

EVALUATING THE PROCESS, COSTS, AND OUTCOMES OF ENGAGING NATURAL LEADERS AND TEACHERS IN
COMMUNITY-LED TOTAL SANITATION

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ABSTRACT

Jonny Crocker: Evaluating the process, costs, and outcomes of engaging natural leaders and teachers in community-led total sanitation
(Under the direction of Jamie Bartram)

Sanitation is a global priority: 1 billion people lack access to any sanitation facility and practice open defecation, which contributes to child mortality, stunting, and decreased school attendance. Community-led total sanitation (CLTS) is a sanitation promotion approach implemented in over 50 countries, in which a facilitator visits a village, and “triggers” a collective desire to eliminate open defecation (OD). Implementing CLTS has challenges: it requires frequent follow-up visits by facilitators, depends on collective action by communities, and the costs are not well understood.

I conducted an operational research project collaboratively with Plan International to investigate the role of CLTS in addressing global sanitation challenges, and how to optimize implementation. Chapter 1 of this dissertation is an evaluation of training “natural leaders” (NLs—motivated community members) during a CLTS intervention in Ghana, using a multi-site, randomized field trial. Chapter 2 is an evaluation of teacher-facilitated CLTS in Ethiopia, using a multi-site, quasi-experimental study design. Chapter 3 is a bottom-up, activity-based cost analysis of the Ghana and Ethiopia interventions.

Training NLs in Ghana caused a 19.9 percentage point decrease in OD. The impact was greatest in small, remote, socially cohesive villages. Teacher-facilitated CLTS in Ethiopia was associated with a 9.8 percentage point smaller decrease in OD than health worker-facilitated CLTS. Neither approach was effective in villages with low baseline OD. The implementation cost in Ghana and Ethiopia ranged from \$14.15 to \$81.56 per household targeted, and generated community activity and latrine construction. Latrines built during CLTS tended to be made of local, low-durability materials.

CLTS should be targeted to villages with high OD, where potential for impact is higher. Training NAs can reduce OD, provided they are from cohesive villages. CLTS should be part of a broader sanitation strategy, as it is not applicable everywhere, and low quality latrines may not last. The multi-site evaluations revealed variation of outcomes across settings. Bottom-up costing enabled greater disaggregation than any prior sanitation study, revealing the burden participatory approaches place on local actors, and potential for improved cost-efficiency. These findings and tools are also applicable to other environmental health behavior interventions.

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LIST OF ABBREVIATIONS

AAA	American Automobile Association
CI	confidence interval
CLTS	community-led total sanitation
DID	difference in difference
FTE	full-time equivalent
HEW	health extension worker
HH	household
KL	kebele leader
LNGO	local non-governmental organization
NGO	non-governmental organization
NL	natural leader
OD	open defecation
ODF	open defecation free
pp	percentage points
PVC	polyvinyl chloride
SDG	Sustainable Development Goal
SE	standard error
SNNP	Southern Nations, Nationalities, and Peoples
TDC	top-down costing
TSC	total sanitation campaign
UN	United Nations
UNC	The University of North Carolina at Chapel Hill
WaSH	water, sanitation, and hygiene

INTRODUCTION

While sanitation has improved dramatically in the past decade, globally 2.5 billion people lack access to improved sanitation (more than a third of the world's population). An estimated 1 billion lack access to any sanitation facility and practice open defecation,¹ though the actual number is probably much higher.^{2,3} Almost half of child stunting can be explained by levels of open defecation,⁴ though the exact mechanism by which open defecation affects growth is not clear, nor are the health benefits of specific sanitation interventions and service levels.⁵ There are rationales for sanitation beyond health. Sanitation can lead to improved social status and dignity,^{6,7} gender-equity benefits,⁸ increased school attendance for girls,⁹ and time savings and increased productivity.¹⁰ However, increased access to sanitation is often not sustained when latrines breakdown, and access to sanitation does not always guarantee use when demand is not stimulated.^{11,12}

A number of approaches have emerged for promoting sanitation and hygiene behavior change, including participatory hygiene and sanitation transformation (PHAST), community health clubs, and community-led total sanitation (CLTS).¹³⁻¹⁵ Community-led total sanitation (CLTS) emerged in the year 2000 as a participatory approach to address open defecation (OD), and draws on a variety of emotional triggers such as shame and disgust to bring awareness to sanitation issues.¹⁵ CLTS has been implemented in over 50 countries,¹⁶ and is included in national policies in many such as Ghana and Ethiopia.^{17,18} CLTS implementation consists of three stages, as described in the Handbook on CLTS: pre-triggering, triggering, and follow-up.¹⁵ Pre-triggering includes community entry and gaining acceptance from local leaders. Triggering consists of a community meeting in which outside facilitators use a set of tools (such as sanitation mapping, and a feces volume calculation) to “trigger” an emotional response, an awareness of sanitation and hygiene issues, and a collective desire to improve the situation. During

follow-up, facilitators visit the village to monitor progress and guide their efforts to eliminate OD. If, during follow-up, a community has determined that open defecation is no longer practiced and the environment has been cleaned of all exposed feces, they can request that a district government team visit and certify them as open defecation free (ODF).

