rate (CPR) and Measles Vaccination Rates (MVR) for Children 12–59 Months by Calendar Year

3. **DATA**

3.1 **Data Sources and Sample**

This paper draws on the unusually rich data available for the Matlab area, a rural district of Bangladesh, and benefits from the ability to link the various data sources by person and/or household identification number. Three main types of data sources are used to construct the dataset. They include two large socioeconomic surveys (2012-2014 and 1996), several periodic censuses of the study area, and an ongoing Health and Demographic Surveillance System (HDSS).
The more recent survey, the 2012-2014 Matlab Health and Socioeconomic Survey (MHSS2) was collected especially for this project. The main outcome variables for this report are from MHSS2. MHSS2 is a follow-up study to the 1996 Matlab Health and Socioeconomic Survey (MHSS1) which is publicly available from the Rand website (http://rand.org/labor/FLS/MHSS.html) and ICPSR (http://www.icpsr.umich.edu/icpsrweb/DSDR/studies/2705). Both MHSS1 and 2 are multi-purpose surveys. The surveys were designed to be a panel for a subset of MHSS1 respondents, and many of the questions are the same in both surveys. MHSS2, however, has a richer array of outcomes, including enhanced cognitive and health tests, more detailed consumption an employment modules, and greater information on social networks and women’s status, and water samples to test for arsenic.

The second source, periodic censuses (e.g., 1974, 1982) collected by iccdr,b on the entire study population (treatment and comparison area), provides information on household location, composition, assets, employment, and education. The 1974 census offers the opportunity to test for program similarity between the treatment and comparison areas, and the 1982 census is used in tracing MHSS respondents back to the 1974 preprogram census.

The third source, demographic surveillance site data on vital events (e.g., births, deaths, migration) was collected by iccdr,b on the entire study population of Matlab, and is used to help create an intent-to-treat variable and examine attrition from mortality or outmigration in the study area. The demographic surveillance data have been collected at least quarterly since 1966 on the entire study population (though they are only computerized since about 1976) and are known to be of high quality.

The sample for this paper is a panel of randomly selected participants who were selected to answer the individual books in MHSS1 in 1996. We follow this sample (regardless of if they did or did not respond in MHSS1). Attrition rates in MHSS2 for this sample are remarkably low and approximately 7 percent for MHSS2 as a whole not including those who died. For the sample and outcomes used in this paper the attrition rate including death is approximately 12 percent for those outcomes included in the phone survey of the international migrants and 17% for those outcomes not included in the phone survey.

3.2 Treatment Variable

In this section we describe how we assign treatment status since this is not a randomized intervention. The MCH-FP program used village of residence is used to determine program eligibility. A variable indicating program eligibility based on a person’s 1996 or 2012/15 MHSS village location might be endogenous, since households could have moved to the treatment area to benefit from the MCH-FP program. To avoid this potential endogeneity, individuals are linked to the 1974 census, and village of residence from the 1974 census is used to determine treatment status. Many individuals cannot be linked directly to the 1974 census since they were born after 1974 or moved into the study area between 1975 and 1977. To trace these individuals back to a household in 1974, a dataset is created that indicates each time a person entered or exited the study area and identifies the household head at that time, using census and demographic surveillance data. For those who moved in after 1974, their village of residence the first time they moved into the survey area determines treatment status. For those born after the 1974 census was taken, the head of the household at the time they were born is traced back to the 1974 census and the village of residence of this household head is used to determine treatment status. The intent-to-treat variable, Treatment Area, takes on the value 1 if the individual (or the household head who is traced back to the 1974 census data) resided in a treatment area in 1974,
or if the individual (or household head who is traced back) migrated to a treatment village in the study area between 1974 and 1977. The 1974 baseline information is linked to individuals in the MHSS using the same method of tracing back individuals to 1974.

3.3 Primary outcomes to be examined
Given that we study the impact of MCH-FP 35 years after it began, the primary outcomes of this evaluation are as much as possible outcomes related to long-term impacts, in particular income, wage per hour, months migrated, urban, rural and international migration.

5. EMPIRICAL STRATEGY
For each outcome of interest, we will estimate the intent-to-treat (ITT) or overall program effect of the MCH-FP program on those who were eligible for the program as children during the experimental period. We use interaction models to examine heterogeneous effects. To estimate ITT effects we will use variation in program implementation across locations to compare outcomes in the treatment versus comparison area. We will also exploit phasing-in of interventions over time within the treatment area, which left certain age cohorts differently affected by the program.

This variation across location (treatment and comparison area) and by age group provides an excellent setting for using either single or double difference estimators to determine the ITT effect of the MCH-FP. ITT estimates are derived from the eligible population regardless of whether the treatment was actually received. It is difficult to separate out the effects of the various interventions. However, the combined effect is of great interest since most programs combine these interventions in developing countries and because early childhood vaccination and family planning programs are arguably two of the most important and widespread health programs in developing countries in the latter part of the twentieth century.

