Building resilience in the chars of Bangladesh: An impact assessment

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1. Introduction

In recent years, Bangladesh has made rapid economic and social progress. In particular, the country has been successful in achieving a number of its Millennium Development Goals (MDG), such as, reducing headcount poverty and also the poverty gap ratio, reducing the proportion of underweight children and under five mortality rates, and attaining gender parity in primary and secondary education (GoB,2013). Despite these achievements, 14.8% of the country's population still lives below $1.90/day (WB, 2016), that is, the international poverty line.[2]

According to the country's poverty map (HIES, 2010), extreme poverty is concentrated in the north, that is, the highlands, and along the coastal regions in the south which includes river islands called chars (Figure 1). Thus, it comes as no surprise that, over the decades, social protection and social safety net programs[3] have targeted these areas. This paper focuses on the char population living along the coastal areas of Bangladesh.[4]

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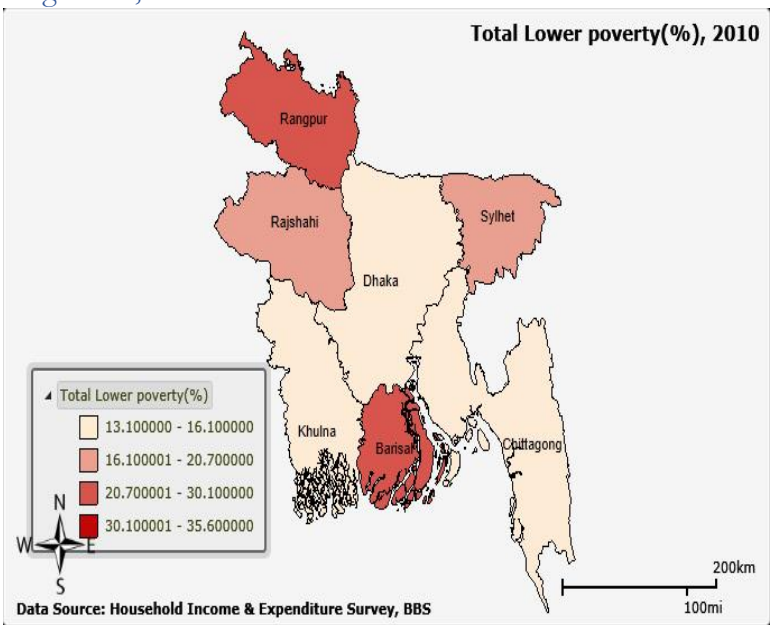
[2] 2011 PPP, https://data.worldbank.org/indicator/SI.POV.DDAY?locations=BD. Last accessed: September 23rd, 2019.

[3] Social safety net programs usually aim to alleviate the short-term effects of shocks through food/cash transfer and are considered as a form of insurance (World Bank, 1990). In contrast, social protection programmes adopt a broader perspective. That includes policies and programs objective to at alleviate different forms of vulnerabilities through effective labour markets, reducing exposure to risks and developing the capacity to protect themselves against shocks, any disruption or loss of income (Baulch et al., 2008).

[4] Bangladesh has a combined area of 47,200sq km, which is almost 32% of the total area of the country. It is inhabited by about 40 million people with about 3 million living on 185 fertile silt islands, known as river chars that are formed by the dynamics of erosion and accretion in the rivers of Bangladesh (Koen de Wilde, 2011).

Figure 1: Poverty map of Bangladesh, HIES 2010



There is considerable international evidence and also in the Bangladeshi context which shows that social protection and safety net programs have had positive impacts on targeted populations living in extreme poverty (Das, Raza, & Misha, 2009; Misha, Raza, Ara, & Poel, 2014). These programs often combine microfinance with other interventions. While there is evidence showing that microfinance programs on their own have positive effects on savings, asset holdings, food security and education (Adjei & Arun, 2009; Barnes et al., 2001), it has often been argued that microfinance by itself is unable to benefit everyone (Amin et al., 2003; Banerjee et al., 2013; Crépon et al., 2011; Giné et al., 2011). Most importantly, an occasional, single shock can push vulnerable households back into poverty. Therefore, a comprehensive approach that encompasses simultaneous efforts on income generation, health support, and access to education, among others, is thought to be more effective (Fields & Lipton, 2000). In Bangladesh, the NGO BRAC has pioneered such a multi-intervention integrated approach. More generally, such approaches include conditional and unconditional cash transfer programs (Behrman & Hoddinott, 2001; Gertler, 2004; Haushofer & Shapiro, 2016; Rawlings & Rubio, 2005; Skoufias, 2001), asset transfers (Bandiera et al., 2013; A. Banerjee et al., 2015; Misha et al., 2014; Raza et al., 2012), as well as livelihood support programs (Bouis, 2000; Nielsen et al., 2003).

This paper deals with the effect of an integrated program implemented by BRAC in the char lands of Bangladesh. These chars offer a distinctive landscape consisting of a number of islands connected to the mainland through rivers, creeks and estuaries.[5] They are mostly newly formed land areas and a majority are located some distance from the mainland. Government administration and law and enforcement agencies are often lacking in these areas. Lack of proper infrastructure makes access to health facilities, education, and functioning markets difficult. Livelihood strategies in these areas are quite different from the other parts of the country since they are considerably more susceptible to covariate shocks due to their exposure to cyclones, erosion, water logging, droughts and salinity intrusion. Baqee (1998) characterises the char population as "some of the most desperate people in the country". Not just in Bangladesh but also

[5] *Chars* which may appear in the form of riverine islands or may also be connected to the mainland, are not unique to Bangladesh. They appear in eastern Uttar Pradesh and Bihar in India where they are called *diaras*. In Pakistan, such lands are described as *kuchha* (not permanent). For details, see Lahiri-Datt and Samanta (2013).

in the upper realms of the Gangetic plains and in West Bengal, India. Lahiri-Dutt & Samanta (2013) indicate that the chars are settled "by the poorest".

A number of tailored interventions have been designed and implemented to improve the livelihoods of the char dwellers (de Wilde, 2011).[6] While development interventions targeting the coastal populations started during the late 70's, the current paper deals with a program called the Char Development and Settlement Programme which was initiated in 1994 and has since expanded and is currently in its fourth phase (further details are provided in Section 2.1). This program includes a range of components that target both infrastructure and livelihoods in the chars.

Despite the growth of the CDSP and other similar programs, the effectiveness of integrated programs implemented in the chars remains largely unexplored. Credible evidence is urgently needed to (re-)design and facilitate further expansion of programs such as the CDSP. The evidence that does exist is based on two rounds of post-intervention data, where Raza et al., (2011) use a propensity score matching approach followed by difference-in-differences (DiD) to examine the effect of CDSP III. They find significant impact on per capita income, living condition of the households and also on secondary school enrolment rates.

More generally, that is, setting aside impact evaluations, there is a relatively small literature on life in the chars. For instance, Adnan (2013a) provides an analysis of the conjectural and empirical aspects of the interrelationships between land grabs, primitive accumulation and accumulation by dispossession through the capitalist development perspective. Ali (1999) examines the effects of climate change, in terms of tropical cyclones, storm surges, coastal erosion and backwater, on the char population and a study by Shah Alam Khan (2008) examines disaster preparedness and finds that a participatory approach is indispensable when planning and designing structural interventions for prevention and mitigation of natural disasters in addition to wider access to education and awareness building programs.

This study investigates the impacts of the Char Development and Settlement Programme (CDSP) on the livelihood status of the people living in the char areas. First, the paper examines the impact of the CDSP on food consumption and food security. Next, considering the objectives of the program and its various interventions, the paper also examines the impact of the CDSP on outcomes associated with legal awareness and hygiene and sanitation practice.

In terms of the paper's structure, section 2.2 presents a profile of the chars and the program under study. The data is introduced in Section 2.3 while section 2.4 outlines the paper's empirical strategy. Section 2.5 presents results, which is followed by the last section that contains a discussion section and concluding remarks.

2. Chars and the Char Development and Settlement Program (CDSP)

Bangladesh is built mainly on low lying deltaic flood plain. The country has more than 700 rivers including tributaries constituting a total waterway of approximately 24,000 kilometres.[7] During monsoons, rivers overflow and cause severe erosion along the riverbanks. The eroded silt is carried

[6] A range of policy documents have focused on the development of the char lands. These include, the Coastal zone Policy (2005), Coastal Development Strategy (2006), Bangladesh Climate Change Strategy and Action Plan (2009), The National Water Management Policy and Plan. Few development efforts include Estuary Development Program (EDP), Char Development and Settlement project (CDSP), Regional Fisheries and Livestock Development Component (RFLDC).

[7] River and drainage system, Banglapedia, National Encyclopaedia of Bangladesh.

towards the coast where its gradual deposition leads to the formation of new land masses called "chars".[8] These low-lying areas are composed of soil with comparatively high salinity and low volume of other minerals (Hobley, 2003). Historical population trends show that landless peasants and households who have lost their land to river erosion elsewhere migrate to these new chars (Adnan, 2013). This type of migration is quite common due to widespread landlessness and poverty in the country. According to government regulations, each landless household is designated 1-1.5 acres of land in the char areas with the Ministry of Land ensuring the execution of this entitlement.