I worked on a systematic review of CLTS literature with another PhD student,¹⁹ which is summarized briefly here. The literature review answered four questions. First, what does the evidence show regarding the success or failure of CLTS? Second, have interventions focusing on natural leaders shown an impact on sanitation and hygiene outcomes, and if so what is the nature and magnitude of this impact? Third, have interventions focusing on teachers and schools shown an impact on sanitation and hygiene outcomes, and if so what is the nature and magnitude of this impact? Fourth, have interventions focusing on district/local government actors shown an impact on sanitation and hygiene outcomes, and if so what is the nature and magnitude of this impact? The review covered journal-published and gray literature (all documents available to the public but not in peer-reviewed journals). Separate search and selection methods were used for each type of literature.

We found few scientific studies on sanitation promotion, and only one rigorous trial of a sanitation promotion intervention.²⁰ Since the systematic review, a number of other evaluations of sanitation promotion interventions have been published which demonstrated an impact on latrine construction and adoption,²¹⁻²³ and one evaluation of India's Total Sanitation Campaign that demonstrated an impact on child health and household welfare.²⁴ Only one impact evaluation of CLTS has been completed, in which CLTS produced a 71% reduction in open defecation in villages in Mali, and small reductions in child stunting.²⁵ The following conclusions also emerged from the peer-reviewed literature: children can be effective behavior change agents for influencing their peers' hygiene and sanitation behavior in the school environment. Teachers can be important agents to accelerate the progress of school sanitation activities.

The systematic review of CLTS gray literature reviewed 115 documents, and found that project settings and processes were well-described, but there was a preponderance of low quality study designs and data collection methods.¹⁹ The following conclusions were drawn from the gray literature. The importance of structured monitoring and evaluation mechanisms, especially to sustain behavior change and the scale-up of CLTS activities, was emphasized in most documents. Structured follow-up activities after triggering were reported to have helped communities eliminate open defecation. Natural leaders, teachers, and local government actors were all referenced as important actors in CLTS implementation across the gray literature, but no evaluations were found of their role in achieving CLTS outcomes.

Research with the objective of informing policy and practice has been given a variety of names in different fields, such as implementation science and operational research. Notable principles of implementation science are collaboration between researchers and practitioners in defining research questions, and study of existing programs.²⁶ Others have coherently argued that research methods should be applied to programs as normally practiced,²⁷ that rigorous evaluations focused on service delivery may have the most potential to influence policy,²⁸ and that research on preventative programs should be emphasized over causes of disease.²⁹ Another paper sets criteria for evaluating evidence on public health interventions, by adapting and expanding on criteria for evaluating clinical evidence, with consideration given to the fact that public health interventions tend to be complex, programmatic, and context dependent.³⁰ The authors conclude that evidence on public health interventions should include information on context, details of the intervention, and its efficiency and effectiveness, so that the transferability of the intervention can be determined. Although many sanitation and hygiene evaluations set out to inform policy and practice, there are no consistent terminology or criteria used. Few of these evaluations include the defining components of implementation science or operational research, that is: collaboratively defined research questions, descriptions of the context, intervention, and intervention process, and findings on the efficiency and effectiveness of the intervention.

My doctoral dissertation comprises operational research on CLTS interventions in Ghana and Ethiopia. The project was conducted as a partnership with Plan International (Plan), who led all implementation, as part of a grant from the Bill & Melinda Gates Foundation. We worked together throughout the project, beginning with collaboratively defining the research questions and writing the grant proposal. The interventions focused on evaluating variations on the CLTS approach, which were designed by Plan in response to challenges they have faced. The context, process, costs, and effectiveness for all of the interventions evaluated are included in this dissertation.

In both Ghana and Ethiopia, Plan's local country staff have been implementing CLTS for over eight years. In response to the various challenges they have faced in scaling-up CLTS, they have begun piloting variations in the CLTS approach with mixed success. In Ghana, Plan staff have trained "natural leaders" (NLs – community members who quickly adopt latrine use and try to influence others to do the same) in a variety of technical and social skills, with the aim of improving CLTS outcomes. In Ethiopia, Plan staff have trained teachers to facilitate the CLTS approach. CLTS facilitation is usually the responsibility of NGO staff and health workers, but health workers are responsible for 15 tasks in addition to CLTS, and are not able to perform adequate follow up. Plan trained teachers with the aim of alleviating some of the burden on health workers, without decreasing CLTS outcomes.