<table>
<thead>
<tr>
<th>Year of Birth</th>
<th>Age in 2012</th>
<th>Program Eligibility</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>Mother eligible for family planning, tetanus toxoid vaccine, folic acid and iron in last trimester of pregnancy.</td>
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<tr>
<td></td>
<td></td>
<td>Children under age five eligible for measles vaccination in half the treatment area</td>
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<tr>
<td></td>
<td></td>
<td>Children under age five eligible in entire treatment area for vaccination (measles, DPT, polio, tuberculosis), vitamin A supplementation, nutrition rehabilitation for children at risk (starting 1987).</td>
</tr>
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</table>

Notes: The 2012 age groupings are based on age in years rounded to approximate age in December 2012. The exact year and month cutoffs will be used to create groups for the analysis. See a more detailed description of table in
We will exploit the quasi-experimental research design and use single- and double-difference intent-to-treat models to estimate the effect of the MCH-FP program on adult cognition and anthropometrics for those born during the experimental period. Given that previous research shows the two areas had similar observable characteristics, single- and double-difference models are appropriate. However, there were more Hindus and better access to tubewell water prior to the program in the treatment area, differences we address in more depth below under heterogeneous analysis. To account for the differences in baseline characteristics, we include the observables in the regression as a robustness check examine the heterogeneity of the treatment effect by tubewell status in 1974.

Using data on individuals aged 22 to 65, the single difference model for person \( i \) from village \( v \) can be estimated using the following linear equation:

\[
C_{iv} = \beta_0 + \beta_1(T_v \times AG^{22-29}_i) + \beta_2(T_v \times AG^{30-34}_i) + \beta_3(T_v \times AG^{35-65}_i) + \alpha_{by} + X'Z + \varepsilon_{iv}
\]

where \( C \) is one of the outcome measures such as height or cognitive functioning. \( T_v \) is a binary variable that takes on the value 1 if person \( i \), or \( i \)'s household, resided in a treatment village before the MCH-FP program started, and 0 if from a comparison village. \( AG^Y_i \) is a binary variable used to indicate whether person \( i \) is in age group \( Y \). Thus, the coefficient \( \beta_1 \) is the ITT effect for the 22- to 29-year old age group—the group of children born before the child health interventions were available. \( \beta_2 \) is the ITT estimate for those children eligible to receive less intensive treatment, and \( \beta_3 \) the ITT estimates for the age groups born prior to the program. \( \alpha_{by} \) are birth year fixed-effects to control for differences in the outcome due to age as well as other events that may be correlated with birth year. \( X \) is a vector of individual (gender and religion) and baseline household and household head characteristics. Standard errors are clustered at the village level to account for likely intracluster correlation in the error term.

If the outcome differed between the treatment and comparison areas in the pre-intervention period, a double-difference estimator is more appropriate. Since we do not have pre-intervention data for most of the outcomes, we instead use the 35-65 year old birth cohort since the outcomes of interest are less likely to have been affected by the program. The double-difference estimator can be determined using Equation 2.

\[
C_{iv} = \beta_0 + \beta_1T_v + \beta_2(T_v \times AG^{22-29}_i) + \beta_3(T_v \times AG^{30-34}_i) + \alpha_{by} + X'Z + \varepsilon_{iv}
\]

where variables are defined as above but interpretation differs because the 35-65 year-old group is the group without an interaction term. Therefore, \( \beta_1 \) provides the difference in means between treatment and comparison areas for those 35-65 year olds, or for the “pre-intervention” period. \( \beta_2 - \beta_3 \) are the double difference estimates for the various age groups of interest.

**Mechanisms**

Understanding which of the program components were most effective is desirable, but, as with many programs, difficult to determine due to the integrated nature of the interventions. However, we can provide some suggestive evidence of the role of the child health interventions. For example, we can take advantage of the fact that the main child health interventions were phased in after 1981 and compare children who were eligible for the program at birth (the 22-29 year olds) to those who would have been eligible in later childhood (the 30-34 year olds). We
can also exploit the phasing in of the measles vaccine over time within the treatment area, by comparing the 22-26 year olds to the 27-29 year olds within the treatment area. In addition, we can include a control in equations 1 and 2 indicating if a person’s mother was eligible for family planning, and run the treatment-on-the treated models discussed above.

6. IMPACT RESULTS

In this section, we will describe research findings to date. Given the scope of the data collection, the long-term nature of the data and that the data is only recently available these results are not available now, but we are presently working on them. We will also examine how differential selection from attrition is affecting the results.

6.1 Treatment Comparison Group Balance

We test whether the areas are similar using preintervention household and household head characteristics from the 1974 census. Table 1 provides the means and standard deviations (SD) of the characteristics for the treatment and comparison areas for the entire sample. The differences in means are statistically insignificant at the five percent level for all variables except religion, drinking water sources, latrine, and age of household head and household head spouse. Since t-statistics are driven by sample size as well as magnitude of the difference, we also examine the normalized differences (difference in the means divided by the SD of the difference) to get a sense of the size of the differences. Imbens and Wooldridge (2008) argue normalized differences greater than 0.25 are substantial. The mean of the differences that do exist are relatively small and less than 0.10 for all the differences except access to tubewell water which is 0.14. These findings, together with previous results on fertility and mortality, strongly suggest that the two areas had very similar observable characteristics. Baseline characteristics for the experimental group (those aged 22-29 and 22-34) are similar.

Before the program, 14 percent greater proportion of households used tubewell water for drinking, which is concerning since tubewell water is often thought to be cleaner than other sources of water. Because a larger percent of treatment area households had access to this water, the program effect might be biased upwards. Unfortunately, there is widespread groundwater arsenic contamination in the tubewells in Bangladesh (Chowdhury et al. 2000; Alam et al. 2002). Arsenic is a serious health concern and has been shown to reduce IQ among school-aged Bangladeshi children (Wasserman et al. 2006). So greater access to tubewell water in the treatment area might actually bias the estimate of program impacts downwards. In section 5.5, we examine the heterogeneity of the treatment effect with the source of drinking water to help determine whether such a bias exists.

REFERENCES


