

THE IMPACT OF THE CHOBA PROJECT IN VIETNAM

By

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Prepared for

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Abstract

Hygienic latrines are found to be very important for health. How to increase the coverage of hygienic latrines in developing countries is a challenging issue given the constraints of income and difficulties in changing sanitary behaviours. The East Meets West Foundation implemented a project called the Community Hygiene Output-Based Aid (CHOBA) reaching more than 100,000 poor rural households in Vietnam. CHOBA included a traditional information and education campaign, facilitation of credit and some supply side measure with results-based payments to partners and a small “consumer rebate” to poor households (less than 10% of the cost of a hygienic latrine). In order to assess the impact of different incentives CHOBA implemented randomised control trials in two provinces of Vietnam were carried out. The treatment groups either received rebates for households constructing a hygienic latrine, or conditional cash transfer to local authorities if the coverage of hygienic latrines in the commune increased by 30 percentage points or both interventions. We find a large effect of the project—and especially of the consumer rebates--on increasing the coverage of septic tank latrines. Although other types of hygienic latrines were eligible for the rebates, poor households overwhelmingly chose septic tanks in spite of their higher cost. The project also improves people’s knowledge of infectious diseases related to poor sanitation. As intended, the project increased ownership of hygienic latrines more among poor households than that among wealthier ones. Interestingly, households that stated before the start of the project that they planned to get a new latrine over the next three years did so to a significantly greater extent than other households.

1. Introduction

Reducing child mortality by two-thirds between 1990 and 2015 was one of the key Millennium Development Goals (MDGs). Although significant progress was made, the goal was not reached and the UN Inter-agency Group for Child Mortality Estimation concluded that around 5.9 million children under the age of five die every year (UNICEF, 2015). Of these deaths, around 361,000 can be attributed to inadequate drinking water, sanitation and hygiene (Wolf et al., 2014).

The importance of sanitation conditions on people's health has been studied substantially in the literature (Fewtrell et al., 2005; Benova et al., 2014; Wolf et al., 2014), particularly on children's health. Adequate sanitation not only prevents endemic diarrhea but also helps reduce numerous globally important infections (Bartram and Cairncross, 2010). Spears (2013) finds that poor sanitation in India as indicated by open defecation is one of major causes for the excess stunting in India as well as in Cambodia (Kov et al, 2013) and Vietnam (WSP, 2014).

Despite the important role of hygienic latrines, there is still a large proportion of people who do not have access to it. According to the WHO/UNICEF Joint Monitoring Programme (JMP, 2015) 2.4 billion people—or one-third of the world population—still lack access to improved sanitation.¹ Not only did the developing world fail to reach the MDG target for improved sanitation, there are great inequities in the access to proper sanitation. Rural areas lag behind urban areas and there is a wide gap in sanitation access between the rich and the poor (JMP, 2012 and 2015).

Vietnam has made great economic and social progress over the last couple of decades. The percentage of the population living below the World Bank's (new) poverty

¹ Improved sanitation includes flush/pour flush (to piped sewer system, septic tank, pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet.

line of \$3.10 (in 2011 PPP terms²) declined from 77% in 1992 to 14% in 2012 (World Bank, 2016). The mortality rate for children under age of 5 declined from 55 per 1,000 in 1990 to 22 in 2015 (UN-IGME, 2015). Vietnam also met the MDG target for improved sanitation and, except for mountainous areas with predominantly ethnic minorities, open defecation has been virtually eliminated. However, in spite of efforts such as the 15 year National Target Program for Rural Water Supply and Sanitation, 61% of the poorest quintile lack improved sanitation facilities as compared to 0.1% for the richest 20% of the households. This can partly explain why the incidence of diarrhea among children under 5 is roughly three times as high as in poor families as in rich families (General Statistical Office and UNICEF, 2015).

In order to address this imbalance, the East Meets West Foundation³ (EMW) has implemented a large scale sanitation program focused on the poorest 40% of the rural population. The program, called the Community Hygiene Output-Based Aid (CHOBA), operated in ten provinces in Vietnam.^{4,5} CHOBA includes traditional sanitation promotion elements as well incentives to all stakeholders. The main incentive for low income households is a “consumer rebate.” More specifically, poor households and those with economic hardship conditions are provided with a rebate upon completing their construction—and use—of an improved latrine. The rebate is VND 560,000 (or the equivalent of USD 28⁶), which is approximately equivalent to 10% of the average cost of construction of a septic tank latrine in rural Vietnam. In addition to household rebates, the program provides an additional intervention of a conditional cash transfers (CCT) for commune authorities (90 million VND or equivalent to 4,500 USD) if the improved latrine coverage of their commune increases by 30 percentage points between the baseline and endline surveys. The CCT aims to get the local authorities (Commune People Committee)

² PPP: Purchasing power parity.

³ East Meets West Foundation is an affiliate of Thrive Networks, a U.S. based non-governmental organization.

⁴ Regarding geographical administrative division, Vietnam is divided into 63 provinces and cities. Each province or city consists of districts, and each district is further divided into communes. There are around 11,000 communes in Vietnam, and the average population size of each commune is around 8,200 people.

⁵ CHOBA was also implemented in Cambodia

⁶ The exchanged rate in 2013 was around 20,000 VND per 01 USD. For consistency, this rate is used throughout the paper.

to have general cooperation in CHOBA and to make a general push for improved sanitation in their communes. Staffs from Vietnam Women's Union (VWU) were recruited as implementers who provided households with project information as well as knowledge of health and sanitation.

Associated with CHOBA was a research study with four arms designed to assess the efficacy of the main program incentives (the consumer rebate and the CCT). Thus findings from this study provide an evidence-based assessment of the sanitation interventions, suggesting effective ways to improve the access to hygienic latrines for poor rural households in Vietnam.

The paper is structured into six sections. The second section presents a brief overview of related literatures. The third section describes the study design. The fourth section presents the estimation methods. The empirical results are discussed in the fifth section. Finally, the sixth section summarises key findings and concludes the report.

2. Literature review

2.1. Sanitation-improving programs

There have been a large number of programs implemented to promote access to hygienic or sanitary latrines. These programs include both supply-driven and demand-driven interventions, and there has been an increasing attention paid to interventions that promote the knowledge and demand of households for sanitation (Pattanayak et al., 2007). Several programs implemented information dissemination campaigns to provide people with information and knowledge of health and sanitation. Popular ways to disseminate sanitation information include mass-media such as radio, television and broadcast, group discussions, village meetings and direct visits of healthcare workers to households (Curtis et al., 2001; Rowland et al., 2002; UNICEF, 2002; Quick, 2003; Barnard et al., 2013). Community Led Total Sanitation (CLTS) that was initiated by Kamal Kar (an Indian consultant) and Village Education Resource Centre, a partner of WaterAid in Bangladesh, has been implemented in many low income countries to increase local

people's awareness of sanitation and mobilise local resources to improve latrines and reduce open defecation (Kar and Chambers, 2008).

Related to the supply side, the Sanitation Marketing (SanMark) approach aims to develop the sanitation market so that households can get better access to skills and materials for upgrading their latrines.⁷ The World Bank's Water and Sanitation Program has implemented a Scaling Up Rural Sanitation program which combines Community-Led Total Sanitation (CLTS), behavior change communication, and sanitation marketing to generate sanitation demand and build up the supply of sanitation products and services at scale. Starting in India, Indonesia, and Tanzania in 2006, the Scaling Up Rural Sanitation program has been carried out in more than 10 countries (O'Connell, 2014). Other interventions also include economic subsidy and micro-credit for households to build latrines and improve sanitary facilities (Shugeng, 2000; Kar, 2003).

With regards to the abovementioned interventions, there is still controversial discussion on the effectiveness of latrine subsidy. Kar and Pasteur (2005) argue that the main motivation for sanitation is the people's self-respect instead of subsidy. According to the Sanitation Marketing approach, subsidies can distort the market.⁸ In addition, there are always problems of leakage and coverage in targeting. For example, in the Progresa program which is often mentioned as a successful cash transfer program, the 60 percent richest of the population received 20 percent of program benefits (Barrientos and DeJong, 2006). The poorest tend to receive less from social programs than the middle income groups and the richest (Howe and Longman, 1992; Castles and Mitchell, 1993).