My overarching research questions are: (1) how does engaging and increasing the role of local actors in a participatory sanitation and hygiene program change the efficiency and effectiveness of the approach? and (2) what role can CLTS have in addressing global sanitation challenges? Chapter 1 of this dissertation is an evaluation of the impact of training natural leaders during a community-led total sanitation intervention in Ghana using a randomized field trial. Chapter 2 is an assessment of teacher-facilitated community-led total sanitation as an alternative to the conventional approach in Ethiopia using a quasi-experimental design. Chapter 3 is a process and cost analysis of the community-led total sanitation interventions in Ghana and Ethiopia. Studying methods and tools for operational research on

sanitation and hygiene is an overarching objective across the three chapters. Each chapter is based on multi-site studies that enable analysis of variation in outcomes across settings. Each study includes development of new data collection tools, to track the implementation process, and evaluate multiple outcomes, to generate findings of immediate relevance for improving sanitation and hygiene programs.

CHAPTER 1: IMPACT EVALUATION OF TRAINING NATURAL LEADERS DURING A COMMUNITY-LED TOTAL SANITATION INTERVENTION: A RANDOMIZED FIELD TRIAL IN GHANA

Introduction

Sanitation and hygiene behavior change interventions have often incorporated recruiting and training of authority figures such as village leaders, or those in a related profession such as health workers or teachers, to deliver and reinforce behavior change messages. Multiple studies have evaluated interventions that include recruiting local actors, all of which reported positive behavioral or health outcomes.^{31–36} However, only three of the studies included random assignment,^{31,33,34} and none were able to attribute outcomes to recruiting or training local actors, as engagement of local actors was embedded within a broader project in each case. One study trained volunteers in sanitation and hygiene promotion, rather than pre-identified authority figures or professionals. The study evaluated participatory training for mothers, and found changes in behavioral and health outcomes, although they could not be attributed to the intervention due to the quasi-experimental study design and small sample size.³⁷ A recent systematic review of social marketing in water, sanitation, and hygiene (WaSH) found a number of high quality studies on promotion of water treatment and handwashing, but only two that included sanitation promotion.³⁸ Many of these studies find that outcomes are skewed toward certain members of a community (such as children when students were trained, or women when teachers or mothers were trained), or hypothesize that the success of the interventions was partially due to the project occurring in a favorable setting.

The influence of authority figures, neighbors, and peers on decisions and adoption of innovations has been studied and discussed from a theoretical perspective and from within WaSH studies. Diffusion theory posits that adoption of innovation is initiated by exogenous factors (such as

triggering), and that diffusion beyond early adopters through a social network depends on communication and the social system.³⁹ A cross-sectional study in India found that individuals were more influenced to adopt latrines by their peers than by the village as a whole.⁴⁰ A recent evaluation of community-led total sanitation (CLTS) in Indonesia found that the intervention succeeded best in villages with high initial “social capital” or participation, and the intervention failed or even had negative impacts in villages with low social capital.⁴¹ However, two studies on water resources have cautioned against participatory approaches, hypothesizing that both formal and informal power structures may concentrate benefits among a few to the exclusion of the most disadvantaged.^{42,43} An editorial on participatory development hypothesized that interventions in communities with endogenous imperfections (or low social capital) will often lead to appropriation of benefits by the most powerful community members.⁴⁴

Community-led total sanitation is a participatory sanitation and hygiene promotion approach in which an external facilitator triggers an awareness of sanitation and hygiene issues with the aim of generating collective action to eliminate open defecation.¹⁵ A few evaluations of CLTS or similar sanitation promotion projects have been conducted, all of which have shown impact on latrine adoption and behaviors,^{20–22,24,45} two of which found an impact on child health.^{24,45}

CLTS has been implemented in over 50 countries, and is included in national policies and guidelines in many countries, including Ghana in which our study took place.¹⁸ CLTS implementation in Ghana consists of the standard three stages of facilitation described in the Handbook on CLTS¹⁵: pre-triggering, triggering, and follow-up, which can involve weekly to monthly community visits and last over one year in Ghana. Facilitators encourage the most motivated and influential community members—called “natural leaders”—to lead their community by example by building a latrine, and to convince others to do the same. Natural leaders are described similarly to early adopters, in that they are not necessarily authority figures. Natural Leaders are a central theme in the CLTS guidelines,¹⁵ and are

mentioned frequently in CLTS gray literature,¹⁹ but they are not mentioned in any of the CLTS peer-reviewed literature. Plan International Ghana (Plan) has worked on CLTS since 2009 in Ghana. They have found intensive, long-term follow-up is required, and in many cases communities do not respond well to CLTS. They proposed that training natural leaders in a variety of skills, from conflict resolution to latrine construction, could improve the community response to CLTS by improving community dynamics and instilling capacity to build latrines.

