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## **Impact of post-conflict development interventions on maternal healthcare utilization**

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**Abstract:** We evaluate the effectiveness of a post-conflict development programme on maternal health-care utilization in the Chittagong Hill Tracts of Bangladesh. Our work varies from conventional impact evaluation studies because of the inclusion of two post-conflict psychosocial risks: the household's actual experience of violence, and subjective perceptions about violence, as key determinants of programme effectiveness. Following the difference-in-difference estimator, and propensity score matching method this study establishes that the post-conflict development programme undertaken by Chittagong Hill Tracts Development Facility of the United Nations Development Programme is successful in improving maternal health-care utilization. Despite this, forced settlement by outsiders, household experiences of conflict, and perceptions of insecurity lower maternal health-care utilization. The effectiveness of the programme would have been greater in the absence of conflict, although the programme may have mitigated some experiences of past conflict. The intervention fails to significantly narrow the inter-ethnic gap in terms of health-care utilization, chiefly attributable to the adverse effects of the forced settlement of non-indigenous peoples in the region.

**Keywords:** conflict, post-conflict reconstruction, healthcare usage, health inequality

**JEL classification:** D74, I14, I15

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## 1 Introduction

In a world where more than a million women die every year from preventable causes related to pregnancy and childbirth there is room for considerable improvement in childbearing safety (WHO 2014). The aim of this paper is to examine the effectiveness of a post-conflict development programme on maternal health-care utilization in the Chittagong Hill Tracts (CHT), a post-conflict region of Bangladesh. Here in this region, the Chittagong Hill Tracts Development Facility (CHTDF) of the United Nations Development Programme (UNDP) operates a multi-sectoral programme aiming to achieve improved economic opportunities, increased literacy, improved health conditions through a strengthened community outreach and localized service delivery, empowering local communities, and ameliorating confidence so as to achieve lasting peace in the region. Improved access to quality health services is a prime objective of CHTDF's health intervention. More specifically, it seeks to improve maternal and reproductive health, reducing child mortality and decreasing the incidence of malaria, tuberculosis, diarrhoea, and other communicable diseases (Sabina and Chakma 2015). Using two rounds of household survey data this paper examines the impact of the CHTDF programme intervention on maternal health-care utilization: ANC check-up, delivery attended by a trained provider, and delivery at a health facility, by comparing changes in treatment and comparison households over time. Following the difference-in-difference (DiD) estimator and the propensity score matching approach this study establishes that the CHTDF programme is successful in increasing maternal health-care utilization, subject to caveats in terms of conflict experience and inter-ethnic outcomes.

Our work varies from conventional impact evaluation studies in several ways. First, this study includes two types of post-conflict psychosocial risks: the household's prior experience of violence; and subjective perceptions about future violence, as key determinants of programme effectiveness. First, differently from our paper, most recent studies, evaluating development projects in post-conflict scenarios, do not employ conflict as a key explanatory variable, rather treating it as a simple control variable (Bozzoli et al. 2013: 261). Second, in the conflict literature, studies examining the impact of conflict on maternal health-care utilization are characterized by their paucity. Most of the other studies deal with the impact of conflict on various health outcomes, not health-care utilization (Bundervoet et al. 2009; Camacho 2008; Guerrero-Serdan 2009, for example). Third, we employ a unique data set of two rounds of household surveys covering the most inaccessible and risky region in Bangladesh. Finally, this paper also examines equity aspects in health-care utilization from the perspective of inter-ethnic gaps, because the population of interest in this study includes an ethnic minority living under marginalized and disadvantaged circumstances.

Despite impressive success in Bangladesh in reducing maternal mortality over the last two decades, there are growing inequalities between rural and urban areas, as well as between rich and poor in health-care service utilization (Khan et al. 2011; Pulok et al. 2015). The lack of doctors and other health personnel at the sub-district administrative levels of the CHT leads to poor service provision (GoB 2011: 1; Tuhin 2015: 82–3, 98). The indigenous populations of the CHT are seriously disadvantaged in terms of reproductive and maternal health issues (Islam 2010: 1). Although there are no official statistics on the health status and health-care utilization by people of this region, the socio-economic baseline survey of CHT used in this study suggests considerable relative deprivation in the region (Barkat et al. 2009). This study also reveals that the indigenous people of CHT rely more on their traditional healing practices because of cultural orientation and local belief systems (Tuhin 2015: 59, 63, 83).

There is a growing literature providing evidence on the impact of various types of programme interventions on maternal health-care utilization. Among others, financial incentives in differing formats (mostly demand side financing, voucher schemes for pregnant women), are widely used

to improve maternal health through increased use of health-care services. Two different studies in Bangladesh show an impressive improvement in maternal health-care utilization among the beneficiary women in the programme compared to those not covered; it is also found to be equity enhancing as it bridges the gap between rich and poor households. These two studies used data from the programme called the Maternal Health Voucher Scheme (MHVS) piloted in other parts of Bangladesh (Ahmed and Khan 2011: 1704–05; Nguyen et al. 2012: 989–90). Jackson and Hanson (2012: 271–2) examined the impact of a safe delivery incentive programme (SDIP) in Nepal, and found modestly positive effects on the utilization of services. For Kenya, findings suggest that there is an improvement in delivery at a facility after the implementation of the safe motherhood voucher programme (Obare et al. 2014: 183). Similar outcomes are found for three West African countries, Senegal, Mali, and Ghana, where community based health insurance played a significant role in increasing maternal health services (Smith and Sulzbach 2008: 2460). Rosas and Sabarwal (2016: 11–14) found positive impact of a public works project on various indicators of household welfare in post-conflict Sierra Leone. Apart from some positive results on employment creation, improved income, and increased expenditure on food, medicines, and assets, they discovered increased health-care service utilization for young children in the treatment group.

There is also a parallel micro-level literature dealing with the impact of violent conflict on a wide range of broad development issues such as poverty, livelihood, education, health, nutrition, and social capital. It is a well-established fact that violence, including war, has substantial adverse effects on human health, which includes deaths, injuries, malnutrition, diseases, and trauma (Altare and Guha-Sapir 2013: 186–93; Litchfield 2013: 155–8). Micro-level studies using survey or census data mostly focus on the direct impact of violent conflict on demographics, mortality, and fertility (Brück and Schindler 2009). The long- and short-term impact of armed conflict on infant mortality, child malnutrition, and maternal mortality is estimated and analysed in different studies (see Gates et al. 2012; Grimard and Laszlo 2014; Urdal and Che 2013).

The adverse effect of armed conflict on child health in Burundi is estimated by Bundervoet et al. (2009: 536), using both survey and event data. Investigations into the causal impact of varying conflict intensities on child health in Iraq reveal that children born in areas affected by high levels of violence are shorter than children born in low-violence provinces (Guerrero-Serdan 2009: 1–2). A significant negative impact of stress shocks from terrorist attacks on child birthweight in Colombia is established by Camacho (2008: 511). The paper looks at channels through which violence may have long-lasting and intergenerational effects on human capital accumulation.

The literature cited above is innovative in ideas, rich in terms of methodological rigour, quality of data, and geographical coverage. However, there are few studies dealing with the impact of programme intervention in conjunction with the consequences of conflict on maternal health-care utilization, which is the subject of this paper. The remainder of the paper is set out as follows. Section 2 outlines the theoretical background, while Section 3 briefly discusses the history of conflict and post-conflict development in CHT, as well as the nature of the CHTDF-UNDP programme. A discussion on the data employed—descriptive statistics and our econometric strategy—is found in Section 4. Our results are presented in Section 5, and finally Section 6 concludes.

## 2 Theoretical considerations in health-care utilization

We are concerned in this section with conceptualizing the possible mechanisms through which CHTDF programme intervention in the presence of post-conflict violence and insecurity can affect health-care utilization. This will inform the empirical strategies followed later. Mueller (2013) offers a comprehensive discussion on the economic cost of conflict in relation to

participation in labour market and economic activities, investment, asset price, health and education outcomes, and preferences related to social welfare, risk, and time.