2.2. Impact of sanitation programs

There are a large number of studies on the relation between sanitation and health. Although there is a broad consensus on the important role of sanitation in reducing diarrhea and improving health, especially for children, there are no consistent empirical findings on the impact of specific water and sanitation programs on health

⁷ For additional information on this approach, see <http://www.sanitationmarketing.com/>.

⁸ For additional information on this approach, see <http://www.sanitationmarketing.com/>.

(Fewtrell et al., 2005). For example, there have been different arguments over the impact of single intervention versus combined ones. Esrey (1996) and Clasen (2010) argued that improvements in sanitation alone can have an impact on reducing diarrhea prevalence even without accompanied improvements in water supply or quality. Fewtrell et al. (2005) argue that multiple interventions were not more effective than interventions with a single focus. By contrast, Garrett et al. (2008) study suggests living in intervention villages showed a lower risk of diarrhea than any individual intervention, possibly because of multiple diarrhea transmission pathways (Gil et al., 2004). Checkley et al. (2004) proved that an integrated approach including better water source, improved sanitation, and better practice of water storages is desired for full health benefits. Studies by Esrey et al. (1996) are also in favor of improvement in sanitation as well as combined effort with water supply.

In order to measure the impact of such intervention in water and sanitation, a properly designed randomization cluster trial (RCT) study is crucial (Clasen *et al*, 2010; Fewtrell & Colford, 2004). However, there are fewer studies using this method or can only partly randomize the studied groups in developing countries (Clasen, 2012). Clasen et al. (2012) is one of the first attempts to conduct a randomized controlled trial (RCT) of sanitation intervention to prevent diarrheal diseases in Orissa, India. Recently, several other RCT of interventions were also employed by Dreifelbis et al. (2014), Freeman et al. (2014), Guiteras et al. (2014), and Duflo et al. (2015).

How to increase the coverage of sanitation is a crucial question that is of interest not only to academic researchers but also to policy makers. The Community Hygiene Output-Based Aid (CHOBA) approach pioneered by East Meets West Foundation represents a potentially effective method for promoting adoption of sustainable hygiene practices among rural households and increasing sanitation coverage in difficult areas worldwide. Its innovative approach, employing consumer rebates and conditional cash transfers as incentive mechanisms for sanitation and hygiene promotion, has proved to be a powerful tool in India, Morocco and Senegal (Tremolet and Evans, 2010) Having the beneficiaries pre-finance the construction of their sanitary facilities has created high

private/public risk sharing while encouraging adoption of better hygiene practice in a sustainable manner.

The CHOPA program design is based on theoretical literature exemplified by two papers discussed in this section. Pattanayak and Pfaff (2009) describe four diseases that stem from exposure to environmental factors: arsenic poisoning, respiratory diseases, diarrhea, and malaria. In the case of diarrhoea, they observe that public policy failures are often related to lack of demand for improved sanitation and water supply infrastructure. To explore causes for this lack of demand, and to seek remedies for it, they develop a microeconomic model of household choice in which utility depends on leisure, disease avoidance, and consumption. Pattanayak and Pfaff (2009) elaborate on dimensions of choice related to disease avoidance and conclude that demand for improved sanitary infrastructure could be increased by promoting knowledge of its health benefits, providing technical knowledge about available options, enhancing perceptions of related non-health benefits (e.g., convenience, privacy, cleanliness, prestige), and subsidizing its acquisition. In addition, they note that private decisions to adopt improved sanitation may be socially inefficient if there are positive externalities to doing so. Finally, they note that adoption by some may induce adoption by others through demonstration effects. These last two points provide the classic justifications for public action.

Jenkins and Scott (2007) draw on theories of reasoned action and theories of planned behavior to develop a highly-nuanced model of the decision to adopt new sanitation facilities, which they use to guide their empirical research in Ghana. The adoption decision takes place in three stages: preference formation, intention determination, and choice to implement. Jenkins and Scott (2007) developed a survey instrument which enabled them to classify households by decision stage, identify determinants of arriving at each stage, and identify constraints to moving from one stage to the next. Examination of determinants and constraints provides guidance for interventions to establish preferences, enhance intention formation, and motivate implementation.

3. Randomized control trial design

3.1. The interventions

The Community Hygiene Output-Based Aid (CHOBA) project is implemented by the East Meets West Foundation (EMW, an affiliate of Thrive Networks) in Vietnam and Cambodia with financial support from the Bill and Melinda Gates Foundation. Over a 3 and 1/2 year period, the project reached more than 100,000 poor households in Vietnam and almost 50,000 poor households in Cambodia. The CHOBA program is designed to influence households at critical stages of their decision-making process, using:

- An information and education campaign for behavior change;
- Access to affordable credit (primarily from the Vietnam Bank for Social Policy);
- Supply chain improvement through training of masons; and
- Incentives to poor households, the VWU, motivators, and participating communes.

These incentives will be discussed further below.

There are slight differences in the institutional arrangements and the incentives provided in Vietnam and Cambodia. The research described in this report was conducted in Vietnam and, thus, the description below refers to the CHOBA project in this country.

CHOBA has a decisive focus on the rural poor. To achieve this, and in view of the discussion above and an analysis of latrine access and health by income group, the CHOBA target population has been defined as:

- Households with a ***certificate of poverty*** issued by the Provincial People's Committee (PPC) and the provincial Department of Labor, War Invalids and Social Affairs (DOLISA);
- Households officially classified as "***near poor***" by the Commune People's Committee (CPC); and

- Households suffering from “*economic hardship*” as identified by the CPC and the community, meeting certain income and asset ownership criteria established by EMW.

These criteria are designed to include households that belong to the poorest 40% of the population. This cut-off is comparable to the World Bank’s USD 2 per day in 2005 PPP terms.

The Vietnam Women’s Union’s (VWU) chapters at the central, provincial, district and commune level are conducting the Information, Education & Communication (IEC) campaign, facilitate access to credit and coordinate all field activities, including the training of masons. Some 5,000 VWU volunteers are engaged in the process, using soft persuasion to encourage participation, advising on latrine options and assisting with loan applications. Other partners are the Vietnam Health Environment Management Agency (VIHEMA), the provincial preventive medical centers (PMCs) and health staff at the district and commune levels as well as the Vietnam Bank for Social Policy.

CHOBA focuses primarily on poor households (who are the only households eligible for the consumer rebate). In traditional sanitation programs, implementers are reimbursed for their costs irrespective of the results achieved. As such, they tend to focus on the “easy wins”, i.e. richer households that have more resources and are more likely than the rural poor to build latrines. In CHOBA, the VWU, the field workers, and EMW are paid only for hygienic latrines built—and used—by poor households. The payments are intended to cover the cost of activities but are paid only after the results (i.e. completed hygienic latrines) have been verified. Thus, key stakeholders are decisively focused on the rural poor. Indeed, the results from the field confirm that CHOBA is clearly reaching the poor.

Local governments (communes) are given conditional cash transfers (CCT) based on their overall progress towards the goal. The goal is to achieve a 30 percentage point increase and a stretch goal of 75% sanitary latrine coverage in their commune. These cash payments are earmarked for sanitation investments at the community level, such as

water and sanitation installations for schools. The CCT payments are intended to get the commune leadership to feel ownership of and cooperate in the implementation of CHOBA. In addition, the CCT seeks to encourage local governments to make a determined push for improved sanitation in the commune. Table 1 present the CHOBA’s structure payment.

Table 1: CHOBA’s Payment Structure

OBA Payments (per Targeted Poor Household)		
Implementing Organization	USD 8.00	
Field Workers	USD 2.00	
Conditional Cash Transfers to Communes		
	Before June 2013	After June 2013
Incentive per poor HH built latrine	0	USD 2.50
Latrine Coverage increased by 30 % points	USD 4,500	USD 3,200
75% latrine coverage reached	USD 1,800	USD 1,800
Consumer Rebates to Targeted Poor Households		
Latrine Completed & Used	USD 20 - 28	

** In June 2013, the payment structure was amended to speed up progress*

An important component of the CHOBA program is the consumer rebate. The rebate of VND 560,000 (about USD 28) for septic tanks, and VND 400,000 (about USD 20) for double pit ventilated or pour-flush latrines, is paid only to households that meet the poverty criteria outlined above. With the investment costs of new sanitary latrines meeting Ministry of Health’s (MOH) standards typically being well over VND 5 million (about USD 250 including the superstructure), the rebate covers at most 10% of the cost to build the latrine. Thus, it does not fundamentally alter the cost-benefit calculation for each household. In fact, it acts primarily as a “carrot”, encouraging the household to build now rather than wait. The rebate helps to open doors for the motivators who can argue “I have a deal for you.” Furthermore, it facilitates their education work as they can use this incentive to encourage households to invest today as the “rebate” will not be there forever. This is similar to the discount or sale concept used to encourage consumers to purchase.