The isolation of the chars from the mainland and the scarcity of proper infrastructure impedes the functioning of the public administration and the implementation of laws. The lack of legal enforcement and government control in the chars provides scope for land disputes and manipulations in the char areas (de Wilde, 2011; Jansen & Roquas, 1998; Adnan 2013). The jotedars, who are rich peasants and dominant power holders in their particular localities, generally on the mainland coastal areas, establish control over these landless people, by using gangs of lathyals. These gangs offer protection (against other gangs) but at the same time control the char dwellers as captive patrons and essentially play the role of rent-seekers.

2.1 Inception of the Char Development and Settlement Program (CDSP)

During the early 80's a Land Reclamation Project (LRP) of the Government of Bangladesh with assistance from the Government of the Netherlands (1978-1991), was launched to aid development in the char areas. Later the project was divided into two separate projects. The Meghna Estuary Study (MES) and the Char Development and Settlement Project (CDSP), essentially a water-based and a land-based development project, respectively.

The first phase of CDSP (1994-1999) encompassed approximately 4,500 households in three chars.[9] The subsequent phase, CDSP II (1999-2005) was scaled up to 9,000 households in two more chars.[10] CDSP III covered the period 2005 to 2010 and included 9,500 households from a single char (Boyer char). The first three phases included components on institutional development, land settlement, peripheral and internal infrastructure building that involved government agencies, e.g., Bangladesh Water Development Board (BWDB) and Local Government Engineering Department (LGED). In CDSP IV, for the first time, the programme included a livelihood component. In total, these various editions of the CDSP have covered nearly 46,000 hectares of char islands and assisted 24,000 households.[11] The fourth phase of the programme was launched in 2012 and ended in 2016.[12] CDSP IV consisted of six components i) Safeguards from climate change through water management and social forestry ii) building climate

[8] The chars in Bangladesh covers a total area of 10,722 square kilometres according to a 1993 estimation. Also the main river char lands was estimated to be 8,444 square kilometres or almost 6 percent of the area of the country (Rahman & Davis, 2005).

[9] Char Baggar Dona II, Char Majid and Char Bhatirtek.

[10] South Hatiya (SA) and Muhuri Accreted Area (MAA). Though a host of interventions was made in unprotected chars that were not yet suitably mature or appropriate for impolderingx (e.g., Char Torabali-Gangchil, Nijhum Dwip-Bandartila, Char Mora Dona., Char Osman and Char Lakshmi).

[11] Here the term 'assisting' r means establishing infrastructure for the promotion of economic and social activities in the chars.

[12] The over-all budget for this programme was USD 89.2 million.

change resilient infrastructure, iii) land settlement and titling, iv) livelihood support v) Field level institutional development and vi) studies and surveys.

This paper deals with CDSP IV and only with outcomes related to the livelihood component. This component was implemented by four NGOs - BRAC, Sagarika Samaj Unnayan Sangstha (SSUS), Society for Development Initiatives (SDI) and Dwip Unnayan Sangstha (DUS), with each NGO operating in specific pre-designated areas.[13] These partner NGOs also contributed to operational costs and some of the components were funded by the beneficiaries themselves through microfinance participation. The livelihood component consisted of eight specific interventions. These included, a) formation of microfinance group and subsequently access to microfinance b) support to health outcomes and family planning c) water, sanitation and hygiene practice and awareness d) legal awareness and human rights services e) awareness building and training on disaster management and climate change f) training on homestead agriculture and value chain development g) training and support on poultry and livestock rearing and h) training and support on setting up and managing fisheries.

Thus, the CDSP program consists of various components that are bundled to enhance socio-economic conditions in the chars by providing physical (i.e., building climate change resilient infrastructure and raising awareness on disaster management), economic (i.e. land distribution and livelihood support by means of training in income generating activities, access to microfinance, development of value chains) and social support (access to legal aid services, raising awareness on human rights and legal actions). The next section discusses the program components in detail.

2.2 Program description: Livelihood component

The livelihood component of the CDSP program includes microfinance as a core intervention. Group formation and microfinance is essentially BRAC's existing microfinance operations. BRAC is the world's largest development organization in terms of employees, it started in Bangladesh and currently operates in 12 countries. BRAC has branches in all 64 districts of Bangladesh. Each branch consists of 5-6 Credit Officers (CO), each CO is responsible for managing at least three microfinance groups. BRAC operates all its programs (e.g., health, education, water and sanitation) from these branches. In total, in 2018, BRAC had 2,267 branches throughout Bangladesh. CDSP IV operated from six of these branches.[14]

Over four decades, microfinance and financial services (e.g. credit, savings, micro insurance and digital financial services) have been at the centre of BRAC's holistic approach. In the chars as well, BRAC's microfinance program follows a group-based loan disbursement model. This includes group formation where all households are invited and information on microfinance is shared.[15] Subsequently, Village Organizations (VOs) are formed, each consisting of 15 to 20 women who are sequentially provided small, collateral-free loans at low-interest (from BDT 5000 to 20,000, which amounts to roughly USD 60 to 235).[16] According to the programme agenda, the

[13] SSUS and DUS operate in both Noler and Nangolia char, SDI in Urir char and BRAC in all chars.

[14] Ziauddin bazar (Zia char), Nangulia (Selim bazar and Hazi Idris Mia Bazar), Noler char (Saddam bazar, Bathankhali and Mojid bazar (Caring char). However, later in 2016, Mojid bazar branch was merged with Bathankhali due to river erosion.

[15] Under the CDSP IV, all households from the treatment chars were eligible for microfinance.

[16] The applied BDT-USD exchange rate is 0.01177 (29 November 2017).

participants are recommended to save, on average 10-20 BDT per month.[17] According to BRAC staff, borrowing habits and trends are seasonal in the areas under study. From June to November, loan disbursement is low as fresh water becomes scarce, limiting the scope for irrigation. This triggers seasonal labour migration to nearby cities.

One interesting feature is that the loan repayment rate among char dwellers is higher than the average repayment rate for the overall BRAC Microfinance Program.[18] BRAC staff attributes this to the fact that, unlike other (non-char) branches, the microfinance officials were the focal persons of contact for the entire CDSP (livelihood) operation, meaning they manage all the program components (e.g. health, water sanitation, human rights and legal services). Since the participants had repeated interactions with the microfinance officials, considerable trust developed between BRAC officials and the char dwellers, which was reflected in savings and loan repayments in a positive way.

The second and third elements of the CDSP livelihood support deals with health and family planning and, water and sanitation. The aim was to provide basic health support in terms of mother and child health care. In addition to that the intervention aimed at ensuring safe sources of water and safe latrines for each household and improved sanitation and hygiene practices in the community. Access to safe water was ensured through the installation and provision of access to deep-water tube-wells. BRAC programme officials identified locations for tube-wells to be installed, usually 1 per 15-20 households and followed up with the Department of Public Health and Engineering (DPHE) to confirm the execution of the task. Upon completion, a group comprised of the users of the well was created (the Tube-well Users Group) and made responsible for its upkeep and maintenance.[19] Regarding sanitation, the programme installed single pit latrines in selected locations. During the Village Officer (VO) meeting, the households were trained on how to use a latrine. They were trained in hygiene practices that includes wearing sandals to the latrine, washing hands after defecation and dental care. In total 1,297 deep tube wells (DTW)s have been installed, 1,454 Tube-well users' groups have been created and 19,270 single pit latrines have been installed.

Distance from the mainland and lack of adequate infrastructure limit the char dwellers' access to suitable and timely healthcare facilities. As a third element of the livelihood component, char dwellers received education on health and nutrition, immunization, and family planning. Access to basic curative facilities was also improved. The remedial services are provided through paramedics identified as Shasthya Shebikas (female health workers) and trained traditional birth attendants. Per BRAC branch there is one paramedic and for every 150 households one Trained Traditional Birth Attendant is assigned.[20] Also, orientation meetings on family planning and health

[17] It is mandatory for the members to save at least BDT 10/month. A member gets a 5% interest on deposits up to BDT 6,000 and 9% interest if the deposit is above BDT 6,000.

[18] In 2015 the overall PAR for Brac Microfinance program was 5.3 and 3.2 in the year 2016. Whereas for CDSP it was 0.67 in 2015 and 1.24 in 2016.

[19] Among the Tube well Users Group (TUG) one or two households were identified based on the location of their household in close proximity to the tube well as the Care Taking Family. The Care Taking Family participates in a training on tube well maintenance and arsenic detection. A monthly meeting is held for every Tube well User Group. Based on available reports from Care Taking Families and Tube well User Groups, faulty tube wells were repaired. Care Taking Families and Tube well User Groups also ensured construction of platform under every tube well.