We used a randomized field trial design to evaluate the impact of training natural leaders on sanitation outcomes in Ghana. This study was designed as operational research, to generate implications for policy and practice. The evaluation included multiple sites (regions in Ghana), paired with situational assessments before interventions began, to study how outcomes varied across settings. Implementation processes, natural leader and community member activities, and a variety of outcomes were tracked, to enable insight into the mechanism if training natural leaders had an impact. This study was a collaborative effort, with UNC leading the research and Plan leading implementation.

Methods

Program Description

Two different interventions were implemented in rural Ghana. The first intervention (“CLTS”) was CLTS as it has typically been implemented in Ghana. The second intervention (“CLTS + NL training”) was CLTS with additional training given to natural leaders on a variety of participatory, social, and technical skills. The full training manual is available online.⁴⁶

For both interventions, CLTS facilitation began in November 2012, and continued for 18 months. CLTS was facilitated by Plan and three local NGOs (one each in the Central, Upper West, and Volta regions). From here on, Plan and the local NGOs they contracted are referred to collectively as Plan. In all project villages, Plan identified eight natural leaders per village after 5 months of CLTS facilitation

(comprising pre-triggering, triggering, and at least one follow-up visit) had occurred. Plan and district government officials then trained the identified natural leaders from *only those villages* receiving the CLTS + NL training intervention in groups in the regional capitals. Training consisted of an initial 4-day session in March 2013, and three 1-day review meetings and a 4-day refresher training over the following year. Natural leaders identified for training had built a latrine (or owned one) within the first 3-months of the CLTS intervention, consistently showed up to community meetings, and worked to convince others from their village to build a latrine. No natural leaders under 18 years of age were trained. At least one female was trained from each village. A timeline of implementation activities for both interventions is in the appendix, and detailed implementation activities are available online in a report written by Plan.⁴⁷ The implementation in this project was enabled by broad exogenous factors. Plan had prior experience implementing CLTS, working with natural leaders, and collaborating with the government on sanitation and hygiene. The Government of Ghana has included CLTS in national policy, and has institutional support mechanisms in place, such coordinating committees for sanitation at the national and regional levels.⁴⁸

Study Design

We used a cluster-randomized field trial design to evaluate the impact on sanitation outcomes of training natural leaders as an addition to a CLTS intervention in Ghana. Three regions with different environmental and social characteristics were selected and treated as strata, to enable a comparison of outcomes between different settings. Half of the villages within each region were randomly assigned to receive just CLTS, or CLTS + NL training (Figure 1). Random assignment occurred after 5 months of facilitation – just before the initial natural leader training session.

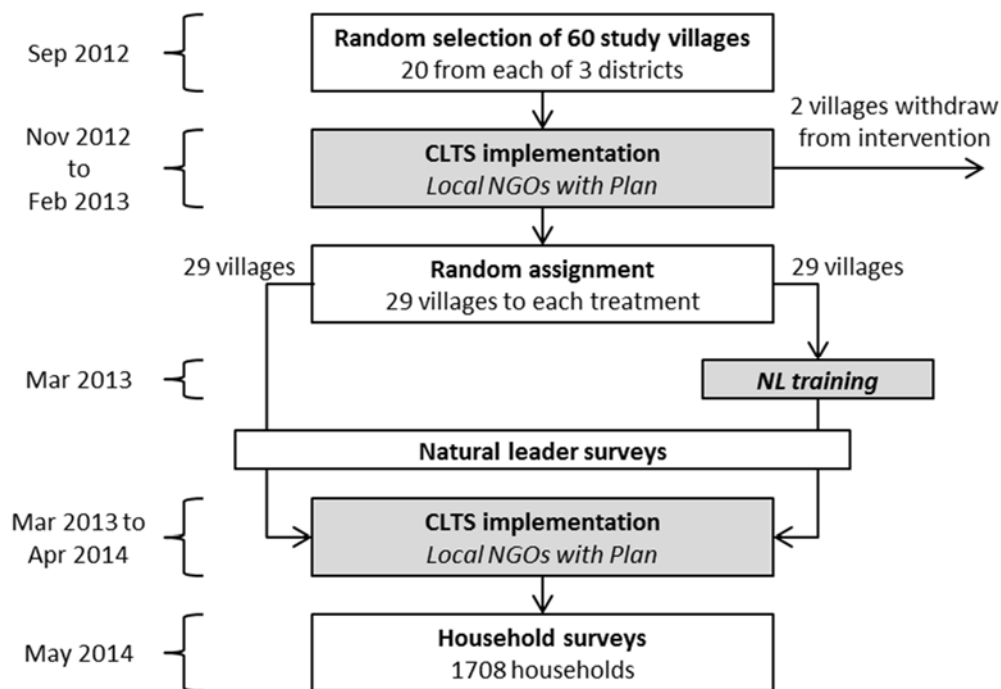


Figure 1. Timeline and sequence of the randomized field trial study design and execution.