Before payments are made, EMW verifies latrine construction and the poverty status of each household. This verification of results is done for a 30% sample and enhances transparency and accountability.

3.2. The randomized control trial design and data set

To allow for rigorous impact evaluation of the project, a randomised control trial design has been implemented in the two provinces Hai Duong in the North and Tien Giang in the South of Vietnam. Firstly, 130 communes are randomly selected from the 428 program communes (in both provinces). There are 58 communes in Hai Duong province and 72 communes in Tien Giang province (Table 2). There are three treatment groups: the first group received both rebate and CCT intervention (standard group), the second group received only the rebate intervention, and the third group received only the CCT intervention. The control group did not receive any intervention.

The initial objective was to undertake classical randomized controlled trials in two provinces. However, for operational and political reasons, modifications had to be made to the allocation of communes to treatment arms. At an early planning stage, the provincial Women's Union chapters and EMW agreed on which communes should be included in CHOBA. In Hai Duong 30 communes were identified and in Tien Giang 37 communes. In the latter province, the VWU gave preference to communes with a low sanitation coverage. While in Hai Duong, the selected communes were closer to the provincial average. The research team randomly assigned these communes to the various treatment and control arms. When the Women's Union and local authorities realized that this would imply that some of the original CHOBA communes would not get any benefits and others would not receive the consumer rebate, they objected. The main reason was that commune officials and local WU members as well as some potential beneficiaries had already been informed that they would be entitled to certain rewards, especially the consumer rebate.

As a compromise, EMW and the VWU agreed that the original CHOBA communes

would be randomly assigned to treatment arms 1 and 2 (both of which would get the consumer rebates). To allow the research to proceed, it was also agreed that EMW would select, on a random basis, additional communes for the CCT only treatment arm and the control arm. Some commune authorities in Tien Giang declined to participate and these communes were replaced by the Women’s Union. The result of this process was that the treatment and control arms in Hai Duong were very similar while the treatment arms and the control arm in Tien Giang were quite different in terms of initial sanitation coverage.

Table 2: CHOBA control and treatment groups

Treatment and control groups	Rebate Level (VND)	CCT Level (VND)	IEC campaign	Number of Communes	
				Hai Duong	Tien Giang
Treatment 1: Rebate and CCT	400,000 or 560,000	90 million	Yes	15	19
Treatment 2: Only rebate	400,000 or 560,000	0	Yes	15	18
Treatment 3: Only CCT	0	90 million000	Yes	13	18
Control group	0	0	No	14	18
Total				57	73

Note: CCT is conditional cash transfers for commune authorities.

CHOBA surveys were conducted by the above 130 communes in 16 districts in Hai Duong and Provinces. The data were collected by Mekong Development Research Institute, Hanoi, Vietnam. A baseline survey⁹ and a mid-term survey were conducted in July/August 2012 and December 2013, respectively. Finally, in February-March 2015, the end-line survey was implemented. There are 2,139 households who were randomly selected into the baseline survey. Until the endline survey, there were 1,991 households in the sample. The attrition rate is approximately 7 percent. In this study, we used the three-year panel data of 1,991 households, of which 504 households are from the control groups and 1487 households are from the three treatment groups. The total number of observations is 5,973.

⁹ The baseline survey was conducted by the Water and Sanitation Reference Center in Hanoi.

3.3. Treatment and control groups

An important issue in the impact evaluation is whether there is a selection bias. Table 3 compares the main outcomes of the project in the baseline survey in 2012. The access to latrines of households is measured by the four mutually exclusive choices of latrines: (i) septic tank; (ii) improved latrines (pour-flush, biogas, double-pit dry and ventilated pit dry latrines); (iii) unimproved latrines such as single-pit dry latrine, fish-pond latrine, ashes-bridge/bucket and other latrines which are not classified as septic tank and improved latrines; and (iv) no latrines. In Hai Duong, the treatment and control groups also had a similar percentage of households with a septic tank latrine. However, in Tien Giang, the treatment group had a lower percentage of households with a septic tank latrine than the control group. This confirms the observation that Tien Giang's VWU intended to select communes with a lower coverage of improved latrines into the treatment group.

The pattern of latrine use is rather different between Hai Duong and Tien Giang. The percentage of households using a septic tank latrine was 29.1% in Hai Duong and 39.3% in Tien Giang. However, the percentage of households without a latrine was substantially higher in Tien Giang (at 25.1%) than in Hai Duong (at 2.5%)¹⁰.

Figure 1 presents the percentage of households with access to a septic tank latrine in the baseline and endline surveys. It highlights the difference in the outcome between the treatment and control groups in Tien Giang in the baseline survey. All the treatment and controls in both the provinces experienced an increase in access to septic tank latrines, and the increase in the control group is smaller than that in the treatment groups. In Hai Duong, the improvement in the septic tank coverage is smaller in the treatment group with only CCT than in the treatment groups with rebate. On the other hands, in Tien Giang, the improvement in the outcome is smaller in the treatment group with only rebate than in the treatment groups with CCT.

¹⁰ Non-ownership of latrines does not imply that the household practices open defecation. Some 91% of the respondents without a latrine claim that they use a neighbor's latrine. Thus, the extent of open defecation according to the 2015 survey is only 1.1% in Tien Giang and 0.3% in Hai Duong.

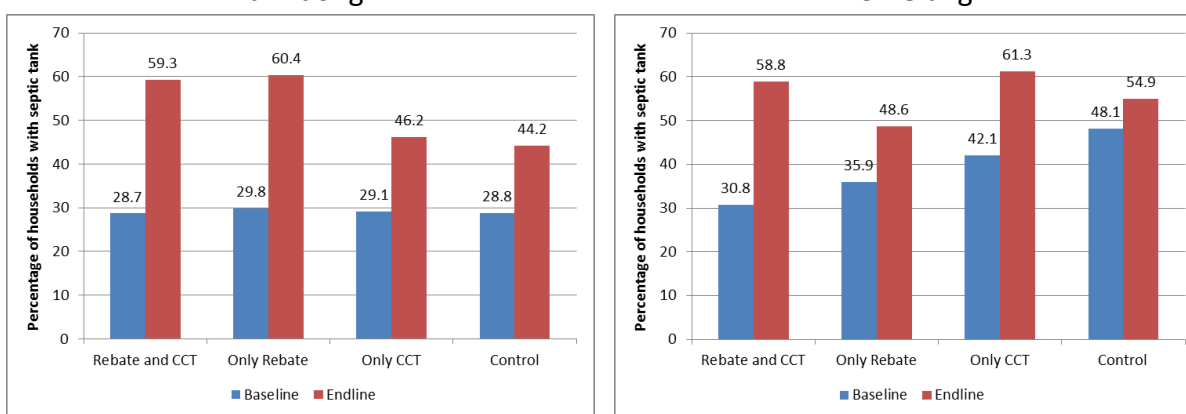
Table 3: Outcome of treatment and control groups in the baseline survey

Treatment and control groups	Percentage of households using a septic tank latrine	Percentage of households using an improved latrine	Percentage of households using an unimproved latrine	Percentage of households not having a latrine
<i>Hai Duong province</i>				
Rebate and CCT	28.7 (2.8)	24.0 (2.7)	45.0 (3.1)	2.3 (0.9)
Only Rebate	29.8 (2.8)	15.8 (2.2)	52.8 (3.1)	1.5 (0.8)
Only CCT	29.1 (3.1)	17.9 (2.6)	49.3 (3.4)	3.6 (1.2)
Control	28.8 (2.9)	17.9 (2.5)	50.4 (3.2)	2.9 (1.1)
Total	29.1 (1.4)	19.0 (1.2)	49.4 (1.6)	2.5 (0.5)
<i>Tien Giang province</i>				
Rebate and CCT	30.8 (2.9)	6.5 (1.5)	33.5 (2.9)	29.2 (2.8)
Only Rebate	35.9 (3.1)	9.0 (1.9)	28.6 (3.0)	26.5 (2.9)
Only CCT	42.1 (3.1)	8.1 (1.7)	25.1 (2.8)	24.7 (2.7)
Control	48.1 (3.1)	14.0 (2.1)	17.8 (2.4)	20.1 (2.5)
Total	39.3 (1.5)	9.5 (0.9)	26.2 (1.4)	25.1 (1.4)

Standard errors are in parentheses.