[20] The Trained Birth Attendants also sell rudimentary medications such as oral rehydration packets, micronutrients, deworming tablets, medicine, iron tablets, and contraceptives.

were held regularly. The trained Traditional Birth Attendants are essentially volunteers who undergo a 15-day compulsory training session that includes hygienic delivery, including the 'three cleans' (handwashing with soap, clean cord care and clean surface) and on completion of the training are provided a delivery kit. All pregnant women for 18 weeks preceding the due date are monitored by the Trained Traditional Birth Attendants and provided both ante and post-natal care. In case of emergencies, the patient is referred to a hospital.

The fourth element concerns legal advice under which the char dwellers were provided training on social and legal awareness through a 3 weeklong course. This is a one-time course and if needed, additional legal support is provided through the CDSP program.

Fifth, frequent meetings were held under the umbrella of the disaster management and climate change intervention on disaster preparedness and mitigation. An individual is usually selected from every micro-finance group and community, in total 2,000 beneficiaries were trained on disaster preparedness. Through this training information on the interpretation of various warning signals, strategies to protect and preserve valuable assets, disaster shelter locations are provided. The members also participate in an annual refresher training. The group also participated in the union level disaster meetings on a regular basis to stay aligned in terms of disaster management activities. In addition to this, houses were improved, and plinths raised to mitigate the effects of natural disasters. The international environment day is observed annually in order to raise awareness among the communities.

Sixth, the agriculture and value chain development programme facilitated seedlings production and sales at the mainland market rate for the farmers aimed at eliminating transactions by any middleman. Also, one farmer per community was chosen for demonstration plot cultivation purposes through which the remaining farmers were trained. Training on fruits and vegetables farming was provided to around 13,000 individuals.[21]

The last sub-component is the farm and non-farm income generation activities (IGA) training. Beneficiaries owning livestock, poultry and fisheries were trained on rearing practices. In total 72 poultry workers and para-vets were employed within the project area. Around 250 beneficiaries (farmers and poultry farmers) were trained on fodder cultivation and breeding. For fisheries, in total 6,660 beneficiaries were trained on fish farming and fish nursery. As stated earlier, this paper focuses on the livelihood component of the intervention. This entails eight specific interventions that may be placed in three categories. These are interventions that focus on socio-economic outcomes (microfinance, IGA training that includes training in poultry, livestock and fisheries and also in homestead agriculture and value chain development), health and sanitation practices (health services and building awareness on family planning, water and sanitation) and social awareness (legal and human rights services). Consistent with this tripartite categorization, the outcome variables in this paper may be mapped onto each of these three categories. As discussed in more detail in the next section, the paper focuses on the effect of the intervention on socio-economic outcomes, health and sanitation practices and legal awareness.

3. Data

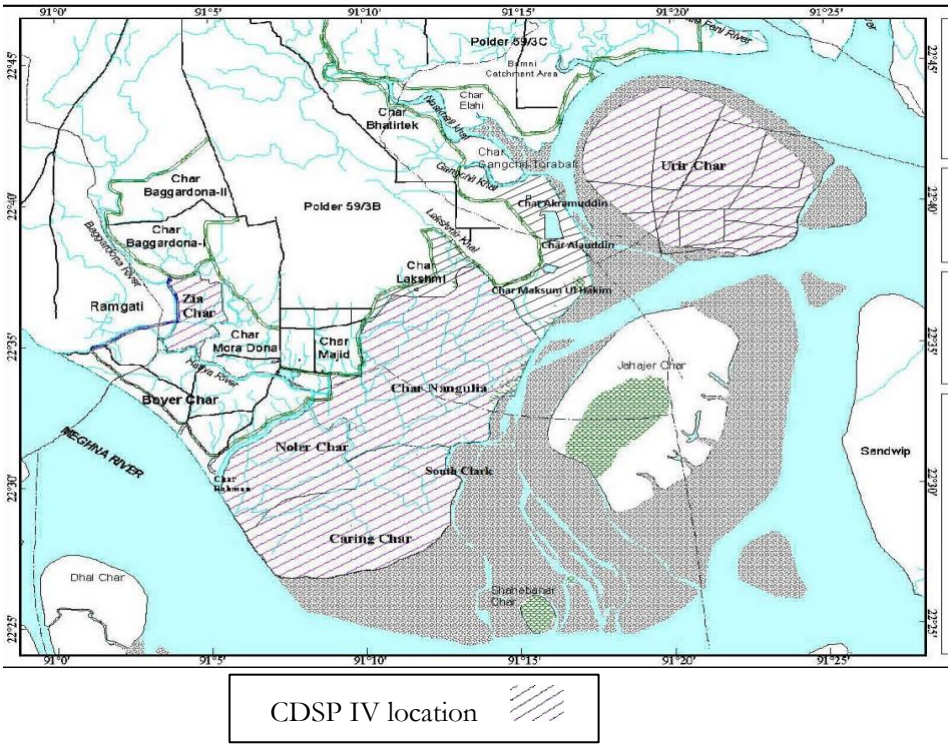
3.1 Survey set up

CDSP IV operated between December 2011 and December 2016 with the livelihood component commencing in 2012. This essay uses a two-round panel dataset collected in 2012 and a follow-up

[21] CDSP IV (http://cdsp.org.bd).

data set collected in 2016. The data were collected by BRAC's Research and Evaluation Division.[22] The study covers 11 chars and includes all 2,816 households living on these chars. Of the 11 chars, seven are treatment chars (1,600 households - 800 households that benefitted from BRAC interventions and 800 households where the intervention was carried out by another NGO). [23] Households in the remaining four chars serve as a control group (Figure 2.2).[24]

Figure 2: Location of the CDSP IV area



The control chars were chosen by local BRAC staff and an attempt was made to select chars that were as similar as possible to the treatment chars.[25] Selection criteria included distance from the main land, total population, impression of the condition of household units, local physical infrastructure (roads, buildings, schools), facilities available to the char dwellers, available modes of transportation, local market structure and access to the market place. Table 1 shows a comparison between the treatment and control chars in terms of infrastructure.

[22] Enumerators were recruited through a rigorous process prior to the survey and participated in a weeklong extensive training on the survey tools (that went through several rounds of piloting). Frequent and random spot checks were conducted by the relevant researchers and field operation staff from BRAC's Research and Evaluation Division throughout the data collection period. Moreover, the completed questionnaires were cross-checked and randomly verified within each team to address any inconsistency, wrong recordings and/or coding while in the field. To counter any possible missed errors, further and final checks were carried out.

[23] Noler Char, Nangolia-1, South Clark Char, Uria, Ziauddin, Nangolia-2 and Caring Char.

[24] Lakshmi, Akramuddin, Alauddin, Maksumul Hakim.

[25] BRAC has a coordinating office and six branch offices at the intervention areas.

Table.1: Comparison between the treatment and control char's infrastructure (on average per char)

Variables	Treatment chars	Control Chars
Age of the chars (years)	17	21
Number of NGOs operating	2.00	2.71
Number of Cyclone shelters available	0.25	6.57
Paved Road (km)	0.00	21.43
Road (Earthen, km)	0.88	21.00
Number of Schools	0.00	7.57
Number of Madrashas	2.75	6.29
Number of Moshjids	4.00	12.14
Number of Mondirs	0.50	1.50
Availability of any Govt services	Not available	Not available
Access to Power supply	Not available	Not available

Note: Information was collected from the respective brac branch offices

On average, the treatment chars (17 years) are slightly younger than the control chars (21 years). The controls chars have better infrastructure in terms of paved roads (21 versus 0 km), the number of cyclone shelters and the number of schools. In 2012, there were no schools in the treatment chars while there were about 8 schools in the control chars. While there are marked differences between the two sets of chars, there are similarities as well, as neither set of chars has access to government services or to power supply.

3.2 Available survey information

The survey collected detailed information from the main female member of the household. The questionnaire asked for information on household demographics and socio-economic status. In addition to these, it also collected information on awareness about health, healthcare and health expenses, hygiene practice, financial market participation (i.e., savings and borrowing record), nutrition, food security, food consumption using a 24 hour recall period, household assets (e.g., physical and financial assets), social issues, as well as information on vulnerability that included various shocks experienced in the last year and coping approaches.

The survey data were used to control for potential confounders and to create a number of outcome variables of interest. First and foremost, given the range of socioeconomic interventions we focus on the effect of the CDSP on food consumption and food security. Food consumption is measured in terms of per capita calorie consumption. We calculate the per capita nutritional value of consumption utilizing food composition tables for Bangladesh (Shaheen, Torab, & Rahim, 2014). Total consumption based on a 24-hour recall period includes consumption of grains (rice, wheat, bread, puffed rice), lentils, animal products (egg, chicken, beef, lamb, duck, fish), vegetables, oil and snacks. Based on these consumption data and food composition tables, we calculated total household calorie consumption (calories per unit of each food item multiplied by total amount of food item consumed). This was divided by total AME (Adult Male Equivalents) to obtain per capita energy/calorie consumption. Since there are several measurement challenges in terms of converting food consumption into per capita calorie consumption we also used a dichotomous variable which indicated whether a household had adequate or surplus access to

food.[26] Given the focus of the CDSP on training related to income generating activities, we also examined the effect of the CDSP on the monetary value (BDT) of a household's income-generating assets. This included the monetary value of a household's livestock and poultry, agricultural machines, rickshaws, van and shops.