Sampling

The Central, Upper West, and Volta regions in Ghana were selected for inclusion in this project as they have different environmental and social conditions, had high levels of open defecation, and Plan had an established relationship with regional government. One district was selected from each region in which the local government was familiar with CLTS, and most villages had not received a CLTS intervention. Twenty villages were randomly selected in each district for inclusion in the study. Villages eligible for inclusion were those with no prior CLTS, and a population of 300-1000 people according to district records. Two villages in the Central region were withdrawn from the study in January 2013 when village leaders turned down the CLTS intervention, reducing the number of study villages to 58.

A census and household listing were completed in May 2014 in all study villages, and GPS locations and number of people living in each household were recorded. Households were sampled proportional to village population, with a minimum of 18 households sampled per village (with the

exception of one village consisting of only 7 households). Twenty-six percent of all households were sampled (1759), of which 97 percent were surveyed (1708). This sample size allows for a detectable difference in latrine ownership between treatment arms ranging from 12 percentage points (10 to 22 percentage points) to 18 percentage points (40 to 58 percentage points) with 80% power, 95% statistical significance, and village-clustering of outcomes accounted for with a conservative intra-class correlation of 0.2.^{20,22,49,50} Census and sampling details are in the appendix.

Data Collection

Village and household characteristics, sanitation and hygiene outcomes, and sanitation-related activities were measured using household surveys, and latrine and handwashing station observations. Survey responses regarding latrines and handwashing stations were validated with surveyor observations. Indicators were selected based on review of prior WaSH research,^{19,20,51,52} and input from UNC and Plan. Surveys were administered by an independent contractor with extensive experience in Ghana, one team lead per region, and local surveyors. Household surveys were translated into the local languages (Fante, Ewe, and Waale) by surveyors during training, translations checked for accuracy by team leads, and then CLTS-related terms checked by Plan staff. The survey tools were developed in SurveyCTO software, and responses and observations recorded on Android devices. Surveys were pre-tested during training and piloted in non-project villages. Team leads reviewed survey responses and counts each evening, and Plan staff were available to answer questions. Surveyors were audited by the regional team leaders visiting a random selection of households each evening to verify the accuracy of data collected.

Shorter printed surveys on training content, and CLTS-related knowledge, attitudes, and practices were administered to natural leaders in all 58 villages in April 2013 (1 month after natural leaders were trained from half of the villages). Natural leader surveys and household surveys were

administered by the same contractor and team using the same protocol. Survey tools are available in the appendix.

Semi-structured interviews with Plan and district government were used to understand the context of each region and the implementation process and challenges. Government officials were interviewed in June 2012, before the interventions began. Plan staff were interviewed in December 2012 and March 2014, at the beginning and end of the interventions. Interviews were administered in English, which was comfortably spoke by all interviewees. The CLTS process was monitored with checklists filled out by Plan, interviews with Plan and district government, teacher and HEW surveys, and questions on interactions in household surveys.

Analysis

Household surveys and observations were used to describe characteristics of the study population. The primary outcome was household-level sanitation practice, as an ordered categorical variable including (1) open defecation, and use of a (2) communal latrine, (3) shared latrine, or (4) private latrine. Self-reported latrine use was validated by observing latrines, and full, collapsed, and unstable latrines were categorized as open defecation. Sanitation practice definitions and measures are available in the appendix. The impact of training natural leaders on sanitation practice was evaluated using an ordinal logistic regression model, because different sanitation practices offer sequential benefits to users. The training impact was modeled for the full sample, and, with a reduced effective sample size, by region. Change in latrine ownership over time was assessed based on respondent recall of how long they had owned their latrine. Recall on latrine age was paired with latrine observations to compare the quality of pre-existing latrines to those built during CLTS interventions. Analysis was completed in STATA 12/13/SE. The study design, including clustering of outcomes within villages,

unequal selection probabilities, and non-response rates, was accounted for using the “svyset” command in STATA.

This study was reviewed and approved by the Office of Human Research Ethics of the University of North Carolina, Chapel Hill (study #12-1970). Local approval was obtained from regional environmental health and sanitation directorates within Ghana. Informed consent was received from all respondents.