We postulate that on the one hand, that programme intervention is expected to improve health-care utilization, while on the other hand violence and insecurity may reduce utilization of health care by households. We wish to focus on the impact of programme intervention from the perspective of demand-side incentives that increase utilization of maternal health care.

According to the simple model of provider choice, individual households essentially face a trade-off between health and non-health consumption expenditure (Gertler and van der Gaag 1990). Subsidies on the cost of health-care services by the programme clearly encourage household to avail themselves of more maternal health-care services. The improvement in utilization of maternal health care can be explained by a substitution effect and an income effect. A strong substitution effect may be in place as it changes the relative price of alternative providers, while the income effect is the outcome of increased income or purchasing power, which is relevant in our case, as the programme also has an income support component (Jackson and Hanson 2012: 272).

Grossman pioneered a model on the demand for health as part of the broader human capital stock. Health capital differs from other forms of human capital where the stock of health capital determines the total amount of time that can be spent producing goods and services. Health is also considered to be a choice variable as it is a source of utility (satisfaction) that determines income or wealth status. Health is also an investment commodity determining available time for market and non-market activities. An individual is born with an initial stock of health capital, diminishing with age, which can be increased by investment in health inputs like medical care utilization (Grossman 2000: 349–51).

We adopt a framework of expected utility under uncertainty as set out, for example, in Layard and Walters (1978), with necessary modifications to contextualize our study. Household decision makers have a utility function comprising two possible states of nature: peace ( $\theta$ ) or war ( $w$ ), under which income and consumption vary. The uptake of health services and private household expenditures will depend on income and consumption ( $Y$  and  $C$ ), and this varies under a state of peace (greater income and consumption) or war (lesser income and consumption). It can also be postulated that health has a positive effect on the future income of households ( $Y_2$ ) in both states of nature, but greater in a peaceful state. We can characterize the household utility function as follows, where discounted future periods are ignored for the sake of simplicity:

$$V = \Pi(\theta) [C^p; H^p(P)] + (1 - \Pi(\theta)) [C^w; H^w(P)] \quad (1)$$

Where  $Y^p > Y^w$ ;  $C^p > C^w$ ;  $H^p > H^w$ ;  $\frac{\partial \pi}{\partial \theta} < 0$ ;  $\frac{\partial H}{\partial P} > 0$ .

$Y$  is income,  $C$  is consumption,  $P$  is the programme intervention,  $H$  is the uptake of health services and expenditures,  $\Pi$  is the probability of peace and  $\theta$  refers to a number of conflict increasing factors.

Utility in both states of nature emanates from consumption and the use of health services. The first argument inside the square brackets states that the household's utility rises with period 1 consumption; it also increases with use of health services as it both directly increases utility and indirectly helps to retain the household's stock of human capital (earning power). Note that expenditure on health cannot exceed total saving in the period:  $H^{p,w} \leq Y^{p,w} - C^{p,w}$  by the budget constraint.

$\Pi$  is the probability of good state (peace), and  $1 - \Pi$  is the probability of conflict, which depends on a variety of factors such as the past individual experience of conflict, the prevalence of forced settlement, and intimidation by security forces ( $\theta$ ). The information contained in  $\theta$  allows households to update their prior beliefs about the probability of violence or peace through a process akin to Bayes' law. Given values of  $\Pi$ , the household chooses  $C$  and  $H$  where observed income  $Y$  is predetermined. The demand for health services increases with income, and the probability of peace. More conflict, other things being equal, should reduce the use of health-care services, because it lowers the uptake of publicly provided health services (including programme interventions), and individuals have lower income and hence are more constrained in their private out-of-pocket health expenditure. Health ( $H$ ) outcomes are a positive function of programme intervention ( $P$ ) in the form awareness building and health-care service received; the marginal impact of programme intervention is expected to be positive;  $\delta H / \delta P > 0$ .

### 3 History of conflict and the CHTDF programme in Chittagong Hill Tracts

#### 3.1 History of conflict in CHT

The CHT region of Bangladesh was mainly populated by ethnically distinct indigenous peoples prior to the mass settlement in the late 1970s of the Bengali speaking population (who make up the overwhelming majority of Bangladeshis). In 1860 the British took the region under their direct administration; an embargo on 'outsiders' settling on or purchasing land in the territory was enacted by the CHT Regulation of 1900. Finally, in 1962, this region was opened up for outsiders via a 'tribal area' classification (see map of the CHT region in Appendix B). Subsequently, a large hydro-electric generation plant was constructed in the area, and an artificial reservoir was built by damming the river Karnaphuli at Kaptai. Approximately 1,036 square kilometres were submerged, and 54,000 acres of highly prized arable land was lost in the river valleys. Soon after the advent of Bangladesh in 1971, the political leadership of the CHT region demanded constitutional recognition of their ethnic identity. This was denied for the sake of greater national unity (see Badiuzzaman and Murshed 2015; Barkat et al. 2009).

Successive Bangladeshi governments adopted mixed strategies of using military force to combat rebellion and protest, while at the same time encouraging, or colluding with, a population transfer programme. In 1976 armed forces were deployed in CHT which triggered tensions in the region. A few indigenous political groups engaged in an armed struggle against this intrusion. Under the counter-insurgency strategy, demographic engineering interventions aimed at settling a large number of Bengali speaking households in CHT were seen as enhancing the size of the population loyal to the state, and these fresh settlements acted as a counterweight to indigenous peoples' demands for rights and regional autonomy. Although there are no official statistics of how many people were brought in to CHT, it is widely believed that about 400,000 people were transmigrated under this programme. Consequently, a substantial number of indigenous households were uprooted from their homes, which intensified the armed struggle. Some 54,000 indigenous people took refuge in the neighbouring Tripura state of India, and another 50,000 indigenous people became internally displaced (Badiuzzaman and Murshed 2015: 148–50).

The insurgency aimed at regional autonomy rather than independence, but the principal local grievance was against officially sponsored land encroachment and grabbing by outsiders who pose a threat not only to local livelihoods, but also to a distinct way of life; see Chakma (2006) and Roy (2000). This insurgency officially ended with the signing of the CHT Peace Accord on 2 December 1997, which stipulated restitution of land and regional autonomy; but this has only been incompletely implemented; the United Peoples Democratic Front (UPDF) continues the struggle for full autonomy (Mohsin 2003). The situation has become so fraught, that the government amended the constitution in 2011 to excise the term indigenous people, putting in

its place the expressions ‘tribes’, ‘minor races’, ‘ethnic sects and communities’. Continuation of human rights violations against indigenous people, and the impunity of the perpetrators remain serious concerns. Although the government transferred a few functions to local government bodies at the district level, there is little progress in making the CHT Land Dispute Resolution Commission functional. Land acquisition by the government for border security, and by the forest department seems to have intensified. Illegal attempts at land acquisition continue, resulting in arson, looting, ransacking, physical assault killing, and violence against women (Indigenous World 2012: 336–43, 2015: 314–20).

### **3.2 Programme intervention of CHTDF-UNDP**

With the signing of the peace accord in 1997, international and national development agencies along with non-governmental organizations (NGOs) entered the region for reconstruction and development. The UNDP has been at the forefront through its CHTDF since 2003. CHTDF is a multi-sectoral confidence building and overall development programme for all inhabitants in CHT, and is being executed through UNDP with a wide range of collaborating institutions. The CHTDF scaled up the programme with wider service and regional coverage in 2005, and in the continued expansion of the programme, the whole of the CHT region was brought under implementation in 2013 (CHTDF 2006, 2013). The programme aims to support the Government of Bangladesh, and enable institutions of CHT and their constituent communities to pursue accelerated, sustainable socio-economic development and regional poverty reduction, based on the principles of self-reliance, local participation, and decentralized development. The key objectives of the project are: (1) enhancing capacities of CHT related institutions; (2) improving economic opportunities for small local enterprises, women, youth, and farmers; (3) increasing literacy through improved access to education; (4) improving health conditions through a strengthened community outreach and localized service delivery; (5) empowering local communities and their capacities to manage their own development; and (6) building confidence so as to achieve lasting peace in the region.<sup>1</sup>

Local communities and local institutions concerned with, or mandated for, development are the two direct beneficiaries of the programme. ‘Economic development and delivery of basic services’ is set out as a crucial outcome of the CHTDF programme, where among others a basic health service is an important element. Improved access to quality health services is the prime objective of CHTDF’s health intervention. More specifically, it aims to improve maternal and reproductive health, reducing child mortality, and decreasing the incidence of malaria, tuberculosis, diarrhoea, and other communicable diseases (Sabina and Chakma 2015).