Source: Authors' estimation based on the 2012 CHOBA survey.

Figure 1: The percentage of households using a septic tank latrine
Hai Duong Tien Giang



Source: Authors' estimation based on the 2015 CHOBA survey.

To understand the difference in VWU's effort in different treatment and control

groups, we estimate the number of visits of VWU’s staffs and volunteers to local households (Table 4). It shows that the frequency of visits is higher in the treatment communes than the control ones. . The treatment group in Tien Giang was visited more frequently than the treatment group in Hai Duong. This is especially true for the the CCT only communes. This might be a reason why households in Tien Giang communes receiving the CCT intervention are more likely to install a septic tank than households in the rebate only communes.

Table 4: Visit of Vietnam Women’s Union staffs to households

Treatment and control groups	Distribution of households by responses about the number of visits of VWU staffs to their households (%)					Total
	No VWU activities on sanitation	No visits of VWU staffs	VWU staffs had one visit	VWU staffs had two visits	VWU staffs had more than three visit	
Hai Duong province						
Treatment 1: Rebate and CCT	10.1 (1.9)	10.1 (1.9)	13.2 (2.1)	34.9 (3.0)	31.8 (2.9)	100
Treatment 2: Only rebate	15.8 (2.2)	8.7 (1.7)	16.2 (2.3)	31.7 (2.9)	27.5 (2.7)	100
Treatment 3: Only CCT	16.6 (2.5)	10.8 (2.1)	12.6 (2.2)	32.7 (3.1)	27.4 (3.0)	100
Control group	27.1 (2.9)	15.8 (2.4)	17.9 (2.5)	20.4 (2.6)	18.8 (2.5)	100
Tien Giang province						
Treatment 1: Rebate and CCT	12.5 (2.1)	10.6 (1.9)	7.5 (1.6)	23.9 (2.7)	45.5 (3.1)	100
Treatment 2: Only rebate	14.9 (2.3)	10.8 (2.0)	14.1 (2.2)	20.1 (2.5)	40.2 (3.1)	100
Treatment 3: Only CCT	11.7 (2.0)	8.5 (1.8)	9.7 (1.9)	21.4 (2.6)	48.8 (3.2)	100
Control group	22.5 (2.6)	11.9 (2.0)	10.3 (1.9)	19.4 (2.5)	36.0 (3.0)	100

Standard errors are in parentheses.

Source: Authors’ estimation based on the 2015 CHOBA survey.

Since the treatment and control groups in Tien Giang are not balanced on the outcome variable, we will need to control for differences between the treatment and control groups when estimating the impact of the CHOBA project. To examine the extent of the difference in outcomes at the baseline, we regress the outcome variables on the three dummies indicating the treatment groups, and control variables using the baseline data.

The control variables include age, education of household heads, and household demographical variables (see Table A.1 and A.2 in Appendix for definition and summary statistics of variables). Table 5 presents the main coefficients of the treatment variables (the full regression results are reported in Table A.3 in Appendix). Most of the treatment variables have a small magnitude and are not significant. However, in Tien Giang province, households in communes with the rebate and CCT interventions have a significantly lower rate of septic tank latrines than households in control communes. The impact evaluation of this treatment group should be taken with caution.

Table 5: Regression of characteristics in the baseline survey

Explanatory variables	Having a poverty certificate (yes=1, no=0)	Using a septic tank latrine (yes=1, no=0)	Using an improved latrine (yes=1, no=0)	Using an unimproved latrine (yes=1, no=0)	Not using a latrine (no latrine=1, latrine=0)
Hai Duong province					
Rebate and CCT	-0.0051 (0.0172)	-0.0189 (0.0614)	0.0460 (0.0475)	-0.0184 (0.0663)	-0.0086 (0.0098)
Only Rebate	-0.0107 (0.0215)	-0.0060 (0.0410)	-0.0432 (0.0477)	0.0649 (0.0525)	-0.0157 (0.0113)
Only CCT	-0.0023 (0.0180)	-0.0190 (0.0452)	-0.0094 (0.0856)	0.0241 (0.0847)	0.0043 (0.0159)
Control group	Reference				
Control variables	Yes	Yes	Yes	Yes	Yes
Constant	1.1796*** (0.2146)	-0.1343 (0.3532)	-0.0503 (0.4083)	0.8950 (0.4942)	0.2896** (0.1068)
Observations	986	986	986	986	986
R-squared	0.19	0.10	0.05	0.12	0.05
Tien Giang province					
Rebate and CCT	-0.0042 (0.0190)	-0.0892** (0.0355)	-0.0412 (0.0316)	0.0925 (0.0737)	0.0379 (0.0671)
Only Rebate	0.0005 (0.0266)	-0.0308 (0.0773)	-0.0289 (0.0368)	0.0546 (0.0657)	0.0051 (0.0614)
Only CCT	-0.0139 (0.0226)	-0.0125 (0.0550)	-0.0246 (0.0445)	0.0463 (0.0662)	-0.0091 (0.0417)
Control group	Reference				
Control variables	Yes	Yes	Yes	Yes	Yes
Constant	0.7248** (0.2814)	-0.2298 (0.3848)	-0.1152 (0.1287)	0.4193 (0.3307)	0.9257*** (0.1496)
Observations	1005	1005	1005	1005	1005
R-squared	0.08	0.13	0.07	0.08	0.11

Standard errors in parentheses. Standard errors are corrected for within-commune and between-commune correlation.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Authors' estimation based on the CHOBA surveys.

4. Econometrics method

As mentioned above, the selection of treatment and control communes in Tien Giang province is not random. In Hai Duong, although the treatment and control communes are randomly selected, the number of communes is not large. Simple comparison of outcome between the treatment and control communes might result in a biased estimate of the project impact. When the number of clusters (communes) is small, even without any intervention the treatment and control groups might still differ in their outcomes. To produce more robust estimates of the project impact, we will use regression to control for potential differences between the treatment and control groups. We assume the access to latrines of households as a reduced function of the interventions and other control variables as follows:

$$Y_{ict} = \beta_0 + \beta_1 \text{Rebate_CTT}_{ct} + \beta_2 \text{Rebate}_{ct} + \beta_3 \text{CCT}_{ct} + X_{ict}\beta_4 + T_t\beta_5 + u_{ic} + v_{ict}, \quad (1)$$

where Y_{ict} is the dummy variable indicating of the latrine status of household i in commune c in year t . Rebate_CTT_{ct} , Rebate_{ct} and CCT_{ct} are dummy variables indicating whether commune c received intervention ‘both rebate and conditional cash transfer’, intervention ‘only rebate’ and intervention ‘only conditional cash transfer’, respectively. X_{ict} is a vector of household characteristics of the household. T_t are year dummies of the mid-term and endline surveys. The unobserved variables are decomposed into time-invariant (u_{ic}) and time-variant components (v_{ict}).

Taking the advantage of panel household data, we can estimate model (1) using household fixed-effects regression. The household fixed-effects regression can control for the difference between the treatment and control group in not only observed variables but also time-invariant unobserved ones (u_{ic}). Using data transformation, time-invariant unobserved variables are eliminated in the fixed-effects regression.

We will use the same model specification to estimate the effect of the project on households’ knowledge of health and sanitation. We can include interactions between

the treatment variables and control variables (X_{ic}) to allow the treatment effect to vary across household characteristics. We will estimate model (1) for Hai Duong province and Tien Giang one separately.