Results

Descriptive Statistics

Table 1 includes characteristics of households and respondents, by treatment group, estimated from the follow-up survey. Variables that would not likely to be influenced by the interventions are presented, as they can be used to assess the balance across the treatment groups with data collected after the interventions. Most characteristics are balanced. One showed a significant difference across treatment groups at $p < 0.1$ (years in village). Families in the CLTS + NL training treatment group had lived in their village an average of 5.2 years less than families in the conventional treatment group (25.4 and 30.6 years, $p = 0.038$). Random assignment of villages was used to ensure internal validity, and all analysis accounts for the study design and sampling.

Table 1. Household and respondent characteristics of 29 villages receiving CLTS, and 29 villages receiving CLTS with natural leader training added on.

Variable	CLTS	CLTS + NL training	t-stat	p-value
Average village size (households)	209	162	-0.88	0.380
Average compound size	2.3	2.7	1.17	0.247
Average household size	4.1	3.9	-0.65	0.521
Children under five years of age	0.7	0.6	-1.05	0.298
Female respondent	74%	69%	-1.37	0.177
Average age	44	43	-0.54	0.592
Completed primary school	52%	58%	0.89	0.378
Years family lived in village	31	25	-2.13	0.038
Years family lived in current house	15	14	-1.16	0.249
Metal / fabricated roofing	88%	93%	1.16	0.252
TV ownership	34%	41%	1.40	0.166
Radio ownership	48%	50%	0.45	0.656
Cell phone owners / house	1.2	1.40	1.33	0.190
Use an improved water supply	77%	77%	0.04	0.970
Main water source is in dwelling or compound	9.0%	10.9%	0.55	0.587
Baseline private latrine ownership*	9.4%	12.7%	1.53	0.132

Twenty-nine villages received each intervention. *All values are taken from the 1.5-year follow up household census and survey, and describe the two treatment groups at that time, *except* for baseline private latrine ownership, which is based on recall of how old their latrines were.

Sanitation Outcomes

Training natural leaders as an add-on activity to CLTS caused a 19.9 percentage point (pp) reduction in households practicing open defecation, as compared to villages that just received CLTS (95% CI: -8.8 to -30.9 pp, $p < 0.001$) (Figure 2). The impact was greatest in villages in the Upper West region, where the impact of the natural leader training was a 38.6 pp reduction in open defecation (95% CI: -14.2 to -63.0 pp, $p = 0.002$). There was a smaller reduction in OD in the villages in the Volta Region (-12.4 pp, 95% CI: -5.1 to -19.7 pp, $p = 0.001$), and no statistically significant reduction in OD in the villages in the Central region.

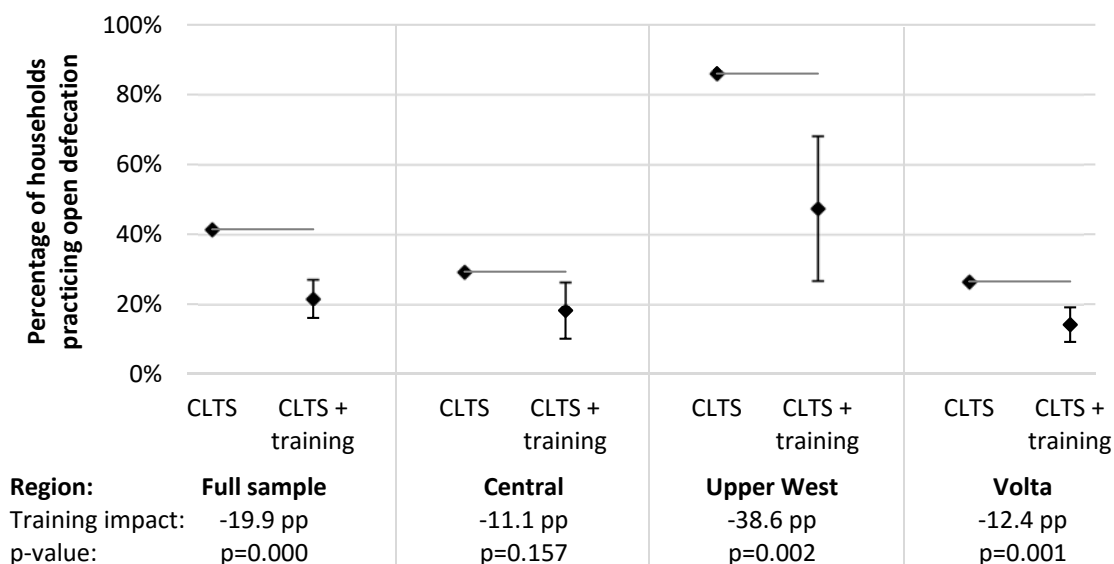


Figure 2. Impact of training natural leaders on open defecation as an add-on activity to CLTS in Ghana, full sample and by region.