In terms of basic health indicators, the CHT region is far behind the national average for Bangladesh. As indicated, there are no official statistics on various development indicators including the health status of households in CHT. According to the first socio-economic baseline survey for this region in 2008, less than one-fifth (18.3 per cent) of expectant mothers received ante-natal care (ANC), while births handled by a trained provider were only 12 per cent. Only 4.2 per cent of births occurred at a health facility (Barkat et al. 2009: 129).

The health project is designed from a community based health initiative perspective. Health interventions under the CHTDF programme have three major components: satellite/mobile clinics, referral services along with ambulance services, and community health service workers (CHSWs). Within the satellite clinic, there is a team comprising a medical doctor, nurse, health

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<sup>1</sup> Information about the CHTDF programme and its objectives along with its implementation and management structure can be found on the programme website: <http://www.chtdf.org/index.php/home> (accessed 16 October 2015).

educator, lab technician, and other support staff. These satellite/mobile clinics are used to visit a selected village/location (node) every week on a given date. They provide treatment for patients, which includes prescription services as well as drugs. A token fee is retained which is used for the maintenance of the clinic, including a water supply and cleaning. Awareness raising activities are organized by health educators, while patients are attended by doctors and other members of the clinic. In the case of more complicated health issues, there is a referral service to sub-district and district level government hospitals. There are also free or highly subsidized ambulance services. With regard to management and maintenance of the satellite clinics, a clinic management committee (CMC) has been established (Sabina and Chakma 2015).

CHSWs are recruited locally and trained to provide basic health care and advice to the communities, as well as organize and participate in various grass-roots based health campaigns. Under each of the three districts in the CHT there are few sub-districts, locally called upazilas, and there are few unions under each sub-district. The CHSWs operate at the union level, with frequent visits to villages. A network of CHSWs and satellite clinics are the two principal health services available to the population of remote villages. The locally recruited CHSW is expected to provide improved health services to communities living in the remote villages (characterized by hilly terrain, scattered inhabitation, and difficulties in communication). The CHSWs also participate in various grass-roots campaigns such as immunization, family planning, vitamin distribution, malaria prevention, and so on, assisting government health workers in such activities. The core objectives are health education and disease prevention (Sabina and Chakma 2015).

Additionally, health intervention provides infrastructure and logistical support to government health-care facilities. Moreover, fast boats and ambulances are provided from the project. A health management information system (HMIS) is also put in place to feed into the national HMIS on malaria, acute respiratory infections (ARI), diarrhoea, and other diseases (Sabina and Chakma 2015).

Currently, there are about 853 CHSWs, 158 community skilled birth attendants (CSBAs), and 16 mobile medical teams serving 80 weekly satellite clinics under this intervention. In 2014, this intervention brought basic health-care services to roughly 2.5 million people cumulatively, treating 382,756 patients and ensuring safe birth deliveries through CSBAs across the most remote and disadvantaged communities. CHSWs work in villages and the surrounding area, with about 120–40 households under each CHSW. Sessions on health education and disease prevention were held across communities through satellite clinics, and the CHSW network contributed to increased awareness on critical health issues. A total of 51,897 health education sessions were organized with more than 20,000 people participating monthly across the region (CHTDF 2014: 15–16; Talukder 2014: 5).

## 4 Methodology

### 4.1 CHTDF programme intervention and defining treatment

Generally, in an impact evaluation exercise, there is a clear binary definition of the treatment status of each individual unit (firm, household, individual) in any specific population. There are a few standard ways: enrolment status, eligibility status, and/or geographical placement of the programme used in defining treatment status. In the case of the CHTDF programme, geographical placement of the programme is the sole criterion to be included in programme intervention. It means any household residing in the programme area is eligible for treatment. But there was little randomness in this geographical placement. Discussion with the people involved in implementing the programme revealed that accessibility in terms of road

communication facilities was the prime criterion in the selection of any particular location. There was a top-down approach in selection of a particular location for programme intervention. For instance, in the CHT region there are three districts and a few upazilas (sub-districts) within each district. Under each upazila there are unions and each union has a number of paras (villages). From the outset, CHTDF started working in three districts of the region but in a limited number of upazilas, unions, and paras in the respective area. By 2012 the programme had expanded to 20 upazilas out of a total of 25 in the region.

Households living in the intervention villages are dealt with as treatment households, assuming that they obtain all types of benefits equally that are provided by the programme. The very specific feature of the CHTDF programme is that a village located in the programme implementation area receives all its various project interventions (community empowerment, economic development, education, and health services). Under the community empowerment and economic development intervention in every village (locally called *para*) there is a platform entitled a para development committee, where all households of the village are members and are entitled to various project benefits. It is a full coverage project; therefore, the benefits are distributed equally. Given this nature of the project implementation design, households living in the intervention villages are treated as intervention households while other households living outside the CHTDF implementation are considered as controls.

It is important to disentangle the intervention of CHTDF from any other intervention made by other development agencies in the region; however, CHTDF is the umbrella organization that manages and controls most of the development interventions and funds for the development of CHT. With its multidimensional programmatic approach CHTDF is working with the highest geographic coverage in the CHT (Tuhin 2015: 49–52, 85). During the baseline survey, the selection of villages was done in such a way that no other intervention was present in the sample villages. In the follow-up survey in 2013, villages with only CHTDF intervention were selected as the intervention or treatment group, while the villages without any intervention were selected as control villages.

The second important issue is that we cannot precisely estimate the impact of health intervention made by CHTDF on maternal health-care utilization, as beneficiary households are likely to receive other kinds of support from the programme. Thus, the impact on maternal health-care utilization will be considered to be the result of the CHTDF intervention as a whole, not just health specific intervention. CHTDF intervention has both demand- and supply-side features. On the one hand, it raises awareness among the community, while on the other hand, it provides health services.

The definition of treatment refers to both demand- and supply-side interventions made by the programme. All these interventions encourage demand for health-care utilization. It also implies that the impact of health services provided by the programme can be assessed but without the incentives of health service providers (e.g. doctors). Therefore, impact assessment does not show the possible supply-side influence of provider incentives on health-care utilization, although it is true that the impact of demand-side incentives can vary with supply-side factors (Jackson and Hanson 2012). The analysis intends to estimate the overall impact of the programme and can be expressed as a weighted mean of the impact on the household that lives in the treatment area ( $t=1$ ), and on the household not living in the treatment area ( $t=0$ ).

## 4.2 Empirical strategy

To estimate the impact of programme intervention on maternal health-care utilization we follow two types of estimation strategies, namely the quasi-experimental and the observational study design. Although there are data available for baseline and post-intervention periods for both treatment and comparison groups, we are compelled to apply a difference estimator (mean

difference between treatment and control) as the data were not collected from the same households in both the baseline and follow-up period. With the non-experimental data, it is not possible to justify the assumption that there is no difference between treatment and comparison groups other than the treatment itself. Due to the nature of the data, we use a quasi-experimental study design as a first strategy, where a regression based estimator using the level of the outcome variable gauges the impact. The regression based DiD model can be expressed as follows:

$$Y_{it} = \beta_0 + \beta_1 X_i + \beta_2 T_t + \beta_3 X_i * T_t + \epsilon_{it} \quad (2)$$

where  $Y_{it}$  denotes the outcome for the household  $i$  in the follow-up period indicated as  $t=1$  and  $t=0$  to denote the pre-treatment (baseline) period. The variable  $X_i$  shown in equation (2) is a dummy variable taking the value 1 if the household is in the treatment group and 0 if it is in the comparison group. The DiD estimator is represented by the coefficient  $\beta_3$  on the interaction between  $X_i$  and  $T_t$  using the simple ordinary least squares (OLS) model. The validity of this estimation depends on the assumption that the underlying ‘trends’ in outcome ( $Y$ ) is the same for both treatment and comparison groups, although it is not possible to test this assumption with two period data. The treatment and comparison households were different with respect to some demographic and socio-economic characteristics (Table A1). Therefore, in equation (2) we include selected baseline characteristics: sex and education level of the household head, ethnicity, distance between the village and the sub-district, violence experience and perception levels, and household economic status).