In addition to the socio-economic outcomes, we use information on a set of six questions to examine the effect of the program on legal awareness (see Table 2), a set of three questions to examine CDSP impact on health and sanitation practices and a set of three additional questions on possession of sanitation/health and hygiene product/practice. In some more detail, to capture legal awareness, we used binary responses to six questions, that is, whether the respondent was aware of the legal age for male marriage, female marriage, voting, the legal process to obtain a divorce according to Muslim law , whether they had the right to physically abuse children and the penalty for taking dowry. The health and sanitation practices are captured by binary responses to a set of three questions, that is, whether the beneficiary is aware of the correct technique to purify water, wears sandals while using a toilet, washes hands after defecating. The final set of three questions includes product possession/practice and asks whether households have soap in the toilet, have toothpaste and brushes, and whether the household consumes iodized salt.

3.3 Summary statistics

Table 2 provides summary statistics of all variables at baseline across treatment and control chars. Panel A contains information on control variables while Panel B has information on the outcome variables.

Table 2: Summary statistics for the baseline period

Description	Baseline Averages				
	Average	Std. Dev.	Non-treated	Treated	p-value
Panel A: Control Variables					
Year of first settlement in the chars	19.145	(4.091)	16.928	20.829	0.136
Gender of the household head (1= female, 0 otherwise)	0.065	(0.246)	0.054	0.072	0.268
Age of the household head	41.014	(12.282)	39.573	42.109	0.007
Education level of the household head (=1 if illiterate, 0 otherwise)	0.704	(0.456)	0.709	0.701	0.887
Number of household members	5.399	(1.923)	5.251	5.511	0.017
Share of male members	0.507	(0.171)	0.504	0.509	0.422
Share of children (below 15 years)	0.433	(0.200)	0.419	0.444	0.028
Natural disaster (=1 if encountered any in last one year, 0 otherwise)	0.718	(0.450)	0.872	0.625	0.132
Illness or death of hh member (=1 if encountered any in last one year, 0 otherwise)	0.095	(0.294)	0.042	0.127	0.067
	0.363	(0.481)	0.169	0.480	0.063

[26] The exact question was "In the last one year how did your household do in terms of food supply corresponding to income?", where the options were; always had a surplus, adequate, sometimes deficit, always deficit.

Conflict (=1 if encountered any in last one year, 0 otherwise)					
Panel B: Outcome Variables					
Per capita calorie consumption (Kcal)	2386.13	(690.318)	2473.51	2319.67	0.097
Food security (=1 enough or more food supply, 0 faced any kind of food deficit)	0.588	(0.492)	0.661	0.533	0.030
Legal age for male marriage (=1 has right knowledge, 0 otherwise)	0.429	(0.495)	0.443	0.417	0.722
Legal age for female marriage (=1 has right knowledge, 0 otherwise)	0.716	(0.451)	0.762	0.682	0.243
Legal divorce for Muslims (=1 has right knowledge, 0 otherwise)	0.061	(0.240)	0.093	0.037	0.072
Legal voting age (=1 has right knowledge, 0 otherwise)	0.757	(0.429)	0.822	0.707	0.033
Right to physically abuse children (=1 no right, 0 otherwise)	0.808	(0.393)	0.788	0.824	0.591
Penalty for dowry demand (=1 has right knowledge, 0 otherwise)	0.070	(0.255)	0.091	0.053	0.021
Knows how to purify water (=1 has right knowledge, 0 otherwise)	0.862	(0.345)	0.887	0.829	0.223
Wears sandals to the toilet (=1 yes, 0 otherwise)	0.941	(0.235)	0.917	0.932	0.484
Washes hands after defecation (=1 yes, 0 otherwise)	0.501	(0.500)	0.366	0.524	0.048
Has soap in the toilet (=1 yes, 0 otherwise)	0.782	(0.413)	0.600	0.732	0.108
Has toothpaste & brush (=1 yes, 0 otherwise)	0.390	(0.488)	0.284	0.273	0.911
Consumes iodized salt (=1 yes, 0 otherwise)	0.672	(0.470)	0.606	0.472	0.305
N			1216	1600	

Note: Taka is the Bangladeshi currency. The Taka US$ exchange rate is 0.01186 (November 16, 2017).

On average, households have lived in the chars for about 19 years, roughly since they became habitable and there are no statistically significant differences between households in control and treatment chars. With regard to household traits, around 6% of the households are headed by women and this does not differ across treated and control households. Household heads from the treated chars are on average two years older (42 versus 39.5) than their control counterparts. While the difference is statistically significant it is not very large. In terms of education, in both groups, about 70% of the household heads are illiterate. The average household size is similar across the two groups (5.5. for treated and 5.3 for control), albeit, larger than the national average household size of 4.06 (Bangladesh Bureau of Statistics, 2016). Household gender composition is similar as is the proportion of children below the age of 15. Considering vulnerabilities and exposure to various shocks, around 72% of the households have been affected by a natural disaster in the past year. The proportion is higher among households residing in control chars (87 versus 63%) but the differences are not statistically significant. With regard to health shocks, it is the opposite. Treated households report greater exposure to health shocks (13 versus 4%). More than one third of the households have faced a conflict such as for example damage to assets due to disputes, theft or burglary, lawsuit or prosecution. The incidence of

conflicts is much higher in the treatment chars. The difference between treatment and control chars is 31 percentage points and it is statistically significant at the 10% level.

Turning to the outcome variables, on average, the per capita nutritional value of consumption is higher for households residing in control chars (153.84 kcal more), although the gap is not very large and is statistically significant only at the 10% level. Although the average caloric intake per person exceeds 2,000kcal and indicates that the households have enough to eat, 41% of the households reported that they have faced food deficits in the last three months. The proportion of households facing food insecurity is substantially higher (47%) amongst households residing in treated chars as compared to control chars (34%). No significant difference was found between treatment and control chars regarding the value of income generating asset holdings. On average, households in the sample own assets worth 26,847 BDT (316 USD).[27] Differences across the two groups are not statistically significant.

With regard to legal knowledge of social issues, only 43% of respondents were aware of the legal age for marriage for men while it was 71% for the case of females. This is perhaps not surprising as the respondents were mainly females. There was very little awareness (6%) of the legal procedures involved while seeking a divorce. A large proportion of the respondents were aware of the legal voting age with a higher rate of awareness amongst control households. Information on whether they have the right to use physical force against children is widespread.

With regard to sanitation practices, 86% beneficiaries know how to purify water properly (i.e., boiling, filtering or using fitkiri [28]) and more than 90% wear sandals to the toilet. Figures are similar for both groups. About half the respondents indicate that they wash hands after defecation, and the proportion is substantially higher (15 percentage points) amongst treated households. With regard to the availability/use of soap, toothpaste and iodized salt, there are no significant differences across the two groups. Overall, 78% have soap in the toilet although a smaller proportion (50%) seem to actually use it. Consumption of iodized salt is 67% with a higher proportion amongst households residing in the control chars.

4 Empirical strategy

To identify the causal impact of CDSP we compare changes over time (t) in outcomes (Y) between household i living in char c in the treated area to those in the control area using the following linear specification:

$$Y_{ict} = \alpha_\theta + X'_{ict}\beta_0 + \beta_1 T_{ict} + \beta_2 t_t + \beta_3 \lambda_{ct} + \varepsilon_{ict}, \quad (1)$$

where, X'_{ict} represents an array of time-varying household level control variables. The coefficient of interest is β_1, which represents the effect of participating in the CDSP. T_{ict} represents the treatment status where the indicator takes on the value of 1 for treated (CDSP) households at end line, zero otherwise. Heterogeneity across time and chars is controlled through fixed effects represented by t_t and λ_{ct} respectively. The error term is denoted, ε_{ict}. The parameter of interest, the difference-in difference estimator is β_1, where, $\widehat{\beta_1} = (\bar{y}_{2,T} - \bar{y}_{2,C}) - (\bar{y}_{1,T} - \bar{y}_{1,C})$. Here the bar denotes average, the first subscript denotes the year, and the second sub-script denotes the group. It captures the average treatment on the treated (ATT) as it measures the effect of the "treatment" or policy on the average outcome of *Y*.

The analysis is based on two underlying assumptions – the parallel trends assumption and the stable unit treatment value (SUTVA) assumption. Considering the selection process of the

[27] USD TK exchange rate =0.0117, January 2012.

[28] Fitkiri, also known as Potassium Alum, is a chemical compound used to filter water.

chars and the treatment assignment, we expect that the trends in the outcomes of interest between households in the treatment and control char will follow a similar trajectory over time. However, in the absence of randomization, we adopt a matching technique to identify causal effects. For the SUTVA, the treatment and control chars are separated by considerable distance and water bodies. Further, given the nature of the intervention, it is unlikely that the control households will be affected in any way by the activities in the treatment chars.