The full sample is 58 villages: 18 in Central, 20 in Upper West, and 20 in Volta, split evenly between interventions. Horizontal lines are means for the CLTS treatment group. Bars are 95% confidence intervals. Percentages are transformed logistic regression parameters (available in the appendix). Open defecation is based on survey responses and latrine observations. All analysis accounts for unequal selection probability, non-response rates, and village clustering. ICC = 0.618 for open defecation at the village level in the full sample.

In the full sample, the reduction in open defecation caused by the natural leader training corresponded to a small increase in use of shared latrines (4.3 pp, 95% CI: 1.7 to 6.9 pp), and a larger increase in use of private latrines (18.3 pp, 95% CI: 9.5 to 27.1 pp) (Figure 3).

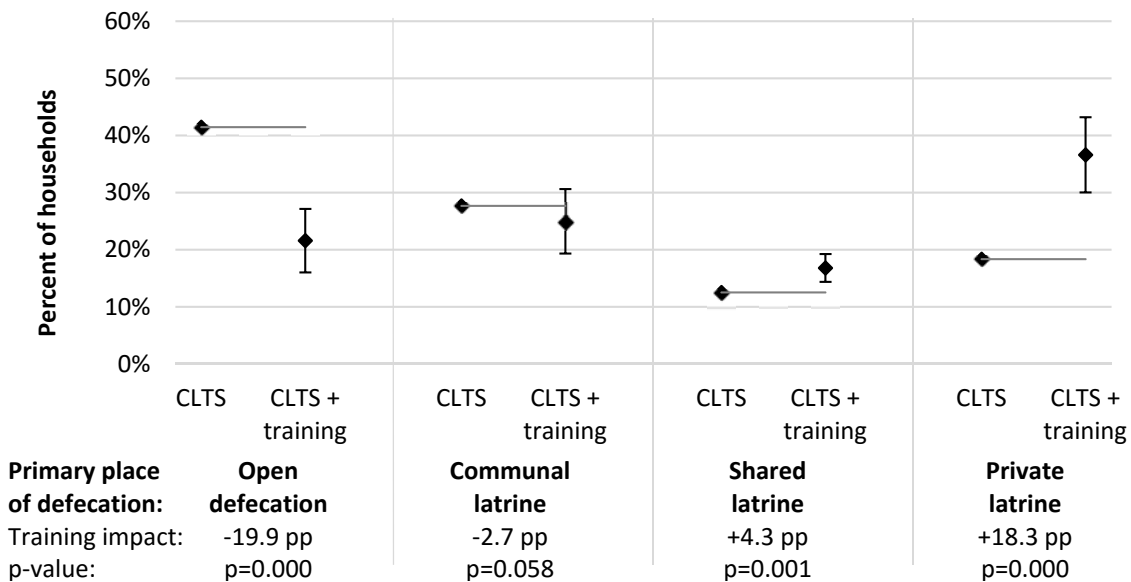


Figure 3. Impact on sanitation practice of training natural leaders as an add-on activity to CLTS in Ghana.

Fifty-eight villages were included in the evaluation, split evenly between interventions. Horizontal lines are means for the CLTS treatment group. Bars are 95% confidence intervals. Sanitation practice was modeled as a function of intervention with an ordered logistic regression. Percentages are transformed regression parameters. Regression parameters and results are in the appendix. Estimates and standard errors account for unequal selection probability, non-response rates, and village clustering.

Table 2 shows household ownership of a private latrine by region and treatment group, and the difference-in-difference of the change in ownership between interventions. Pre-CLTS latrine ownership was estimated from follow-up survey data, based on respondents recalling how many months they had had their latrine. Ownership of a private latrine in Table 2 is differentiated from *use* of a private latrine in Figure 3– the latter includes rented latrines (families renting a house that has a latrine). Across all three regions and both interventions, there was an increase in the percentage of households owning a private latrine. Conventional CLTS, without natural leader training, was associated with the greatest increase in private latrine ownership in the Upper West region, followed by the Volta region. The difference-in-difference estimates indicate that the addition of natural leader training was associated with the greatest increase in private latrine ownership in the Upper West region as well (28.8 pp), with much smaller increases occurring in Central and Volta regions (2.9 pp and 4.7 pp).

Table 2. Household ownership of a private latrine before and after CLTS and CLTS + NL training in Ghana, by region and intervention.