Differences between treatment and comparison groups with respect to household characteristics leads to selection bias, such that these two groups of households may not have experienced similar development trajectories over time without the programme intervention. Designing observational studies to approximate a randomized trial could be an alternative way of estimating unbiased causal inferences, as suggested by Rubin (2008). Propensity score matching (PSM), as proposed by Rosenbaum and Rubin (1983), is a commonly used method to reduce bias in the estimation of treatment effects with observational data sets. The idea is to create a comparison group of non-treated households that is as similar as possible to the treatment group in relation to the observed characteristics. Members of the comparison groups are selected as per their propensity score, defined as;

$$P_r(W) = Pr(X=1|W) \text{ and } (0 < P_r(W) < 1) \quad (3)$$

where  $X$  is the treatment indicator and  $W$  is the set of covariates unaffected by programme intervention. The treatment probabilities,  $P_r(W)$ , are called propensity scores which strictly lie between 0 and 1.

To ensure correct identification and consistent estimates of the average treatment effect on the treated (ATT) we need to satisfy two important assumptions: the conditional independence or unconfoundedness, and overlap or the common support condition. The first assumption of conditional independence or unconfoundedness implies that the assignment to treatment is independent of outcomes, but conditional on the covariates ( $Y_0; Y_1 \perp W|X$ ). The common support assumption refers to the condition where the probability of assignment varies between 0 and 1. It implies that there are treated and comparison households with the similar observable characteristics ( $0 < Pr(W = 1|X) < 1$  [Rosenbaum and Rubin 1983, 1984]). By holding these conditions, ATT is estimated non-parametrically by the mean conditional difference in the

outcome using the common support, and weighted by the distribution of the probability of treatment assignment,  $P_r(W)$  in the treatment group.

There are several ways to construct a comparison group using PSM. To apply PSM, we use the STATA statistical package developed by Leuven and Sianes (2003). We apply three PSM methods: neighbourhood matching, caliper matching, and kernel matching to find a more appropriate comparison group. After comparing the balancing outcome for the covariates, kernel matching with bandwidth of 0.03 appears to be the best matching method to get a comparison group where mean bias is less than 5 per cent after matching (for details, see Table A2). We used kernel matching, as it reduces the bias most without losing many observations. After matching, we find that there is a difference between treatment and comparison group in relation to ethnicity and location (village). Based on the results of reduction in bias after the kernel matching, this difference (3.6 per cent bias) can be ignored (Figures 1 and 2).

Figure 1: Reduction in bias after matching

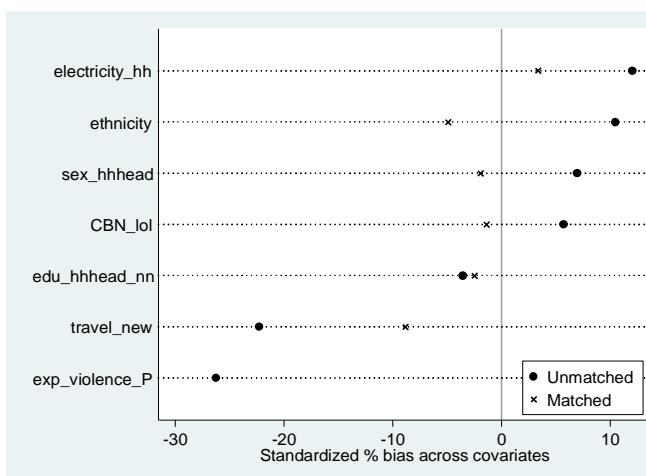
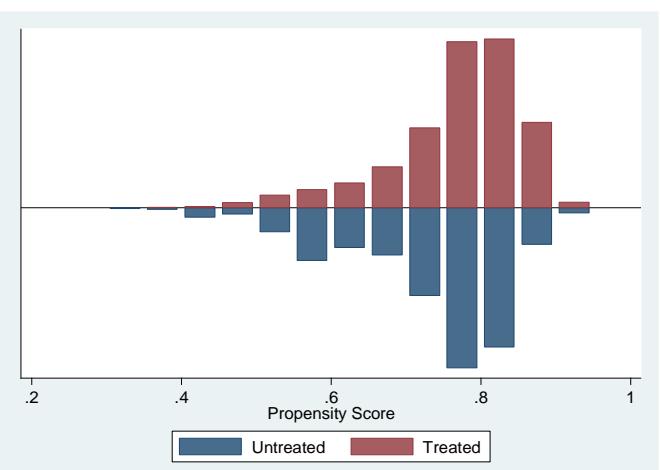


Figure 2: Propensity score matching for treated and untreated



Source: Authors' calculations based on survey data.

In implementing the PSM method, we estimate a probit model using baseline (2008) data to generate the propensity score. We include all the crucial variables that can affect both the treatment and outcome variables in predicting the propensity scores (Table A3). There are many observations for both treatment and comparison groups even after the matching exercise. The total number of observations is 5,148, while after matching it reduces to 3,580 with enough variation between treatment and comparison.

We assess the impact of the CHTDF programme on maternal health-care utilization by estimating the ATT through applying two different estimation designs: a regression based DiD estimator with and without covariates and PSM. A comparative analysis of these two estimations provides the sensitivity analysis of our results. Furthermore, we are interested in identifying impact heterogeneity in terms of ethnicity of household and violence experience, as well as perception, settlement of non-indigenous people in indigenous people's land, and economic status. The innovative feature of this impact evaluation is the incorporation of conflict variables in terms of violence exposure and fear of violence, or insecurity in estimating the treatment effect on utilization of maternal health care. Impact heterogeneity estimates by ethnicity and poverty will provide evidence on equity aspects of the programme. Studies find that indigenous population have a poor performance in terms of reproductive and maternal health issues (Islam 2010: 1). Similarly, poor people have a lower demand for health care compared to rich people, assuming health is a normal good, where price elasticity of demand is also at work (Gertler et al.

1987). As the majority of the population in the CHT region lives under the poverty line, it would be useful to see whether poor households adequately benefit from programme intervention.

The effect of the programme is expected to vary along these dimensions. As the indigenous people are the most affected community during the conflict it is expected that the programme would have a higher impact on them. By contrast, the experience of violence as well as the fear of violence could have an adverse effect on programme implementation, which in turn would have negative effects on people's awareness of health related problems and treatments, resulting in decreased service utilization. Variations in the impact of the programme by economic status could result from biases in providing services to the affluent. The impact heterogeneity is estimated applying a linear probability model where we regress health-care utilization on the treatment variable, the covariates, and a set of interactions between treatment and covariates of interest.

Our estimation results are not a control for the quality of service or quality of programme implementation, due to the absence of data. We deal with this issue by controlling for the district level fixed effect. In the event of bias in the estimated ATT due to omitted variables, such biases can work in the same direction for both treatment and control groups.