5. Empirical results

Table 5 presents the estimates of the project impact on the latrine status of households. There are four dummies indicating households' choice of a latrine type. Since the choices are mutually exclusive and the sum of the choice is equal to one, the sum of the coefficients of an explanatory variable in the four regressions is equal to zero. It should be noted that we estimate equation (1) using a linear probability fixed-effects regression. Binary dependent variables are often estimated using a logit or probit model, and in the case of multiple response model, a multinomial logit can be used. However, fixed-effects probit estimators are not available, while fixed-effects logit estimators are not efficient. In cases of no available non-linear probability models, linear probability models are widely used (e.g., Angrist, 2001; Angrist and Krueger, 2001). The standard errors are heteroskedasticity-robust. In addition, we also use the multi-way clustering technique of Cameron et al. (2011) and Thompson (2011) to allow for the correlation of errors within communes and between communes within the same district simultaneously.

We use a small set of control variables including age and education of household heads, household size, and the proportion of children and old people in households (see Table A.1 and A.2 in Appendix for definition and summary statistics of variables). Geography and any variables that are unchanged during the period 2012-2015 are controlled in the household fixed-effects regression. Tables in this section present only the coefficients of the treatment variables. The full regression results are presented in Table A.4 and A.5 in Appendix.

Table 5 shows that the project helps households in both Hai Duong and Tien Giang to increase the probability of installing a septic tank latrine. In Hai Duong, the effect of the rebate is remarkably higher than the effect of CCT. More specifically, the

intervention of only rebate increases the probability of using a septic tank latrine of household by 0.119. This effect is almost the same as the effect of the intervention of both rebate and CCT. It means that adding the CCT intervention do not increase the probability of installing a septic tank. The intervention of only CCT does not have a significant effect either. On the other hands, in Tien Giang the effect of CCT is higher than the effect of rebate. The intervention of only CCT increases the probability of households installing a septic tank latrine by 0.083. The effect of both CCT and rebate is even higher, at 0.144. However, there are no significant effects of the intervention of only rebate on the septic tank latrines. A possible reason for this difference is that Tien Giang selected the treatment group based on CCT orientation. They focus their efforts in communes under the CCT intervention. Table 4 also shows that in Tien Giang the number of VWU's visits to households was in communes with CCT higher than in communes without CCT.

Interestingly, there are no significant effects of the project on other types of improved latrines (pour-flush, double pit, one pit ventilated).¹¹ Besides, there is a negative effect on unimproved latrines and no latrines. It means that households mainly upgrade their latrines from unimproved latrines to septic tank latrines. For households without latrines, they also tend to install a septic tank instead of an unimproved latrine. As mentioned, the ratio of the rebate to the average construction cost is higher for improved latrines than for septic tank latrines. It implies that households want to install the highest quality latrines only one time rather than upgrading latrines over several times.

¹¹ This is not surprising since in the baseline survey in 2012, some 91% of the households expressed a clear preference for septic tanks and when the cost of the superstructure, the cost differences in the below ground installation is relatively minor.

Table 5: Household fixed-effects regressions of latrines of households

Explanatory variables	Using a septic tank latrine (yes=1, no=0)	Using an improved latrine (yes=1, no=0)	Using an unimproved latrine (yes=1, no=0)	Not using a latrine (no latrine=1, latrine=0)
<i>Sample of Hai Duong province</i>				
Rebate and CCT	0.1231*** (0.0294)	-0.0406 (0.0599)	-0.0601 (0.0425)	-0.0224** (0.0098)
Only Rebate	0.1187** (0.0519)	0.0017 (0.0552)	-0.1206*** (0.0451)	0.0001 (0.0131)
Only CCT	-0.0020 (0.0488)	0.0110 (0.0629)	-0.0080 (0.0464)	-0.0011 (0.0198)
Control variable	Yes	Yes	Yes	Yes
Number of observations	2958	2958	2958	2958
Number of households	986	986	986	986
<i>Sample of Tien Giang province</i>				
Rebate and CCT	0.1441** (0.0617)	-0.0509 (0.0659)	-0.0601 (0.0384)	-0.0331* (0.0189)
Only Rebate	0.0212 (0.0453)	0.0042 (0.0528)	-0.0471 (0.0321)	0.0218 (0.0341)
Only CCT	0.0831* (0.0451)	-0.0591 (0.0462)	0.0289 (0.0333)	-0.0529** (0.0207)
Control variable	Yes	Yes	Yes	Yes
Number of observations	3015	3015	3015	3015
Number of households	1005	1005	1005	1005
Standard errors in parentheses. Standard errors are corrected for within-commune and between-commune correlation.				
* significant at 10%; ** significant at 5%; *** significant at 1%.				
Source: Authors' estimation based on the CHOBA surveys.				

The CHOBA project aims to increase the use of hygienic latrines by improving the health knowledge and sanitary behaviours. To test whether the health knowledge and sanitary behaviours are channelled through the main objective of increasing the coverage of septic tank latrines, we regress health knowledge and sanitary behaviours on the treatment variables. Table 6 shows that the intervention of both rebate and CCT increases the availability of water and soaps at the hand washing place in Hai Duong. Households in project communes are more likely to have better knowledge about the association between infectious diseases and exposure to feces in Hai Duong. However, we do not find significant effects of the project on health knowledge and sanitary behaviours in Tien Giang.

Table 6: Household fixed-effects regressions of health knowledge of households

Explanatory variables	Available water at hand washing place (yes=1, no=0)	Available soap at hand washing place (yes=1, no=0)	Times of hand washing with soap yesterday (yes=1, no=0)	Know diarrhoea caused by feces (yes=1, no=0)	Number of known diseases caused by feces (yes=1, no=0)	Do not know any disease caused by feces (yes=1, no=0)
<i>Sample of Hai Duong province</i>						
Rebate and CTT	0.0477** (0.0220)	0.0872** (0.0391)	0.0530 (0.0910)	0.1533*** (0.0530)	0.1871** (0.0895)	-0.1195*** (0.0304)
Only Rebate	0.0322 (0.0256)	0.0562 (0.0556)	-0.0007 (0.0998)	0.1256* (0.0662)	0.1101 (0.1147)	-0.0831** (0.0397)
Only CCT	0.0392 (0.0326)	0.0993 (0.0704)	-0.0015 (0.1059)	0.1497*** (0.0520)	0.1469 (0.0917)	-0.1094** (0.0504)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	2958	2958	2958	2958	2958	2958
Number of households	986	986	986	986	986	986
<i>Sample of Tien Giang province</i>						
Rebate and CTT	-0.0110 (0.0216)	0.0273 (0.0262)	-0.0087 (0.1543)	0.0109 (0.0435)	0.1620 (0.1454)	0.0020 (0.0482)
Only Rebate	-0.0054 (0.0224)	-0.0304 (0.0212)	-0.1125 (0.1602)	0.0680 (0.0585)	0.0977 (0.1120)	-0.0131 (0.0454)
Only CCT	0.0108 (0.0223)	0.0029 (0.0453)	-0.1303 (0.1403)	0.0016 (0.0455)	0.1692 (0.1102)	0.0131 (0.0681)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	3015	3015	3015	3015	3015	3015
Number of households	1005	1005	1005	1005	1005	1005

Standard errors in parentheses. Standard errors are corrected for within-commune and between-commune correlation.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Authors' estimation based on the CHOBA surveys.

In Table 7, we examine the heterogeneous impact of the project on the installation of a septic tank latrine by including interactions between the treatment variables and other control variables in regression of septic tank latrines using pooled sample of Hai Duong and Tien Giang. All the interacted variables are dummy. The coefficients of treatment variables (i.e., Rebate and CCT, Only Rebate, and Only CCT) measure the effect of treatment variables for households with the value of interacted variables equal to zero. The coefficients of treatment variables plus the coefficients of interactions are estimated effects of the treatment variables for households with the value of interacted variables equal to one. For example, the effect of Rebate and CCT on households in the mid-term survey is equal to 0.0957. In this case, variable 'Year 2015' is

equal to zero. When variable 'Year 2015' is equal to one, it means that the effect of Rebate and CCT on households in 2015 is equal to 0.0957 plus 0.0750. In other words, the effect of Rebate and CCT in 2015 is 0.075 higher than the effect in the mid-term.

Table 7 shows that the effect in the endline survey is higher than the effect in the mid-term survey. This is because the project requires time for preparation, and changing health knowledge and behaviour can take a long time.