The paper works with several outcome variables (*Y*). These include consumption, the value of income generating assets and food security. In addition, in order to capture the potential effects of the hygiene related and legal awareness outcomes, three thematic indices were constructed by grouping related questions that attempt to capture similar underlying outcomes. These three include an index for legal awareness, an index for health, sanitation and hygiene practices, and a third for practice and possession of water, sanitation and hygiene products. These indices are constructed on the basis of coefficients obtained from a set of seemingly unrelated regressions (SUR) in which each dependent variable (Y) is a response to one of the individual questions that comprise the index. That is, for a set of J related outcomes where the effect of CDSP on each of the components of the index is denoted as π_j, the average effect size (AES) is,

$$\tau = \frac{1}{J}\sum_{j=1}^{J}\frac{\pi_J}{\sigma_J},$$

where, σ_j is the standard deviation of outcome j in the group that is not exposed to the CDSP (Brien, 1984; Kling & Liebman, 2004) The benefits of using such indices is that they reduce the chance of Type I error and by reducing noise in the data, since averaging enhances statistical power, also reduce the probability of Type II error (Clingingsmith, Khwaja, Kennedy, & Kremer, 2008).

All the regressions controls for household characteristics - gender, age and education of the household head, number of household members, male and children share of the households, households access to safe cooking and drinking water source, types of latrine and exposure to different shocks (e.g., natural disaster, health and conflict) and treatment status and time. Standard errors in parentheses are clustered at the char level.

4.1 Attrition

In total 2,816 households were surveyed during the baseline in 2012 (1,600 treatment and 1,216 control households). Of these, 2,506 households could be traced during the follow up survey in 2016. This represents an attrition rate of 11% (among the 310 households that could not be re-surveyed, 82 were control households and 228 were treatment households). Given the precarious nature of living conditions on the chars, a 11% attrition rate over a four-year period is not particularly high.

In any case, to examine whether attrition was systematic, we estimated a probit model to identify differences in the characteristics of the households that dropped out (attrited) with those who remained in the sample (Table 3).

Table 3: Overall Attrition

Variables	Marginal Effect	Standard Error	t stat
CDSP Beneficiaries (=1 if treatment household)	0.094***	(0.024)	3.77
Sex of the household head (=1 if female, 0 otherwise)	0.051**	(0.026)	1.94
Age of the household head	-0.001**	(0.001)	-1.94
Number of household members	0.005	(0.010)	0.48
Household head's education			
Primary education	-0.022	(0.022)	-1.01
Secondary education	0.005	(0.025)	0.23
Higher secondary education	0.021	(0.042)	0.51
Share of male members	0.051	(0.049)	1.05
Share of children	-0.100*	(9.053)	-1.89
Source of cooking water (=1 if safe, 0 otherwise)	-0.060	(0.094)	-0.63
Source of drinking water (=1 if safe, 0 otherwise)	-0.027*	(0.015)	-1.80
Types of Latrine (=1 if safe, 0 otherwise)	-0.016	(0.016)	-1.02
Natural disaster (=1 if faced in last one year, 0 otherwise)	0.014	(0.017)	0.83
Illness of death of household member (=1 if faced in last one year, 0 otherwise)	-0.0006	(0.027)	-0.02
Conflict (=1 if faced in last one year, 0 otherwise)	0.018	(0.029)	0.63
Log of per capita income	0.004	(0.013)	0.35
Log of Per capita consumption	0.005	(0.025)	0.22
Log of household's value of total assets	-0.012**	(0.004)	-2.53
Food security (1= if had enough food in last 6 months, 0	0.020*	(0.012)	1.66
N	2801		
Pseudo R^2	0.0415		

*Note: *, **, *** indicate significance at the 10%, 5% and 1% level respectively.*

The bulk of the characteristics are statistically insignificant. However, the estimates do show that households living in the treated char areas were more likely to drop-out from the sample as were female-headed households. Households with older household heads, a larger share of children in their families, households with access to a safe source of water and with a larger value of assets were less likely to drop out. These patterns suggest that perhaps the more vulnerable households were more likely to drop-out.[29]

Table 4 below presents means of the outcome variables for households that dropped out and households that remained in the sample at end-line.

Table 4: Summary statistics of outcomes for attrited and non-attrited households

Variables	Attrited households	Non attrited Households	P value
Per capita energy consumption (Kcal)	2380.116	2386.871	0.911
Value of income generating assets (Tk)	21416.419	27518.935	0.210

[29] Model investigating the determinants of attrition separately for treatment and control chars are presented in Annex Table 1. Treatment households with female heads are more likely to attrite. Treatment households with older heads, greater asset holding, and more children are less likely to drop out. Households with a larger number of males in the family and older household head are more likely to attrite. One possible explanation for the attrition of households with a larger share of male members is that they are looking for better opportunities outside the char.

Food security (=1 enough or more food supply, 0 faced any kind of food deficit)	0.603	0.587	0.664
Dowry Sentence (=1 has right knowledge, 0 otherwise)	0.068	0.070	0.944
Legal age for male marriage (=1 has right knowledge, 0 otherwise)	0.410	0.431	0.195
Legal age for female marriage (=1 has right knowledge, 0 otherwise)	0.668	0.722	0.086
legal divorce for Muslims (=1 has right knowledge, 0 otherwise)	0.071	0.060	0.587
legal voting age (=1 has right knowledge, 0 otherwise)	0.739	0.759	0.519
Right to physically abuse children (=1 no right, 0 otherwise)	0.829	0.806	0.455
Knows how to purify water (=1 has right knowledge, 0 otherwise)	0.810	0.860	0.028
Wears sandals to the toilet (=1 yes, 0 otherwise)	0.900	0.929	0.347
Washes hands after defecation (=1 yes, 0 otherwise)	0.442	0.458	0.584
Has soap in the toilet (=1 yes, 0 otherwise)	0.626	0.681	0.245
Has toothpaste toothbrush (=1 yes, 0 otherwise)	0.242	0.282	0.047
Consumes iodized salt (=1 yes, 0 otherwise)	0.500	0.534	0.591

*Note: *, **, *** indicate significance at the 10%, 5% and 1% level respectively.*

Of the 15 variables related to the outcome, only three are statistically significantly different across the two groups (legal age for female marriage, knowledge of how to purify water, possession of toothpaste/ toothbrush).

Next to check whether attrition is random, the Verbeek-Nijman test for attrition was applied in the outcome variables. A variable indicating drop-out was added in a regression of the outcome variables on baseline characteristics and test the significance of the drop-out (selection) indicator (Jones, Rice, Bago d'Uva, & Balia, 2013). Table 2.5 shows that attrition is random for food consumption and food security.

Table 5: Attrition outcome based: Verbeek and Neijman estimates

Variables	Log of per capita	Food security
Verbeek Neijman variable	-0.000	-0.031
	(0.028)	(0.024)
CDSP Beneficiary	0.172**	0.146*
	(0.057)	(0.071)
Gender of the household head (1= female, 0	0.007	-0.099***
	(0.035)	(0.030)
Age of the household head (years)	0.001***	-0.002**
	(0.000)	(0.001)
Number of household members	-0.037***	0.008
Education of household head		
	(0.004)	(0.006)
Illiterate	0.063	-0.096
	(0.079)	(0.092)

Primary education	0.051	-0.018
	(0.077)	(0.090)
Secondary education	0.063	0.015
	(0.071)	(0.093)
Higher education	-0.035	-0.000
	(0.081)	(0.114)
Share of male members	0.043	0.198***
	(0.031)	(0.055)
Share of children	0.220***	-0.323***
	(0.028)	(0.059)
Source of cooking water. (=1 if safe, 0 otherwise)	0.004	0.004
	(0.030)	(0.036)
Source of drinking water (=1 if safe, 0 otherwise)	-0.010	0.030
	(0.026)	(0.075)
Types of latrine (=1 if safe, 0 otherwise)	-0.016	0.133***
	(0.024)	(0.027)
Shock (natural disaster) (=1 if faced in last one year, 0	0.030**	-0.056
	(0.012)	(0.040)
Shock (Illness or death of hh member) (=1 if faced in	-0.018	-0.112***
	(0.011)	(0.034)
Shock (Conflict) (=1 if faced in last one year, 0	0.039***	0.023
	(0.012)	(0.058)
	-0.014	-0.049
	(0.050)	(0.038)
R_2	0.071	0.107
Number of households	5280	5280

*Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively. °IGA stands for income generating activities; §hh stands for household.*

Overall, the tests suggest that while attrition is not systematically related to the outcome variables, there is some evidence that attrition is not random with respect to the control variables. Given the low attrition rate and the limited differences in both outcome and control variables between those who drop out of the sample and those who remain, it is unlikely that adjustments for attrition will have a large bearing on the outcomes. However, the paper conducts robustness checks by correcting attrition bias for all outcomes using inverse probability weights. These results are presented in the appendix (Annex Table 2.2, 2.3 and 2.4).