### **4.3 Data and descriptive statistics**

The empirical evidence presented in this paper is based on two household surveys in the CHT region, conducted in 2008 and 2013. The first survey established a baseline status for households in terms of demographic variables, socio-economic indicators, and confidence building measures. Therefore, to establish a baseline for the programme in future, sample villages were selected from the list of villages where no programme intervention was present in 2008. The geographical coverage and dispersion of the sample villages were considered in the sample selection process. The baseline survey in 2008 covered 199 villages in 29 unions of 13 upazillas, while in the follow-up survey in 2013, a total of 174 villages under 24 unions in 13 upazillas of three CHT districts were brought under the survey. The majority of the villages (77 per cent) is inhabited by one or more indigenous community/(ies), whereas 16 per cent of villages are inhabited by only Bengalis, and the remaining villages (7 per cent) are mixed. There are on average 46 households in a village in the region (Barkat et al. 2009: 28–9).

Identifying villages without CHTDF programme implementation at the time of the baseline survey was not difficult as most of the villages in the region were discovered by the programme. There were few other agencies working in some villages in the region, so that with the help of the CHTDF programme, a list of villages in sample unions where there was no additional programme intervention by other development agencies could be prepared. It was the first survey at the household level to provide reliable statistics about the socio-economic situation of the people living in this region. The follow-up survey in 2013 was commissioned to track changes in the lives of people due to the CHTDF's programme in the region. In this connection, the survey was designed using an intervention (or treatment) and control approach. At the time of the survey in early 2013, the CHTDF programme had been implemented in 20 out of a total of 25 sub-districts. Treatment households were chosen from the programme implementation region, while comparison households were chosen from areas of non-implementation by CHTDF or any other development agencies. Sampling was done scientifically to ensure representativeness of the two categories: treatment and comparison.

Both household surveys used multi-stage stratified random sampling, where the village was the primary sampling unit. Sample villages were selected randomly using probability proportionate to size on the basis of the list of villages both in treatment and comparison categories. At the final stage, households were selected from the sampled villages applying systematic randomness. As the surveys aimed to ensure representation of each ethnicity, randomness was compromised due

to the absence of complete information on ethnic distribution of households at a village level prior to the data collection. This makes the external validity of the analysis questionable. However, there is enough room for internal validation, which is why we are able to utilize average treatment effect as an estimation model for the treated.

As the second household survey in 2013 followed the experimental study design using a treatment-control approach, we feel reasonably confident about making use of the baseline information to estimate the impact of CHTDF programme intervention following a quasi-experimental or observational study design. After careful investigation of the sampling procedures followed in both surveys, it was revealed that the five sub-districts considered as the non-implementation region in 2013 were included in the baseline survey in 2008. The number of sample households selected from these non-implementation sub-districts in both the surveys is large enough for our estimation purposes. Finally, the total number of sample households for the treatment group is 3,783, while for comparison group it is 1,365, although after matching the number of observations was reduced to 2,710 and 870 for the treatment and comparison groups respectively.

These two household surveys are noteworthy in terms of development and policy formulation. First, the CHT region is not included in the national surveys, such as the demographic and health surveys, and the household income/expenditure surveys which are regarded as the main source of information on various developmental issues. Even when the region is included in surveys, the data are unrepresentative of the region, and no data sets at the household level are available in the public domain. Second, a majority of indigenous people of this region are seriously disadvantaged in terms of measurable socio-economic indicators. Geographically, this region is regarded as either inaccessible or hard to reach for development outreach activities. Third, this region happens to be conflict ridden, and collecting data is challenging, risky, and expensive. Finally, the two household surveys in CHT provide a wealth of information in terms of the breadth of their coverage on topics ranging from demographic factors, asset ownership, employment, crop production, income, expenditure, education, health, reproductive health, water-sanitation, access to services, and post-conflict confidence building.

The outcome variables on maternal health-care utilization are: ANC received, deliveries attended by trained provider, and delivery at health facility. Data on reproductive health and safe delivery were collected from women of the reproductive age cohort (15 to 49 years). Data on ANC were collected based on the experience of the women who had had a delivery in the three years preceding the survey. Women in households of the reproductive age group were asked whether they received any ANC during their pregnancy. The response was coded as a dummy variable: yes (1) or no (0). In a similar fashion, data on delivery attended by a trained provider and delivery at a health facility were collected from eligible women. To define medically trained providers for delivery care we apply the definition used by NIPORT et al. 2013.<sup>2</sup> Delivery at a health facility refers to the union health and family welfare centre (UHFWC), upazila health complex (UHC), and district hospitals. Since data on these three variables on maternal health-care utilization could be collected only from those households where eligible women could be found, the number of observations decreased. In the case of more than one eligible woman in the household, the woman who experienced delivery most recently was included in the survey.

Descriptive statistics with a simple mean differences test established the fact that there are improvements in maternal health-care utilization among the treated households relative to comparison households. The difference in utilizing ANC services and delivery attended by a

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<sup>2</sup> According to the Bangladesh Health and Demographic Survey 2011, a medically trained provider is either a qualified doctor, nurse, midwife, paramedic, family welfare visitor (FWV), CSBA, medical assistant (MA), or sub-assistant community medical officer (SACMO) (NIPORT et al. 2013: 122).

trained provider between treatment and comparison groups is statistically significant except for delivery at a facility. The results of the mean difference test are found similar for both the unmatched and matched samples (Table 1).

The covariates affecting both treatment and outcome variables included in estimation of the PSM are shown in the second panel of Table 1: ethnicity of the household, sex, and education level of the household head, the household's access to electricity, and poverty status of households as per the national poverty line (lower poverty line based on the basic needs method). There are two other covariates that are measured at the village level: distance between village and sub-district headquarters and the conflict situation at the village level. Distance is measured in terms of travel time (in hours) needed for a round trip. Travel time is a good predictor of distance, as the region is hilly and people do not have an accurate knowledge of physical distance. Distance is a strong predictor of the demand for health-care services, although the CHTDF intervention aims to provide services on the doorstep, and may encourage indigenous people to use modern health-care services. Indigenous communities in this region largely depend on traditional medicine and healing practices. The incidence of violent conflict is assumed as another crucial predictor of programme effectiveness, as it influences both service providers and household behaviour in maternal health-care utilization. Even after matching, the treatment and comparison households have significant differences in term of ethnicity and distance from the sub-district (Table 1).

Table 1: Descriptive statistics by treatment and comparison group

Variables	All households; before matching				After matching*			
	Treatment	Comparison	t-Stat	N	Treatment	Comparison	t-Stat	N
<b>Outcomes variables</b>								
ANC check-up (yes=1)	0.34	0.19	8.95	3783	0.30	0.19	6.61	3779
Delivery attended by trained provider (yes=1)	0.19	0.11	5.14	3698	0.17	0.11	4.14	3695
Delivery at health facility (yes=1)	0.08	0.06	1.84	3664	0.08	0.07	1.08	3661
<b>Covariates included in the matching</b>								
Ethnicity of households (indigenous =1)	0.57	0.52	2.64	5148	0.55	0.58	2.09	3580
Distance from upazila (travel time in hours)	2.1	2.4	5.68	5148	2.1	2.3	3.57	3580
Status of violence (Yes=1)	0.17	0.21	5.04	5148	0.17	0.16	1.04	3580
Poverty status (poor household=1)	0.63	0.60	2.25	5148	0.70	0.71	0.33	3580
Access to electricity (yes=1)	0.29	0.23	4.47	5148	0.24	0.22	1.02	3580
Sex of household head (male=1)	0.92	0.90	2.65	5148	0.92	0.93	0.75	3580
Education of household head (educated=1)	0.33	0.32	0.92	5148	0.32	0.32	0.70	3580
<b>Covariates not included in matching</b>								
Annual income per capita (in Taka)	15968	15239	2.35	5148	14144	13249	2.93	3580
Household living in high settlement area (yes=1)	0.47	0.59	7.21	5148	0.50	0.55	2.49	3580
Household perceiving insecurity (yes=1)	0.74	0.73	1.52	5148	0.78	0.77	1.25	3580
Note: PSM method ( <i>psmatch2</i> ) is applied to correct the bias emerging from the non-random placement of the treatment, and differences in observable characteristics at the baseline, which leads to violation of the assumption of conditional independence. For matching, we use a probit model and carry out kernel matching using 0.03 bandwidth.								
Source: Authors' calculations.								