The status of latrines at the baseline time is related to the effect of building a septic tank latrine. Firstly, because of the treatments, households without a latrine in the baseline are more likely to install a septic-tank latrine than households with a latrine. Secondly, households without improved latrines are also more likely to install a septic tank latrine than those with a septic tank, improved latrine, or without a latrine. Thirdly, it's interesting that households with an improved latrine in the baseline (not including septic-tank latrines) are more likely to upgrade to a septic-tank latrine than households without an improved latrine. So it means that among households who did not have a septic-tank latrine in the baseline, households with an improved latrine are the most likely to upgrade to a septic-tank latrine, then followed by households with an unimproved latrine, and then households without any latrines.

The project has a higher effect on poor households than non-poor households. Compared with non-poor households in the baseline, the effect of [Rebate and CCT](#) on poor households is 0.0676 higher. In the baseline survey, there is a question on whether households had intention to upgrade or build a more improved latrine in the coming three years. Table 7 also shows a stronger effect of the project on households who had intention to upgrade or install a latrine than those without intention to upgrade their latrines.

Table 7: Household fixed-effects regressions of probability of having septic tank latrines

Explanatory variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Rebate and CTT	0.0957*** (0.0361)	0.1175*** (0.0355)	0.0472 (0.0410)	0.0932*** (0.0335)	0.1107*** (0.0362)	0.0159 (0.0402)
Only Rebate	0.0435 (0.0385)	0.0578 (0.0391)	-0.0150 (0.0360)	0.0280 (0.0332)	0.0517 (0.0328)	0.0034 (0.0341)
Only CCT	0.0257 (0.0368)	0.0095 (0.0361)	-0.0041 (0.0430)	-0.0075 (0.0349)	0.0429 (0.0411)	-0.0342 (0.0383)
Rebate and CTT × Year 2015	0.0750*** (0.0257)					
Only Rebate × Year 2015	0.0577* (0.0317)					
Only CCT × Year 2015	0.0280 (0.0174)					
Rebate and CTT × No latrine in the baseline		0.0925*** (0.0242)				
Only Rebate × No latrine in the baseline		0.1185** (0.0490)				
Only CCT × No latrine in the baseline		0.2118*** (0.0381)				
Rebate and CTT × Unimproved latrine in the baseline			0.2282*** (0.0452)			
Only Rebate × Unimproved latrine in the baseline			0.2074*** (0.0304)			
Only CCT × Unimproved latrine in the baseline			0.1220** (0.0482)			
Rebate and CTT × Improved latrine in the baseline				0.2628*** (0.0612)		
Only Rebate × Improved latrine in the baseline				0.3444*** (0.0476)		
Only CCT × Improved latrine in the baseline				0.3627*** (0.1116)		
Rebate and CTT × Being poor household in the baseline					0.0676* (0.0380)	
Only Rebate × Being poor household in the baseline					0.0619 (0.0413)	
Only CCT × Being poor household in the baseline					-0.0096 (0.0399)	
Rebate and CTT × Intention to improve latrine in the baseline						0.2837*** (0.0322)
Only Rebate × Intention to improve latrine in the baseline						0.2058*** (0.0320)
Only CCT × Intention to improve latrine in the baseline						0.2192*** (0.0451)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5973	5973	5973	5973	5973	5973
Number of households	1991	1991	1991	1991	1991	1991
R-squared	0.11	0.11	0.13	0.13	0.11	0.14

Standard errors in parentheses (corrected for within-commune and between-commune correlation).

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Authors' estimation based on the CHOBA surveys.

6. Conclusions

Although hygienic latrines are important for health, there is still a large proportion of people not having access to a hygienic latrine in developing countries. Increasing access to hygienic latrines is challenging given the constraints of income and difficulties in changing sanitary behaviors. In this study, we evaluate the impact of randomised control trials of incentives that were implemented by East Meets West Foundation to encourage construction of hygienic latrines by poor households in two provinces, Hai Duong and Tien Giang in Vietnam. The incentives include a rebate which is targeted at households and conditional cash transfer which is targeted at the commune authorities. Overall, we find a large effect of the interventions on the coverage of septic latrines. Interestingly, households are more likely to install a septic tank latrine the most among all improved latrines although the cost of a septic tank latrine is higher than the cost of other improved latrines. The effect of rebate on latrine installation is higher than the effect of conditional cash transfers (CCT) in Hai Duong province. On the other hand, in Tien Giang where the treatment and control groups were selected by local authority, the effect of CCT is higher than the effect of rebate. However, this appears to be due—at least in part—to a more vigorous follow-up by the VWU in the CCT only communes. The project also improves people’s knowledge of infectious diseases related to poor sanitation in Hai Duong. The effect of the project is higher on poor households and those having intention to upgrade latrines than non-poor households and those not having intention to upgrade latrines.

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Appendix

Table A.1. Summary statistics of variables in the baseline survey

Variables	Type	Treatment group				Control group			
		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
<i>Dependent variables</i>									
Using septic tank	Binary	0.3268	0.4692	0	1	0.3889	0.4880	0	1
Using improved latrines	Binary	0.1358	0.3427	0	1	0.1587	0.3658	0	1
Using unimproved latrines	Binary	0.3914	0.4882	0	1	0.3333	0.4719	0	1
Having no toilet	Binary	0.1459	0.3532	0	1	0.1190	0.3242	0	1
Available water at hand washing place	Binary	0.9899	0.1000	0	1	0.9940	0.0770	0	1
Available soap at hand washing place	Binary	0.8944	0.3074	0	1	0.9226	0.2675	0	1
Times of hand washing with soap yesterday	Discrete	2.4586	1.2187	0	4	2.3274	1.2104	0	4
Know diarrhea caused by feces	Binary		0.4894	0	1	0.6468	0.4784	0	1
Number of known diseases caused by feces	Discrete		0.9928	0	7	1.0536	0.9886	0	6
Do not know any disease caused by feces	Binary		0.4721	0	1	0.3056	0.4611	0	1
Being poor local authority	Binary	0.3309	0.4707	0	1	0.3294	0.4704	0	1
<i>Explanatory variables</i>									
Age of household head	Discrete	54.058	13.339	22	90	54.115	13.014	20	90
Household head is male	Binary	0.6658	0.4719	0	1	0.5992	0.4905	0	1
Education level of household head	Discrete	2.6046	0.9199	1	5	2.6468	0.9280	1	5
Household size	Discrete	3.9126	1.6026	1	12	3.6448	1.5326	1	10
Proportion of children aged 0-5	Continuous	0.0621	0.1141	0	0.6	0.0612	0.1194	0	0.67
Proportion of children aged 6-15	Continuous	0.1076	0.1585	0	1	0.0946	0.1496	0	0.67
Proportion of women aged 15-49	Continuous	0.2568	0.2057	0	2	0.2394	0.2085	0	1
Proportion of people above 65	Continuous	0.1162	0.2539	0	1	0.1193	0.2633	0	1
Number of observations		1487				504			

Source: Authors' estimation based on the 2012 CHOBA surveys.

Table A.2. Summary statistics of variables in the endline survey

Variables	Type	Treatment group				Control group			
		Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
<i>Dependent variables</i>									
Using septic tank	Binary	0.5601	0.4965	0	1	0.4970	0.5005	0	1
Using improved latrines	Binary	0.1061	0.3081	0	1	0.1623	0.3691	0	1
Using unimproved latrines	Binary	0.2283	0.4199	0	1	0.2515	0.4343	0	1
Having no toilet	Binary	0.1055	0.3073	0	1	0.0892	0.2854	0	1
Available water at hand washing place	Binary	0.9272	0.2598	0	1	0.9108	0.2854	0	1
Available soap at hand washing place	Binary	0.7644	0.4245	0	1	0.7505	0.4332	0	1
Times of hand washing with soap yesterday	Discrete	2.9232	1.1147	0	4	2.9006	1.1191	0	4
Know diarrhea caused by feces	Binary	0.4927	0.5001	0	1	0.4909	0.5004	0	1
Number of known diseases caused by feces	Discrete	1.2543	0.9883	0	5	1.2292	0.9970	0	5
Do not know any disease caused by feces	Binary	0.2397	0.4270	0	1	0.2596	0.4389	0	1
Being poor local authority	Binary	0.2036	0.4028	0	1	0.2110	0.4084	0	1
<i>Explanatory variables</i>									
Age of household head	Discrete	56.272	12.888	22	102	56.763	13.018	23	92
Household head is male	Binary	0.6629	0.4729	0	1	0.6004	0.4903	0	1
Education level of household head	Discrete	2.2770	1.0587	1	5	2.3651	1.1300	1	5
Household size	Discrete	3.5674	1.5563	1	11	3.4604	1.5424	1	10
Proportion of children aged 0-5	Continuous	0.0543	0.1098	0	0.5	0.0476	0.1063	0	0.5
Proportion of children aged 6-15	Continuous	0.1013	0.1557	0	0.67	0.0971	0.1521	0	0.67
Proportion of women aged 15-49	Continuous	0.2079	0.2035	0	1	0.2131	0.2074	0	1
Proportion of people above 65	Continuous	0.1253	0.2657	0	1	0.1468	0.2837	0	1
Number of observations		1487				504			