5 Results

5.1 Estimation results

Table 2.6 presents the causal effects of participating in the CDSP program, estimated using difference-in-difference (DiD) methods on an unbalanced panel. We find program participation to increase per capita calorie consumption by 15% among beneficiary households. Similarly, households living in treatment chars are 25 percentage points more likely to report having adequate access to food.

Table 6: Difference in difference estimates using unbalanced panel

Variable	Log of energy consumption	Food Security
CDSP beneficiaries	0.146**	0.252**
	(0.052)	-(0.097)

Gender of the household head (1= female, 0 otherwise)	-0.010	-0.104***
	(0.037)	-(0.032)
Age of the household head (years)	0.001***	-0.002**
	(0.000)	-(0.001)
Household Head's education		
Primary education	0.058	-0.126*
	(0.066)	(0.069)
Secondary education	0.049	-0.04
	(0.067)	-0.069
Higher education	0.058	(0.020)
	(0.062)	-0.069
Number of household members	-0.037***	0.013*
	(0.005)	-(0.006)
Share of male members	0.039	0.219***
	(0.033)	-(0.055)
Share of children	0.247***	-0.316***
	(0.036)	-(0.058)
Natural disaster (=1 if faced in last one year, 0 otherwise)	0.029**	-0.061
	(0.012)	-(0.040)
Illness or death of household members (=1 if faced in last one year, 0 otherwise)	-0.018	-0.116**
	(0.014)	-(0.040)
Conflict (=1 if faced in last one year, 0 otherwise)	0.034*	0.027
	(0.017)	-0.071
Year (2016)	-0.006	-0.02
	-0.044	-0.072
r2	0.079	0.104
N	4523	4523

*Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively. °IGA stands for income generating activities*

These effects appear to be driven by a reduction in calorie consumption among control households in the end-line (see Table 2.7) along with an increase among the treated.

Table 7: End line averages for outcome variables for both treatment and control char

Description	End line Averages		
	Non-treated	Treated	p-value
Outcome Variables			
Per capita calorie consumption (Kcal)	2415.155	2577.16	0.038
Food security (=1 enough or more food supply, 0 faced any kind of food deficit)	0.655	0.733	0.280
Legal age for male marriage (=1 has right knowledge, 0 otherwise)	0.241	0.332	0.077
Legal age for female marriage (=1 has right knowledge, 0 otherwise)	0.774	0.799	0.578

Legal divorce for Muslims (=1 has right knowledge, 0 otherwise)	0.052	0.173	0.008
Legal voting age (=1 has right knowledge, 0 otherwise)	0.730	0.752	0.654
Right to physically abuse children (=1 no right, 0 otherwise)	0.965	0.911	0.172
Dowry Sentence (=1 has right knowledge, 0 otherwise)	0.011	0.128	0.001
Knows how to purify water (=1 has right knowledge, 0 otherwise)	0.867	0.873	0.894
Wears sandals to the toilet (=1 yes, 0 otherwise)	0.956	0.961	0.684
Washes hands after defecation (=1 yes, 0 otherwise)	0.608	0.504	0.105
Has soap in the toilet (=1 yes, 0 otherwise)	0.899	0.903	0.866
Has toothpaste & brush (=1 yes, 0 otherwise)	0.599	0.447	0.066
Consumes iodized salt (=1 yes, 0 otherwise)	0.903	0.772	0.008
N	1134	1372	2506

To rule out model driven effects on the outcomes, we conduct robustness checks using a baseline matching technique in combination with DiD.[30] Annex Table 2.2 shows estimates using DiD with inverse probability weights (IPW) and restricting the sample to those on common support. The results are robust and comparable to those based on the primary approach – we find a 14% increase in per capita energy consumption (significant at 5% level) and a 25-percentage point increase in food security (significant at 5% level).

Tables 2.8 and 2.9 provide estimates of the average effect sizes on other individual level outcomes using the unbalanced panel. We find that CDSP program participation increases the legal awareness index by 0.32 standard deviations among the treated. This change is driven by a simultaneous increase in the index among the treated in the end-line with a corresponding decline among the control over the same period.

Table 8: AES (Average Effect Size) estimates for legal awareness

Variables	Unbalanced
Legal awareness	0.319 ***
	(0.079)
Legal age for getting married for male members	0.102**
	(0.044)
Legal age for getting married for female members	0.090
	(0.056)
Divorce process	0.198***
	(0.037)
Legal age for voting	0.123**

[30] For each household, propensity scores were constructed on the basis of household characteristics: Gender, age, occupation and level of education of the household head, household size, number of children in the household, source of cooking water. A two-step procedure was followed, where the difference-in-difference regression was combined with the propensity score weights, so that even under weak conditions, causal estimates remain consistent (Ho et al., 2007; Imbens & Wooldridge, 2009; Robins & Rotnitzky, 2001). The standard errors were clustered at the char level to control for any possible intra-char correlation in the unobserved error term. After generating propensity scores, we had 2807 households on common support (1600 beneficiary and 1207 non-beneficiary households). Distribution of the p-score (Figure A1: Panel A) shows limited differences in the distribution of these characteristics across the treated and control groups. We then ran difference in difference estimation on the common support using the propensity score as a weight in order to address any possible selection bias.

	(0.053)
Abusing children	-0.127
	(0.081)
Dowry sentence	0.163***
	(0.034)
N	4523

*Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively*

In the case of ownership of water and sanitation products (toothpaste, toothbrush, soap), we find a statistically significant decline among the treated which is reflected in the negative average effect size. Consistent with the relative decline in the possession of soap and toothpaste-brush, there is a decline in what may be considered good water and sanitation practice (-0.23 standard deviation), derived primarily from a reduction in the incidence of handwashing after defecation.

Table 9: AES (Average Effect Size) estimates for water and sanitation practice (for different specifications)

Variables	Unbalanced
Water and Sanitation practice	-0.236***
	(0.053)
Knows right way to purify water	0.022
	(0.036)
Wears sandals to the toilet	-0.039**
	(0.018)
Washes hands after defecation	-0.305 ***
	(0.042)
N	4523
Water and Sanitation product possession	-0.230
	(0.199)
Have soap	-0.139515
	(0.101)
Have toothpaste-toothbrush	-0.166***
	(0.044)
Consumes Iodize salt	-0.013
	(0.153)
N	4523

*Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively. °IGA stands for income generating activities*

As a robustness check, results wear compared to those derived using an IPW derived from matching and restricting the sample to observations on common support. The findings are comparable (Annex Table 2.2 and 2.3). The trends in outcomes are better understood when examining the summary statistics more closely. The rate of ownership of such products increased faster among the control group rather than a decline among the treated – the effects can therefore be concluded as the control group catching up to the treated.

6 Concluding remarks

The Char Development and Settlement Program (CDSP) was launched by the Government of Bangladesh and was funded by the International Fund for Agricultural Development (IFAD) and the Kingdom of the Netherlands (EKN). The components of the programs were implemented largely by government agencies and a number of NGOs. The program combined infrastructure development with a livelihood support component which was lacking in previous phases of the program. This essay evaluates the impact of the livelihood component of the CDSP, which was implemented by various NGOs, including BRAC.

While multi-intervention programs such as the CDSP are not unusual, what is different is that CDSP participants live in very precarious landmasses and are more likely to be exposed to natural shocks (Shahed et al.2016). Furthermore, despite operation for a number of years there are arguably no credible evaluations of the CDSP.

In particular, this paper investigated the impact of this livelihood component of the fourth phase of the Char Development and Settlement Programme (CDSP) on food consumption, water and sanitation practice and social awareness outcomes. Using a difference-in-difference framework, the analysis showed that CDSP participation led to a positive and statistically significant increase in per capita calorie consumption and food security. Results also suggest that the program had significant positive effects on awareness regarding knowledge on human rights and legal procedures. However, with regard to water and sanitation practice, there was a decline in the proportion of households living in the treated areas that followed the recommended water and sanitation practices. It may well be that it is easier to influence socio-economic outcomes and raise awareness as compared to changing behavior. The difficulty of influencing behavior has often been noted. For instance, according to (Tearfund, Accedes & ODI, 2007) it is not enough to 'educate' people about the health benefits of hygiene practices. In order to have lasting impact on WASH indicators, hygiene, sanitation, and water 'hardware needs to be complemented by schemes that generate behavioral change (Peal, Evans, & Voorden, 2010).

While the analysis presented in this paper does suggest that the livelihood component of the CDSP program enhances food security and increases legal awareness there are several limitations. First, it was not possible to identify which of the specific components of the livelihood program was responsible for enhancing food security. Second, to further complicate the picture, the livelihood component was accompanied by a number of other interventions such as the construction of climate resilient infrastructure, and it is not possible to identify whether the increase in food consumption may be attributed to the livelihood component or to the other components that were also implemented at the same time. Nevertheless, what we can say is that the multi-pronged CDSP intervention does seem to have translated into greater food security and greater legal awareness of beneficiaries. While this may seem underwhelming and modest given the complexity of the program and the resources expended, it may be viewed as a first step in systematically assessing the effects of the CDSP. Future research may need to consider isolating the specific effects of the various components and examining the effect of the intervention on other outcomes.