There are several other variables working as important predictors in estimating the heterogeneous impact of the treatment shown in the third panel of Table 1. Economic affluence measured as income per capita could have a positive effect on maternal health-care utilization, although CHTDF programme delivers services at a token price. It might be interesting to investigate the impact of the settlement of Bengali speaking people in the region, since it is considered the prime cause of conflict in the region. The settlement variable is a geographical variable measured at the union level where households living in the high settlement area were coded as 1, and otherwise 0. Finally, it would be essential to identify the impact of household perceptions of violence or insecurity on maternal health-care utilization. Although 17–21 per cent of households reported actual exposure to violence, a majority of the population (73–74 per cent) recorded their perceived insecurity. We did not include these three covariates in the probit estimation, as they are highly collinear with a few other covariates.

In addition to estimating the treatment effect, this paper aims to gauge the effect of violence, which has different dimensions in terms of the past and the future. First, violent conflict refers to household's *previous* experience of violence (the three years preceding the survey) and second, perceptions (fear) of *future* violence. Both the violence variables (experience and fear) are considered as measures of post-conflict violence and/or post-conflict risk of violence. Data on fears about future violence are a very special feature of this data set. Any post-conflict societies face two distinct types of challenges: economic recovery and reduction of the risk of conflict recurrence (Collier et al. 2008).

Data on the recent exposure to violence (during the three years preceding the survey) are an aggregate variable, which is a simple aggregate of two indicators: communal riots, and oppression by the army or other security forces. All these indicators are binary outcome variables taking the value of 0 (no experience) or 1 (experience). It does not take into account the degree of exposure to violence. As the data are household specific, violence experienced by any member of the household is applicable to the entire household. There is a possibility that a particular household could have exposure to more than one type of violence, and these two types of violence could arguably be interrelated with each other. Thus, it is reasonable to prepare an aggregate variable ‘any experience of violence’ which is also a dummy variable. To avoid missing data problems, we estimated this variable at the village level, assuming that such violent incidents usually occur at the village level, and households are affected by this.

The most crucial and innovative variable used in this paper is the household’s current perception of future violence (at the time of survey) which reflects a distinct post-conflict risk. The variable current fear of violence is measured through the same two indicators as with past experience of violence. Again, these are binary (0,1) outcomes. The magnitude or degree of fear of violence perceived by households was not taken into consideration during data collection. There is a possibility that a particular household could have more than one type of apprehension about future prospects of violence. Again, these two sub-components are aggregated into a dummy variable where 1 refers the existence of fear or insecurity and 0 otherwise. Similar to the experience of violence, this fear variable is also household specific, reported by an adult member of the household (in most cases the head of the household), and assumed to be a proxy for all members of that particular household. We estimate this variable at the village level also to avoid the missing data problem and assuming that household perceptions are affected by their neighbours’ experiences and perceptions.

Collecting and analysing the data on fear of violence is crucial to the understanding of post-conflict development and peace-confidence building challenges in the CHT and elsewhere, as most intra-state post-conflict situations are characterized by a substantial risk of conflict reignition (Collier et al. 2008). Successful implementation of a peace treaty is a challenging and complex issue. Murshed (2010) found that after the Cold War (between 1991 and 2005), 148 peace accords were signed and about 70 per cent (104) of these treaties appear to have been implemented successfully. The other 44 treaties (30 per cent) are reported to have failed. Even after a conflict has formally ceased with the signing of a peace accord, there is a tendency for conflict to persist. This makes it difficult to find a completely peaceful post-conflict scenario.

## 5 Results and discussion

The results of the impact evaluation of the CHTDF programme are presented in the following order. We first discuss the main impact effects of the CHTDF programme on three types of maternal health-care utilization. Subsequently, we will shed light on the role of violence and insecurity on the effectiveness of the programme, with particular reference to maternal health-care utilization. Finally, we concern ourselves with equity aspects, as ethnic identity and the economic status of the household are found to be central to inclusion.

### 5.1 The impact of CHTDF on maternal health-care utilization

The estimated impact of the programme on maternal health-care utilization, before and after matching, is shown in Table 2. We show results of DiD estimators under the unmatched sample but we will rely more on the results of DiD estimators under the matched sample. Results of DiD estimators from both unmatched and matched samples reveal the sensitivity or robustness of the results. We only interpret the results obtained after matching.

Estimates using DiD before matching explicitly show a substantial and statistically significant difference between treatment and comparison households in utilizing maternal health care. In case of multivariate DiD, the estimated change for an ANC check-up is not statistically significant, however the result is statistically significant for delivery care. The reliability of this unmatched estimation is under question because of selection bias. After correcting for the selection bias through PSM, the estimated result indicates a major success of the programme in increasing ANC use in the treatment group. In the case of deliveries attended by trained providers, the programme is also successful, although the increase is smaller. The estimated ATT implies that utilization of an ANC check-up rises by 15 percentage points in the treatment group, while delivery attended by a trained provider increases by 8 percentage points in the same group. The estimated effect of the programme on ANC check-up and on delivery attended by a trained provider is statistically robust, as the impact is statistically significant in both unmatched and matched estimations. Although the estimated result indicates an impressive success in the case of utilizing ANC and delivery care, we do not find any statistically significant increase in delivery at a health facility, especially after matching.

Table 2: Programme effectiveness on maternal health-care utilization

Outcome indicator	Before matching				After PSM matching <sup>b</sup>	
	Mean difference	t-Stat	Multivariate regression based DiD (ATT) <sup>a</sup>	t-Stat	ATT	t-Stat
ANC check-up received	0.157***	8.95	0.02	0.60	0.149***	8.98
Delivery attended by trained provider	0.074***	5.14	0.16***	5.08	0.077***	5.68
Delivery at health facility	0.019*	1.85	0.13***	5.32	0.011	1.06

Note: We run a linear probability model using covariates: age, sex, and education status of household head, ethnicity and access to electricity of household, poverty status, distance from sub-district, and district dummy.

In utilizing PSM we apply the kernel matching method using a 0.03 bandwidth. We carry out matching for each outcome variable independently as the number of observations varies.

\*\*\* significant at 1%, \*\* significant at 5% and \* significant at 10%.

Source: Authors' calculations.

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The impact of demand-side incentives in the form of financial incentives on maternal health-care utilization is found to be positive in a number of studies in other parts of Bangladesh (Ahmed and Khan 2011: 1704–10; Nguyen et al. 2012: 989–96). It is argued that availability of proper infrastructure and quality of service are two important factors in increasing demand for health care (Jackson and Hanson 2012: 271–84). Given the programme design, the limited capacity of health infrastructure, lack of proper communication facilities, and the sociocultural context of the region, it is not reasonable to expect substantial improvements in CHT. Several studies show that along with sociocultural taboos, poor health infrastructure and communication facilities are the main obstacles to providing services in the region (Islam 2010; Tuhin 2015). Despite these obstacles, improvements in the provision of facilities have been made by CHTDF interventions.

## 5.2 Violence and CHTDF programme effectiveness

To investigate the impact of post-conflict violence on the effectiveness of the programme in relation to the utilization of various types of maternal health care we use three different variables as proxies for post-conflict violence and insecurity. The first variable of interest is settlement of the Bengali speaking population. It is the principal cause of ethnic tensions and conflict in this region. The geographical pattern and intensity of settlement, could, therefore have an influence on programme impact. As indicated, we include past experience of violence and perceptions (for

the future) of insecurity or fear of violence. To estimate the combined effect of the programme intervention and violence, we take interaction of treatment and the relevant violence variable and run the regression. We estimate ATT using a multivariate regression model.