Source: Authors' estimation based on the 2015 CHOBA surveys

Table A.3. Regressions of outcome variables in the baseline survey (2012)

Explanatory variables	Hai Duong province sample				Tien Giang province sample			
	Using a septic tank latrine (yes=1, no=0)	Using an improved latrine (yes=1, no=0)	Using an unimproved latrine (yes=1, no=0)	Not using a latrine (no latrine=1, latrine=0)	Using a septic tank latrine (yes=1, no=0)	Using an improved latrine (yes=1, no=0)	Using an unimproved latrine (yes=1, no=0)	Not using a latrine (no latrine=1, latrine=0)
Rebate and CTT	-0.0189 (0.0614)	0.0460 (0.0475)	-0.0184 (0.0663)	-0.0086 (0.0098)	-0.0892** (0.0355)	-0.0412 (0.0316)	0.0925 (0.0737)	0.0379 (0.0671)
Only Rebate	-0.0060 (0.0410)	-0.0432 (0.0477)	0.0649 (0.0525)	-0.0157 (0.0113)	-0.0308 (0.0773)	-0.0289 (0.0368)	0.0546 (0.0657)	0.0051 (0.0614)
Only CCT	-0.0190 (0.0452)	-0.0094 (0.0856)	0.0241 (0.0847)	0.0043 (0.0159)	-0.0125 (0.0550)	-0.0246 (0.0445)	0.0463 (0.0662)	-0.0091 (0.0417)
Age of household head	-0.0068 (0.0103)	0.0035 (0.0158)	0.0100 (0.0182)	-0.0067 (0.0034)	0.0165 (0.0139)	0.0097* (0.0047)	-0.0091 (0.0127)	-0.0171** (0.0055)
Age squared of household head	0.0001 (0.0001)	-0.0000 (0.0001)	-0.0001 (0.0002)	0.0001 (0.0000)	-0.0001 (0.0001)	-0.0001 (0.0000)	0.0001 (0.0001)	0.0001** (0.0000)
Household head is male	0.0715*** (0.0071)	0.0000 (0.0278)	-0.0732* (0.0316)	0.0016 (0.0092)	-0.0786 (0.0434)	0.0219 (0.0210)	0.0860** (0.0276)	-0.0293 (0.0267)
Education level of household head	0.1241*** (0.0136)	0.0148 (0.0223)	-0.1318*** (0.0205)	-0.0071 (0.0055)	0.1187*** (0.0119)	-0.0094 (0.0059)	-0.0470** (0.0199)	-0.0622*** (0.0119)
Household size	0.0381* (0.0183)	0.0005 (0.0090)	-0.0230 (0.0132)	-0.0156** (0.0059)	0.0242* (0.0116)	-0.0057 (0.0091)	0.0031 (0.0083)	-0.0216*** (0.0037)
Proportion of children aged 0-5	-0.0124 (0.2388)	-0.1863 (0.1313)	0.0184 (0.1993)	0.1803 (0.1390)	-0.2523* (0.1282)	-0.0028 (0.0796)	0.0255 (0.1768)	0.2297* (0.1190)
Proportion of children aged 6-15	-0.2094** (0.0836)	-0.1372 (0.1294)	0.2985*** (0.0656)	0.0481 (0.0367)	-0.1347 (0.1094)	-0.0196 (0.0515)	0.0144 (0.0949)	0.1399 (0.1077)
Proportion of women	0.0957 (0.0956)	-0.0232 (0.1005)	-0.0920 (0.1138)	0.0195 (0.0232)	0.0173 (0.0684)	0.0089 (0.0437)	0.0456 (0.0471)	-0.0717 (0.0631)
Proportion of people above 65	0.0467 (0.0245)	-0.0375 (0.0863)	-0.0264 (0.1010)	0.0171 (0.0245)	0.0977 (0.1292)	-0.0777 (0.0528)	-0.0831 (0.0655)	0.0631 (0.1006)
Constant	-0.1343 (0.3532)	-0.0503 (0.4083)	0.8950 (0.4942)	0.2896** (0.1068)	-0.2298 (0.3848)	-0.1152 (0.1287)	0.4193 (0.3307)	0.9257*** (0.1496)
Observations	986	986	986	986	1005	1005	1005	1005
R-squared	0.10	0.05	0.12	0.05	0.13	0.07	0.08	0.11

Standard errors in parentheses. Standard errors are corrected for within-commune and between-commune correlation.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Authors' estimation based on the CHOBA surveys.

Table A.4: Household fixed-effects regressions of latrines in Hai Duong and Tien Giang samples

Explanatory variables	Hai Duong province sample				Tien Giang province sample			
	Using a septic tank latrine (yes=1, no=0)	Using an improved latrine (yes=1, no=0)	Using an unimproved latrine (yes=1, no=0)	Not using a latrine (no latrine=1, latrine=0)	Using a septic tank latrine (yes=1, no=0)	Using an improved latrine (yes=1, no=0)	Using an unimproved latrine (yes=1, no=0)	Not using a latrine (no latrine=1, latrine=0)
Rebate and CTT	0.1231*** (0.0294)	-0.0406 (0.0599)	-0.0601 (0.0425)	-0.0224** (0.0098)	0.1441** (0.0617)	-0.0509 (0.0659)	-0.0601 (0.0384)	-0.0331* (0.0189)
Only Rebate	0.1187** (0.0519)	0.0017 (0.0552)	-0.1206*** (0.0451)	0.0001 (0.0131)	0.0212 (0.0453)	0.0042 (0.0528)	-0.0471 (0.0321)	0.0218 (0.0341)
Only CCT	-0.0020 (0.0488)	0.0110 (0.0629)	-0.0080 (0.0464)	-0.0011 (0.0198)	0.0831* (0.0451)	-0.0591 (0.0462)	0.0289 (0.0333)	-0.0529** (0.0207)
Age of household head	0.0027 (0.0058)	0.0086*** (0.0025)	-0.0121** (0.0058)	0.0009 (0.0024)	0.0108 (0.0070)	-0.0021 (0.0034)	-0.0017 (0.0055)	-0.0070 (0.0064)
Age squared of household head	-0.0000 (0.0001)	-0.0001*** (0.0000)	0.0001** (0.0000)	-0.0000 (0.0000)	-0.0001 (0.0001)	-0.0000 (0.0000)	0.0000 (0.0001)	0.0001 (0.0001)
Household head is male	-0.0179 (0.0365)	0.0600* (0.0355)	-0.0597 (0.0412)	0.0176 (0.0146)	0.0283 (0.0335)	-0.0420 (0.0266)	0.0018 (0.0282)	0.0119 (0.0216)
Education level of household head	0.0472*** (0.0161)	-0.0038 (0.0145)	-0.0302* (0.0163)	-0.0132 (0.0088)	0.0296** (0.0130)	0.0033 (0.0123)	-0.0152*** (0.0053)	-0.0177** (0.0081)
Household size	0.0223*** (0.0066)	0.0018 (0.0039)	-0.0097 (0.0080)	-0.0144* (0.0077)	0.0144 (0.0101)	-0.0048 (0.0061)	0.0017 (0.0046)	-0.0112* (0.0061)
Proportion of children aged 0-5	0.0530 (0.0936)	-0.1482 (0.0908)	0.0147 (0.0683)	0.0804 (0.0758)	-0.0220 (0.1340)	0.0031 (0.0636)	0.1005 (0.0682)	-0.0815 (0.0613)
Proportion of children aged 6-15	-0.0112 (0.0691)	-0.0652 (0.1022)	0.0732 (0.0802)	0.0033 (0.0407)	0.1184* (0.0698)	-0.0429 (0.0559)	-0.0118 (0.0362)	-0.0636 (0.0718)
Proportion of women	0.0514 (0.0472)	0.0166 (0.0246)	-0.0562 (0.0616)	-0.0118 (0.0162)	-0.0420 (0.0304)	0.0136 (0.0271)	0.0489 (0.0577)	-0.0206 (0.0256)
Proportion of people above 65	0.0031 (0.0285)	0.0015 (0.0461)	-0.0029 (0.0347)	-0.0017 (0.0237)	0.0142 (0.0672)	-0.0072 (0.0504)	0.0647* (0.0362)	-0.0717 (0.0527)
Dummy year 2013	0.0633 (0.0453)	-0.0217 (0.0590)	-0.0715* (0.0414)	0.0299*** (0.0115)	0.0446 (0.0536)	0.0478 (0.0575)	-0.0607*** (0.0224)	-0.0318* (0.0181)
Dummy year 2015	0.1887*** (0.0437)	-0.0635 (0.0508)	-0.1236*** (0.0347)	-0.0016 (0.0115)	0.1150*** (0.0375)	0.0576 (0.0574)	-0.1047*** (0.0188)	-0.0680*** (0.0211)
Observations	2958	2958	2958	2958	3015	3015	3015	3015
Number of households	986	986	986	986	1005	1005	1005	1005
R-squared	0.16	0.02	0.09	0.02	0.07	0.01	0.06	0.03