Reference

Adjei, J. K., & Arun, T. (2009). Poverty Reduction : The Case of Sinapi Aba Trust of Ghana March 2009 BWPI Working Paper 87. *World Development*, (March), 1–23.

Adnan, S. (2013). Land grabs and primitive accumulation in deltaic Bangladesh: interactions between neoliberal globalization, state interventions, power relations and peasant resistance. *The Journal of Peasant Studies*, *40*(November 2014), 87–128. https://doi.org/10.1080/03066150.2012.753058

Ali, a. (1999). Climate change impacts and adaptation assessment in Bangladesh. *Climate Research*, *12*, 109–116. https://doi.org/10.3354/cr012109

Amin, S., Rai, A. S., & Topa, G. (2003). Does microcredit reach the poor and vulnerable? Evidence from northern Bangladesh. *Journal of Development Economics*, *70*(1), 59–82. https://doi.org/10.1016/S0304-3878(02)00087-1

Bandiera, O., Burgess, R., Das, N., Gulesci, S., Rasul, I., & Sulaiman, M. (2013). Can basic entrepreneurship transform the economic lives of the poor ?, (April).

Banerjee, a, Duflo, E., Glennester, R., & Kinnan, C. (2013). The miracle of microfinance? Evidence from a randomized evaluation. *MIT Department of Economics Working Paper No. 13-09*, *7*(1), 1–6. https://doi.org/10.1257/app.20130533

Banerjee, A., Duflo, E., Goldberg, N., Karlan, D., Osei, R., Parienté, W., … Udry, C. (2015). A multifaceted program causes lasting progress for the very poor: Evidence from six countries, *348*(6236). https://doi.org/10.1126/science.1260799

Bangladesh Bureau of Statistics. (2016). *Household Income and Expenditure Survey Report(HIES)*.

Baqee, A. (1998). *Peopling in the land of Allah Jaane:Power, peopling & Environment: The case of Char lands of Bangladesh*. The University Press Limited.

Barnes, C., Gaile, G., & Kibombo, R. (2001). *The Impact Of Three Microfinance Programs in Uganda*. *Development Experience Clearinghouse, USAID*. Retrieved from http://www.mendeley.com/catalog/impact-three-microfinance-programs-uganda/

BBS. (2009). Updating Poverty Maps of Bangladesh. Retrieved from http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/UpdatingPovertyMapsofBangladesh.pdf

Behrman, J. R., & Hoddinott, J. (2001). AN EVALUATION OF THE IMPACT OF PROGRESA ON PRESCHOOL CHILD HEIGHT, (104).

Bouis, H. E. (2000). Commercial vegetable and polyculture fi sh production in Bangladesh : Their impacts on household income and dietary quality, *21*(4), 482–487.

Brien, P. C. O. (1984). for Comparing Samples with Multiple Endpoints, (December), 1079–1087.

Clingingsmith, D., Khwaja, A. I., Kennedy, J. F., & Kremer, M. (2008). *Estimating the Impact of the Hajj: Religion and Tolerance in Islam's Global Gathering Estimating the Impact of the Hajj: Religion and Tolerance in Islam's Global Gathering*. *Faculty Research Working Papers Series*. https://doi.org/HKS Working Paper No. RWP08-022

Crépon, B., Devoto, F., Duflo, E., & Parienté, W. (2011). Impact of microcredit in rural areas of Morocco: Evidence from a Randomized Evaluation. *Mimeo*, (March).

Das, N. C., Raza, W. A., & Misha, F. A. (2009). An Early Assessment of CFPR II Support Packages. *Journal of Development Effectiveness*, (July 2014). Retrieved from http://research.brac.net/workingpapers/red_wp9_new.pdf

de Wilde, K. (2011). *Moving coastlines : emergence and use of land in the Ganges-Brahmaputra-Meghna estuary*. Dhaka: University Press Limited.

Fields, G. S., & Lipton, M. (2000). *Successes in Anti-Poverty*. *Industrial and Labor Relations Review* (Vol. 53). https://doi.org/10.2307/2696148

Gertler, P. (2004). Do conditional cash transferts improve child health^ Evidence from PROGRESA's control randomized experiment^. *American Economic Review*, *94*, 336–341.

Giné, X., Bank, W., Mansuri, G., & Jel, C. (2011). Money or Ideas ? A Field Experiment on Constraints to Entrepreneurship in Rural Pakistan. *The World Bank Policy Research Working Paper Series*, (September). Retrieved from http://www-wds.worldbank.org/servlet/WDSContentServer/WDSP/IB/2014/06/30/000158349_20140630163715/Rendered/PDF/WPS6959.pdf

Haushofer, J., & Shapiro, J. (2016). The Short-Term Impact of Unconditional Cash Transfers to the Poor : Experimental Evidence from Kenya, (September), 1973–2042. https://doi.org/10.1093/qje/qjw025.Advance

Hobley, M. (2003). The Practice of Design: Developing the Chars livelihoods Programme in Bangladesh. *Journal of International Development*, *15*, 90–893. https://doi.org/10/10002/jjd.1042

Jansen, K., & Roquas, E. (1998). Modernizing Insecurity: The Land Titling Project in Honduras. *Development and Change*, *29*(1), 81–106. https://doi.org/10.1111/1467-7660.00071

Jones, A., Rice, N., Bago d'Uva, T., & Balia, S. (2013). *Applied Health Economics* (Vol. 2). New York, NY 10017: Routledge.

Kling, J. R., & Liebman, J. B. (2004). EXPERIMENTAL ANALYSIS OF NEIGHBORHOOD EFFECTS ON YOUTH Jeffrey R. Kling and Jeffrey B. Liebman *, (May).

Lahiri-Dutt, K., & Samanta, G. (2013). *Dancing with the river:People and life on the chars of South Asia*.

Misha, F. A., Raza, W., Ara, J., & Poel, E. Van De. (2014). How far does a big push really push ? Mitigating ultra-poverty in Bangladesh, (November).

Nielsen, H., Roos, N., & Thilsted, S. H. (2003). Animal Source Foods to Improve Micronutrient Nutrition and Human Function in Developing Countries The Impact of Semi-Scavenging Poultry Production on the Consumption of Animal Source Foods by Women and Girls in Bangladesh 1 , 2, 4027–4030.

Peal, A., Evans, B., & Voorden, C. Van Der. (2010). Hygiene and sanitation software : an overview of approaches. *Water Supply*, 156.

Planning Commission. Government of the People's Republic of Bangladesh. (2013). *The Millennium Development Goals: Bangladesh Progress Report 2012*. https://doi.org/10.1787/9789264173248-4-en

Rawlings, L. B., & Rubio, G. M. (2005). Evaluating the Impact of Conditional Cash Transfer Programs Conditional Cash Transfer Programs : A New Approach (pp. 29–55). Oxford University Press. https://doi.org/10.1093/wbro/lki001

Raza, W. (2011). Impact of Char Development and Settlement Project on Improving the Livelihood of Char Dwellers, *7*(17).

Raza, W. A., Das, N. C., & Misha, F. A. (2012). Can ultra-poverty be sustainably improved? Evidence from BRAC in Bangladesh. *Journal of Development Effectiveness*, *4*(2), 257–276. https://doi.org/10.1080/19439342.2012.686046

Shah Alam Khan, M. (2008). Disaster preparedness for sustainable development in Bangladesh. *Disaster Prevention and Management: An International Journal*, *17*(5), 662–671. https://doi.org/10.1108/09653560810918667

Shahed, S. S., Rahman, M. M., & Misha, F. (2016). Building Resilience in the Char Area : Building Resilience in the Char Area :, (66).

Shaheen, N., Torab, A., & Rahim, M. A. (2014). *Food Composition Table for Bangladesh*. Dhaka, Bangladesh.