Table 3: Impact of programme and violence on maternal health-care utilization

Impact heterogeneity indicator	Maternal health-care utilization		
	ANC check-up	Delivery attended by trained provider	Delivery at health facility
Treatment x Settlement	-0.002	-0.148***	-0.019
Treatment x Violence experience	-0.053	-0.044	-0.0000
Treatment x Insecurity perception	-0.023	-0.043	-0.132**

Note: We use a linear probability model in this estimation. We run separate regressions for all interaction variables, as they are highly correlated with each other. Each model includes all the covariates that interacted with the treatment variable. Other general covariates include age, sex, and education status of household head, ethnicity and access to electricity of household, poverty status, distance from sub-district and district dummy to control district level variations.

\*\*\* significant at 1%, \*\* significant at 5% and \* significant at 10%

Source: Authors' calculations.

According to the estimated results indicated in Table 3, all three variables measuring past and contemporary violence have a clearly negative impact on the effectiveness of the programme, although they are not statistically significant for every aspect of maternal health-care utilization. The impact of settlement interacted with treatment on delivery attended by trained by provider is found to be negative and statistically significant. The estimated coefficient shows that there is a decrease in delivery attended by the trained provider by about 15 percentage points for the treated group. In other words, if there were no settlement, delivery attended by the trained provider would have been 15 percentage points greater.

However, the impact of interaction between treatment and exposure to violence by households does not show any statistical significance on maternal health-care utilization. It implies that the treatment effect is strong enough to offset the negative effect of experience of violence on the utilization of health care, but cannot eliminate it completely. Perhaps this is due to the programme intervention paying close attention to direct victims of violence. The estimated effect is negative and significant if we do not control for district fixed effects in the regression. Although different studies demonstrate a negative effect of civil war on various health outcomes, there is very limited evidence on the impact of civil war on health-care utilization.

Similar to the interaction term for treatment and experience of violence, the estimated interaction effect of perception of insecurity or fear of violence with the treatment shows a negative impact on maternal health-care utilization. Although the estimated impact is not statistically significant for an ANC check-up and delivery attended by a trained provider, we have found significant negative impact on delivery at a health facility. In the treatment group there is a 13 percentage point decrease in delivery at a health facility due to the fear of violence or perception of insecurity. It implies that the treatment effect on delivery at a health facility could have been 13 percentage points greater in the absence of insecurity or fear of violence. This result establishes the fact that the risk of post-conflict violence has a detrimental effect on health-care utilization. In recent studies, it is argued that the indirect effect of armed conflict or civil war may be more far reaching than its direct effects. Psychological scars or trauma created by civil war violence is a serious matter for health outcomes (Camacho 2008: 511–15).

### 5.3 Equity issues in the impact of the programme

With respect to ethnicity of household, the study finds that indigenous households do not benefit as much as the Bengali speaking households in the programme area (Table 4). Estimates show that the interaction effect on treatment and ethnicity has a strong and statistically negative impact on maternal health-care utilization across the board. There is a 13 percentage point decline in ANC check-up, a 10 percentage point decrease in delivery attended by a trained provider, and a 4 percentage point reduction in delivery at a health facility as indicated in the estimated results. Since the CHTDF programme is being implemented as a post-conflict development programme it is expected that the main victims of the conflict, the indigenous population, would be targeted more than anyone else, but this has clearly not occurred.

Table 4: Equity in the impact of programme on maternal health-care utilization

Impact heterogeneity indicator	Maternal health-care utilization		
	ANC check-up	Delivery attended by trained provider	Delivery at health facility
<b>Equity impact by ethnicity</b>			
Treatment	0.20***	0.12***	0.03**
Ethnicity	-0.09**	-0.04	0.02
Treatment x ethnicity	-0.13***	-0.098***	-0.038*
<b>Equity impact by poverty</b>			
Treatment	0.17***	0.08***	0.04**
Poverty	0.002	0.008	0.02
Treatment x poverty	-0.06*	-0.03	-0.04*

Note: We use a linear probability model in this estimation. We run separate regressions for all of these interaction variables as they are highly correlated with each other. Each model includes all the covariates that were interacted with the treatment variable. Other general covariates are: age, sex, and education status of household head, ethnicity and access to electricity of household, poverty status, distance from sub-district, and district dummy to control district level variation.

\*\*\* significant at 1%, \*\* significant at 5% and \* significant at 10%

Source: Authors' calculations.

Our results suggest that in the treatment group, poor households are behind in maternal health-care usage compared to the non-poor. The estimated utilization of an ANC check-up is 6 percentage points lower, while utilization of a health facility for child delivery is about 4 percentage points lower for poor households compared to the rich in the treatment areas. This lower utilization status of using an ANC check-up and health facility use at the time of delivery by poor households is statistically significant. Deliveries attended by trained providers are also found to be lower for poor households, but statistically insignificant.

## 6 Conclusion

In this paper we have attempted to carry out an impact evaluation exercise of health interventions made by a UN development agency (UNDP-CHTDF) with a particular focus on usage, not just health outcomes, as is standard in the majority of the literature. The programme intervention under study has not only a health improvement dimension, but also other facets including education, employment, empowerment, and confidence building. It may be difficult to disentangle one component of the programme from its many other facets. The region we research is a post-conflict zone, and akin to other post-conflict societies in the developing world, there is a clear and present danger of the recurrence of conflict.

Our research questions include: (i) the impact of the CHTDF programme intervention on household's utilization of maternal health services; (ii) the effect of violent experiences, and fear of future violence on the programme intervention; and (iii) the success of the programme across ethnic and socio-economic fault lines. The programme has been an overall success in raising maternal health-care utilization. However, we find that violence in the two dimensions uniquely studied in this paper related to previous experiences of violence as well as current apprehension about recurring violence reduces use of health facilities provided by the programme interventions. Quite obviously, present perceptions are based on past experiences, particularly if we are to believe in a Bayesian framework of expectations formation.

Interaction effect of the programme intervention in the presence of violence is variable, which suggests that the programme in a post-conflict region has been partially successful in a few areas, particularly in tackling the impact of past experiences of violence on health service use. But when we view the programme through an affirmative action lens, it still leaves the indigenous people behind, as their take up of services still lags behind the relatively more advantaged Bengali speaking population (it has to be borne in mind that both groups are poor). Even if the programme has increased the absolute uptake among the indigenous, the gap between Bengali speaking and the indigenous peoples linger, and this has important consequences for the future risk of conflict, as gaps between communities can raise the risk of conflict when the average level of achievement of both or all groups has risen in absolute terms, according to the relative deprivation theories put forward by Ted Gurr (1970). The enduring inequality in health remains an important issue to be addressed, as is the restitution of land occupied by settlers, arguably not a politically feasible option in the land hungry context of Bangladesh.

The major policy ramifications of our project, not just for the CHT region in Bangladesh but also for other developing areas, concern both conflict prevention and affirmative action, which help to reduce the risk of conflict. The occurrence of violent organized conflict or rebellion requires mobilization (Tilly 1977). Grievances need resources in order to convert discontent into organized rebellion; but also the flames of conflict are fanned by a 'victim like' narrative and psychological framing in the mind of the oppressed. Unless gaps in achievement including health outcomes between the antagonists are reduced there is every chance of victimhood notions being perpetuated. In the present context, conflict prevention and confidence building require that the gaps between Bengalis and the indigenous people of the CHT are narrowed, and the land seizure grievance is mollified. The forced settlement issue is central to this conflict, and according to our findings can diminish the use of maternal health-care facilities among the indigenous people. Ultimately, conflict preventing affirmative action would necessitate greater efforts at outreach of development initiatives, including in the health sector, to the indigenous population of CHT.