Standard errors in parentheses. Standard errors are corrected for within-commune and between-commune correlation.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Authors' estimation based on the CHOA surveys.

Table A.5: Household fixed-effects regressions of health knowledge of households

Explanatory variables	Hai Duong province						Tien Giang province					
	Available water at hand washing place	Available soap at hand washing place	Times of hand washing with soap yesterday	Know diarrhoea caused by feces	Number of known diseases caused by feces	Do not know any disease caused by feces	Available water at hand washing place	Available soap at hand washing place	Times of hand washing with soap yesterday	Know diarrhoea caused by feces	Number of known diseases caused by feces	Do not know any disease caused by feces
Rebate and CTT	0.0477** (0.0220)	0.0872** (0.0391)	0.0530 (0.0910)	0.1533*** (0.0530)	0.1871** (0.0895)	-0.1195*** (0.0304)	-0.0110 (0.0216)	0.0273 (0.0262)	-0.0087 (0.1543)	0.0109 (0.0435)	0.1620 (0.1454)	0.0020 (0.0482)
Only Rebate	0.0322 (0.0256)	0.0562 (0.0556)	-0.0007 (0.0998)	0.1256* (0.0662)	0.1101 (0.1147)	-0.0831** (0.0397)	-0.0054 (0.0224)	-0.0304 (0.0212)	-0.1125 (0.1602)	0.0680 (0.0585)	0.0977 (0.1120)	-0.0131 (0.0454)
Only CCT	0.0392 (0.0326)	0.0993 (0.0704)	-0.0015 (0.1059)	0.1497*** (0.0520)	0.1469 (0.0917)	-0.1094** (0.0504)	0.0108 (0.0223)	0.0029 (0.0453)	-0.1303 (0.1403)	0.0016 (0.0455)	0.1692 (0.1102)	0.0131 (0.0681)
Age of household head	0.0029 (0.0050)	-0.0086 (0.0149)	-0.0564* (0.0321)	0.0267*** (0.0083)	0.0443** (0.0197)	-0.0189** (0.0082)	-0.0001 (0.0066)	-0.0043 (0.0062)	0.0169 (0.0151)	0.0085 (0.0090)	-0.0075 (0.0102)	-0.0048 (0.0044)
Age squared of household head	-0.0000 (0.0000)	0.0001 (0.0001)	0.0005 (0.0003)	-0.0002*** (0.0001)	-0.0004** (0.0002)	0.0002** (0.0001)	-0.0000 (0.0001)	0.0000 (0.0000)	-0.0002 (0.0001)	-0.0001 (0.0001)	0.0000 (0.0001)	0.0001* (0.0000)
Household head is male	-0.0486 (0.0334)	-0.1091* (0.0625)	0.0197 (0.1490)	0.0820** (0.0399)	0.2253** (0.1030)	-0.1208*** (0.0312)	-0.0114 (0.0127)	-0.0367 (0.0308)	-0.1006 (0.0789)	-0.0902* (0.0468)	-0.0324 (0.0564)	0.0392 (0.0377)
Education level of household head	0.0165** (0.0067)	0.0355*** (0.0134)	0.0788* (0.0450)	0.0256 (0.0243)	0.0010 (0.0569)	-0.0052 (0.0191)	0.0073 (0.0050)	-0.0225* (0.0116)	-0.0414 (0.0611)	0.0135 (0.0118)	0.0359 (0.0433)	0.0096 (0.0142)
Household size	-0.0012 (0.0033)	-0.0094*** (0.0036)	0.0548 (0.0394)	-0.0167 (0.0140)	-0.0545** (0.0244)	0.0215 (0.0167)	-0.0083*** (0.0027)	0.0004 (0.0056)	0.0253 (0.0322)	0.0092 (0.0124)	0.0094 (0.0206)	-0.0117 (0.0076)
Proportion of children aged 0-5	0.0102 (0.0330)	0.1838*** (0.0681)	-0.1757 (0.3535)	-0.0127 (0.1827)	0.4485* (0.2336)	-0.1077 (0.1656)	0.0339 (0.0505)	0.0886 (0.1231)	0.3648 (0.2716)	-0.0246 (0.0452)	-0.0024 (0.1677)	0.0133 (0.1458)
Proportion of children aged 6-15	0.0632 (0.0476)	0.1048*** (0.0401)	-0.3606 (0.2663)	0.1711*** (0.0512)	0.4478** (0.1943)	-0.1853** (0.0764)	0.0953 (0.0835)	0.1013 (0.0989)	-0.0945 (0.2195)	0.0202 (0.1014)	0.1049 (0.1930)	0.0748 (0.0921)
Proportion of women	0.0623** (0.0251)	0.0671 (0.0524)	-0.2904 (0.2887)	0.0196 (0.0501)	0.1450 (0.1358)	-0.0329 (0.0517)	0.0427 (0.0294)	-0.0628 (0.0437)	0.0670 (0.1818)	0.0251 (0.1000)	-0.0650 (0.1198)	0.0020 (0.0754)
Proportion of people above 65	0.0062 (0.0171)	-0.0527 (0.0643)	-0.3403 (0.2509)	0.0450 (0.0695)	-0.0370 (0.1330)	0.0514 (0.0740)	0.0069 (0.0488)	0.0329 (0.0809)	0.2183 (0.2912)	-0.0337 (0.0872)	-0.3583* (0.1911)	0.1539 (0.1056)
Dummy year 2013	-0.0800** (0.0379)	-0.1922*** (0.0698)	0.2298* (0.1276)	-0.2372*** (0.0479)	0.1914 (0.1955)	0.0502 (0.0470)	-0.0706** (0.0313)	-0.1452*** (0.0175)	0.3684*** (0.1017)	-0.1574** (0.0779)	0.0696 (0.1198)	-0.0161 (0.0616)
Dummy year 2015	-0.0418* (0.0237)	-0.1985*** (0.0505)	0.4242*** (0.0763)	-0.1993*** (0.0493)	0.2315** (0.1162)	-0.0088 (0.0451)	-0.1110** (0.0450)	-0.1466*** (0.0485)	0.6245*** (0.1441)	-0.1532** (0.0603)	0.0833 (0.1318)	-0.0909 (0.0609)
No. of observations	2958	2958	2958	2958	2958	2958	3015	3015	3015	3015	3015	3015
No. of households	986	986	986	986	986	986	1005	1005	1005	1005	1005	1005
Within R-squared	0.04	0.05	0.05	0.04	0.04	0.03	0.06	0.05	0.08	0.04	0.02	0.02

Standard errors in parentheses. Standard errors are corrected for within-commune and between-commune correlation.

* significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Authors' estimation based on the CHOBA surveys.