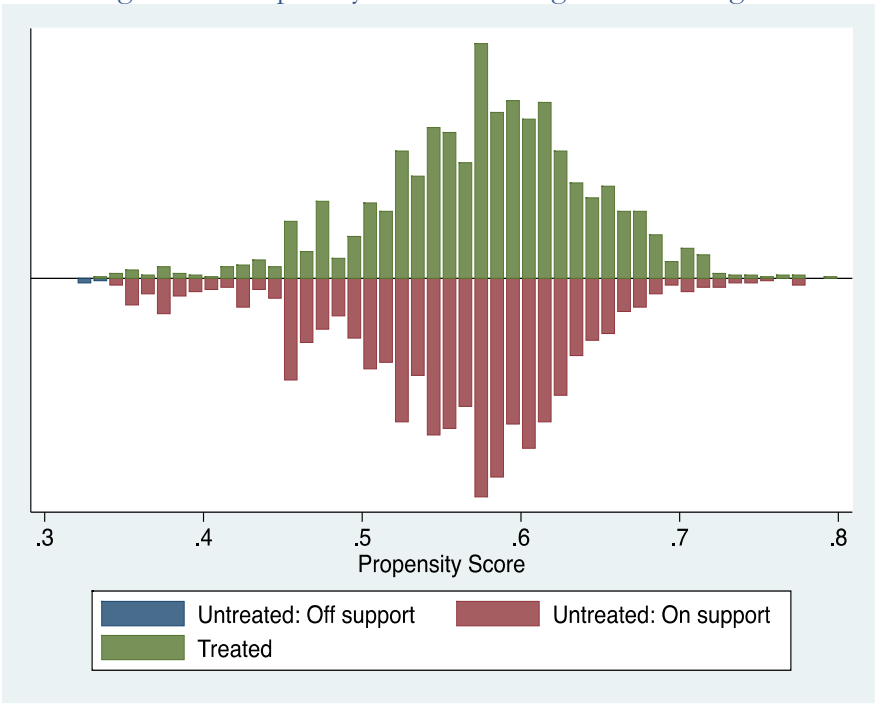
Skoufias, E. (2001). PROGRESA and its Impacts on the Human Capital and Welfare of Households in Rural Mexico : A Synthesis of the Results of an Evaluation by IFPRI, (December).

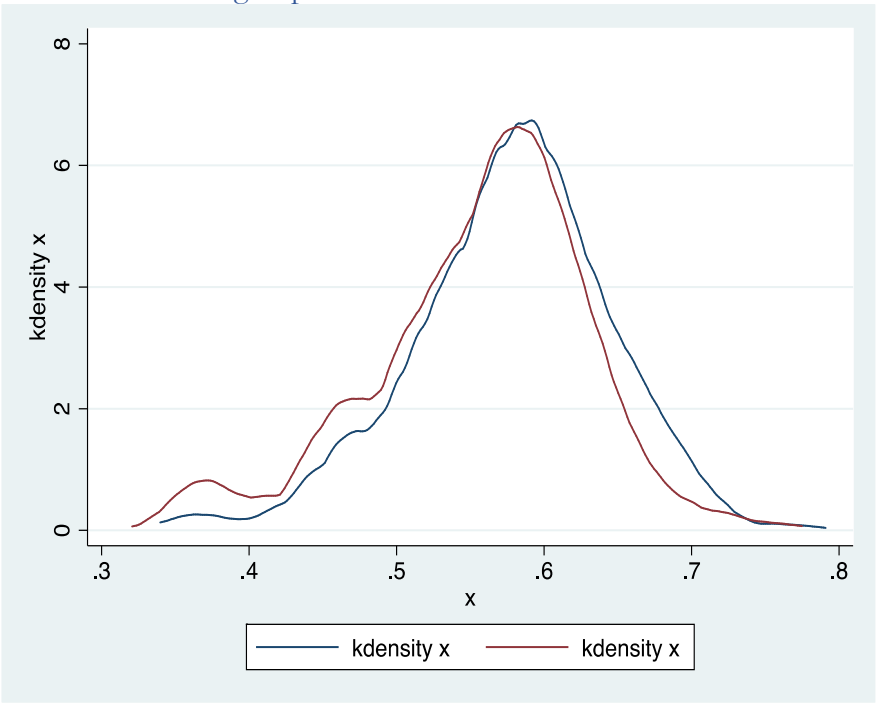
Tearfund, Accedes, & Odi. (2007). Sanitation and hygiene in developing countries: identifying and responding to barriers. A case study from Burkina Faso, 22. https://doi.org/http://dx.doi.org/10.1590/S1415-790X2010000100008

Wilde, Koen de. (2011). *Moving Coastlines: Emergence and Use of Land in teh Ganges-Brahmaputra-Meghna Estuary* (First). Dhaka 1000, Bangladesh: The University Press Limited.

World Bank. (1990). *World Development Report 1990 : Poverty*. New York: Oxford University Press.

Annex Figure 2.1: Propensity Score Matching and balancing across treatment and control groups





Panel A: Distribution of Propensity Score across treated and control group

Panel B: Kernel Density curves representing balancing of propensity scores

Annex Table 2.1: Determinants of attrition for both treatment and control groups

Variables	**Treatment Households**		**Control Households**	
	Marginal effect	Standard errors	Marginal effect	Standard errors
Gender of the household head (1= female, 0 otherwise)	0.075**	(0.033)	0.008	(0.052)
Age of the household head (years)	-0.003***	(0.001)	0.000***	(0.000)
Number of household members	0.009	(0.017)	-0.001	(0.007)
Household head's education				
Illiterate	-0.046	(0.088)	-0.090***	(0.033)
Primary Education	-0.092	(0.095)	-0.086*	(0.051)
Secondary Education	-0.072	(0.119)	-0.054	(0.045)
Share of male members	0.019	(0.082)	0.083***	(0.032)
Share of children	-0.153**	(0.066)	-0.039	(0.078)
Source of cooking water (=1 if safe, 0 otherwise)	-0.052	(0.125)	Note[31]	
Source of drinking water (=1 if safe, 0 otherwise)	-0.027	(0.045)	-0.015	(0.016)
Types of toilet (=1 if safe, 0 otherwise)	-0.009	(0.021)	-0.023	(0.030)
Natural disaster (=1 if faced in last one year, 0 otherwise)	0.021	(0.029)	0.001	(0.016)
Illness or death of hh member (=1 if faced in last one year, 0 otherwise)	-0.006	(0.037)	0.037	(0.058)
Conflict (=1 if faced in last one year, 0 otherwise)	0.022	(0.042)	0.013	(0.021)
Log of per capita income	0.006	(0.026)	0.003	(0.012)
Log of per capita energy consumption	0.019	(0.042)	-0.006	(0.018)
Log of the value of total asset holding	-0.022*	(0.012)	-0.006	(0.005)
Food security (1= if had enough food in last 6 months, 0 otherwise)	0.028*	(0.017)	0.013	(0.021)
N	1598		1197	

[31] The coefficient has been omitted due to perfect prediction with source of cooking water. For the treatment groups, they have tubewell installed and some households use tubewell water for drinking and other sources for cooking. However. for the control chars they use the same source of water for both cooking and drinking purpose.

*Note: *, **, *** indicate significance at the 10%, 5% and 1% level respectively. $hh stands for household.*

Annex Table 2.2: Difference in difference estimates on common support using IPW

Variable	Log of per capita energy consumption	Food security
CDSP Beneficiary	0.139**	0.256**
	(0.053)	(0.098)
Gender of the household head (1= female, 0 otherwise)	-0.031	-0.091**
	(0.026)	(0.030)
Age of the household head (years)	0.001**	-0.002**
	(0.000)	(0.001)
Household Head's education		
Primary education	0.107	-0.084
	(0.076)	(0.086)
Secondary education	0.098	0.004
	(0.078)	(0.092)
Higher education	0.101	0.053
	(0.071)	(0.099)
Number of household members	-0.039***	0.015**
	(0.005)	(0.005)
Share of male members	0.025	0.221***
	(0.036)	(0.054)
Share of children	0.223***	-0.307***
	(0.033)	(0.056)
Natural disaster (=1 if faced in last one year, 0 otherwise)	0.033**	-0.098***
	(0.014)	(0.030)
Illness or death of household members (=1 if faced in last one year, 0 otherwise)	-0.018	-0.118**
	(0.014)	(0.045)
Conflict (=1 if faced in last one year, 0 otherwise)	0.040*	0.023
	(0.020)	(0.080)
Year (2016)	0.003	-0.020
	(0.046)	(0.073)
r2	0.092	0.116

N	4523	4523

*Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively. °IGA stands for income generating activities.*

Annex Table 2.3: AES (Average Effect Size) estimates for legal awareness (using IPW on common support)

Variables	With IPW on common support
Legal awareness	0.221***
	(0.061)
Legal age for getting married for male members	0.086
	(0.070)
Legal age for getting married for female members	0.031
	(0.043)
Divorce process	0.149***
	(0.040)
Legal age for voting	0.066
	(0.070)
Abusing children	-0.106*
	(0.060)
Dowry sentence	0.131***
	(0.025)
N	4523

*Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively. °IGA stands for income generating activities.*

Annex Table 2.4: AES (Average Effect Size) estimates for water and sanitation practice (for different specifications)- using IPW on common support

Variables	With IPW on common support
Water and Sanitation practice	-0.244**
	(0.054)
Knows right way to purify water	0.024
	(0.035)
wears sandals to the toilet	-.044
	(0.017)
washes hands after defecation	-0.311***
	(0.040)
N	4523
Water and Sanitation product possession	-0.238
	(0.202)
Have soap	-0.141
	(0.103)
Have toothpaste-toothbrush	-0.172***
	(0.046)
Consumes Iodize salt	-0.016
	(0.156)
N	4523

Note: *,**,*** indicate significance at the 10%, 5% and 1% level respectively. °IGA stands for income generating activities.