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## Appendices

Table A1: Characteristics of household in baseline and follow-up survey before matching

Type of service	Pre-treatment baseline in 2008			Follow-up survey in 2013		
	Treatment	Comparison	T-stat (p-value)	Treatment	Comparison	T-stat (p-value)
Ethnicity of household (Indigenous=1)	0.56	0.51	0.0084	0.57	0.54	0.3070
Household size	5.29	5.08	0.0124	5.13	5.16	0.8072
Age of household head	43.27	44.60	0.0179	44.76	44.02	0.2499
Sex of household head (Male=1)	0.92	0.87	0.0005	0.92	0.92	0.9948
Education of household head (years of schooling)	0.96	1.00	0.4145	1.07	.94	0.0154
Distance between village and sub-district (travel time in hours)	2.15	2.84	0.0000	1.63	1.69	0.3323
Per capita income (in Taka)	12735	12098	0.0020	21841	19660	0.0008
Per capita land (in acres)	0.49	0.41	0.0074	0.63	0.64	0.8407
Access to electricity (Yes=1)	0.17	0.13	0.0077	0.49	0.35	0.0000
No. of observations	2440	798	-	1343	567	-

Source: Authors' calculations.

Table A2: Covariate balancing indicators before and after matching

Matching estimators	Number of observation		Probit pseudo R <sup>2</sup>		p>chi2	Mean bias (%)	
	Treatment	Comparison	Before	After	After	Before	After
Nearest neighbour matching	2710	870	0.027	0.021	0.000	12.4	10.7
K(3)-nearest neighbours matching	2710	870	0.027	0.010	0.000	12.4	7.9
K(5)-nearest neighbours matching	2710	870	0.027	0.007	0.000	12.4	6.4
Radius matching (0.05)	2710	870	0.027	0.003	0.001	12.4	4.2
Kernel matching (bandwidth 0.03)	2710	870	0.027	0.002	0.017	12.4	3.6
Kernel matching (bandwidth 0.05)	2710	870	0.027	0.003	0.004	12.4	4.0

Source: Authors' calculations.

Table A3: Probit model results for the estimation of the propensity score

Variables	Probit model: Marginal value of the coefficient	Standard error
Ethnicity (indigenous household=1)	0.181***	(0.0512)
Distance from upazila HQ (travel time in hours)	-0.0568***	(0.00880)
Status of violence (Yes=1)	-1.014***	(0.118)
Poverty status (poor household=1)	0.0900	(0.0556)
Access to electricity (Yes=1)	0.259***	(0.0706)
Sex of household head (Male=1)	0.330***	(0.0834)
Education of household head (primary and above=1)	-0.0747	(0.0541)
Constant	0.549***	(0.0938)
Number of observations = 3,238		
Pseudo R <sup>2</sup> = 0.0422		
Prob > chi2 = 0.0000		
Log likelihood = -1731.7904		
*** significant at 1%, ** significant at 5% and * significant at 10%		

Source: Authors' calculations.

Table A4: Maternal health-care utilization by ethnicity status using PSM method

Outcome indicator	Bengali household		Indigenous household		Bengali to indigenous
	Mean difference	t-Stat	ATT	t-Stat	ratio
ANC check-up received	0.243	8.34	0.065	2.97	3.7
Delivery attended by trained provider	0.17	7.00	0.20	1.15	0.85
Delivery at health facility	0.04	2.54	-0.006	0.41	6.6

Source: Authors' calculations.

Table A5: Maternal health-care utilization by poverty status using PSM method

Outcome indicator	Non-poor household		Poor household		Non-poor to poor ratio
	ATT	t-Stat	ATT	t-Stat	
ANC check-up received	0.198	5.94	0.123	6.50	1.6
Delivery attended by trained provider	0.094	3.47	0.067	4.35	1.5
Delivery at health facility	0.031	1.55	0.0003	0.03	100

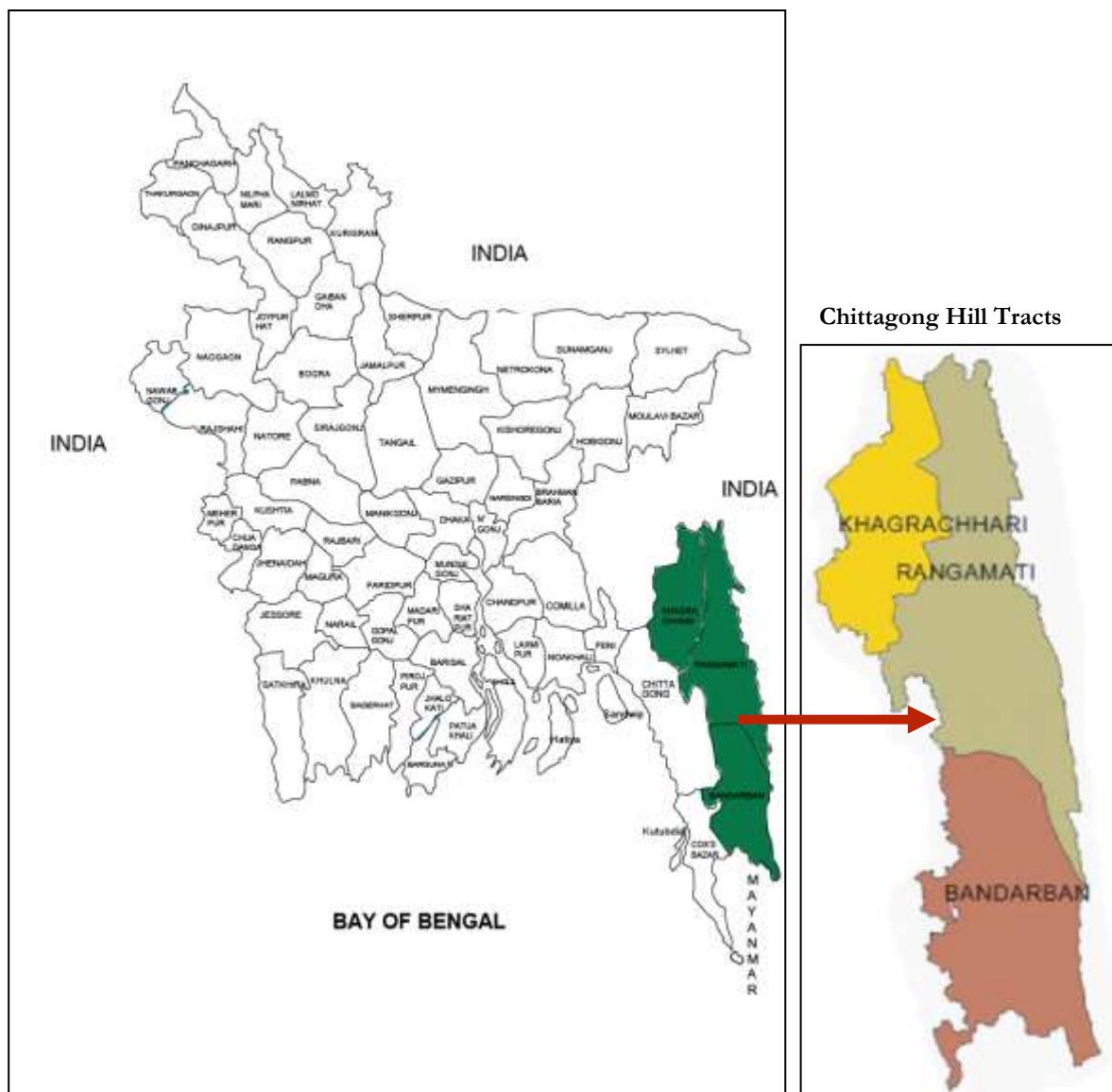
Source: Authors' calculations.

Table A6: Unadjusted estimates of the use of maternal health services in 2008 and 2013

Type of service	2008			2013		
	Intervention area	Comparison area	T-stat (p-value)	Intervention area	Comparison area	T-stat (p-value)
ANC care received	0.25	0.11	0.0000	0.628	0.447	0.0000
No. of observations	2182	688		725	188	
Delivery attended by trained provider	0.14	0.11	0.0210	0.123	0.123	0.0000
No. of observations	2192	694		618	194	
Delivery at health facilities	0.05	0.06	0.3547	0.224	0.097	0.0001
No. of observations	2192	694		584	194	

Source: Authors' calculations.

Appendix B: Map of Chittagong Hill Tracts in Bangladesh



Source: Authors' illustration.