Region	Treatment	Private latrine ownership*		Change	Difference-in-difference
		Pre-CLTS**	Post-CLTS		
Central	CLTS	11.6%	15.7%	4.1 pp	2.9 pp
	CLTS + NL training	14.6%	21.6%	7.0 pp	
Upper West	CLTS	5.0%	14.5%	9.6 pp	28.8 pp
	CLTS + NL training	13.9%	52.3%	38.4 pp	
Volta	CLTS	9.7%	18.9%	9.2 pp	4.7 pp
	CLTS + NL training	9.9%	23.9%	13.9 pp	

The study included 18 villages in Central, 20 in Upper West, and 20 in Volta, split evenly between interventions in each region. Percentages account for unequal selection probability and non-response rates. ICC = 0.349 for ownership of a usable latrine at the village level in the full sample. *Private latrine ownership is different from "private latrine use" as it does not include latrines at rented households. **Pre-CLTS private latrine ownership is based on respondent recall of the age of their latrine at the follow-up survey.

Compared to pre-existing latrines, latrines built during the CLTS interventions were made of lower quality, less durable materials, offered users less privacy and protection from weather, and less often had a hole cover and ventilation (Table 3). However, latrine cleanliness and level of flies were comparable between latrines built during CLTS and pre-existing latrines. Latrines were observed after the CLTS interventions, so owners of pre-existing latrines may have upgraded or maintained them during the CLTS interventions.

Table 3. Characteristics of latrines built during CLTS compared to pre-existing latrines in 58 villages in Ghana.

Variable	Latrine built:		p-value	CLTS latrines compared to pre-existing latrines	
	pre-CLTS	during CLTS			
Infrastructure	Durable flooring material*	84%	60%	0.000	Less durable flooring
	Stable / safe flooring	94%	86%	0.005	Slightly less stable and safe flooring
	Fully intact walls	71%	55%	0.002	Less likely to have intact walls
	Intact door	77%	47%	0.000	Less likely to have an intact door
	Protective roof	79%	57%	0.000	Less likely to have an intact roof
	Pit ventilation	56%	31%	0.000	Less likely to be ventilated
	Complete privacy	66%	48%	0.003	Less privacy provided
	Improved latrine**	52%	43%	0.026	Less likely to be an improved latrine
Upkeep	Hole covered	50%	47%	0.584	Comparable hole coverage
	Clean (no feces on floor)	83%	83%	0.869	Comparable cleanliness
	Less than ~10 flies	74%	70%	0.316	Comparable level of flies
	Water or cleansing material for handwashing	6%	21%	0.000	Better access to handwashing facilities

This analysis covers the 530 of 554 privately owned latrines and 213 of 264 shared latrines that were observed during the follow-up survey. Latrines are in the pre-CLTS category if households reported their latrine as more than 18 months old. The pre-CLTS category covers 447 latrines, and the during CLTS category covers 296 latrines. Percentages and p-values account for unequal selection probability, non-response rates, and village clustering. *Concrete or wood. ** The “improved” latrine is a separate variable based on the Joint Monitoring Program definition, though measurement of improved latrines varies globally.^{1,53}

Implementation Process

During the 1.5-year implementation period, Plan facilitators averaged 12.1 visits per village that received just CLTS, and 12.9 visits per village that received CLTS + NL training (Table 4). Overall participation in triggering (which occurred before NL training) was similar across treatment groups, though it varied between regions. After triggering was completed in all villages, eight natural leaders were trained per village, of which 35% were females. This represents a larger portion of each village in Upper West region, where villages were considerably smaller.

Table 4. Implementation details – natural leaders trained, village visits, and community presence at triggering, by region and treatment.

Treatment	Region	Villages	HHs	Follow-up visits per village *	Community hours in CLTS triggering, per 10,000 people targeted.**	NLs trained***	
						Total	Female
CLTS	Central	9	1463	12.6	7,360	0	0
	Upper West	10	808	10.5	11,187	0	0
	Volta	10	1172	13.2	9,752	0	0
	Average	-	-	12.1	9,424	0	0
CLTS + NL training	Central	9	1495	13.1	8,634	8.0	3.6
	Upper West	10	540	11.5	8,295	7.8	2.0
	Volta	10	1277	14.2	9,383	8.0	3.0
	Average	-	-	12.9	8,814	7.9	2.8

*Follow-up visits includes visits by Plan, local NGOs, and government. **Triggering occurred between December 2012 - March 2013, before natural leader training. ***Natural leader training occurred in March 2013, after triggering was complete in all villages.

At the follow-up survey, the percentage of community members participating in sanitation and hygiene related activities and interactions was nearly identical across treatment groups. For both treatment groups, approximately one-third of community members reported they had attended any sanitation or hygiene meeting in the past two months, and approximately one-third reported they had discussed sanitation or hygiene with a neighbor over the same period (Table 5). However, the intensity (total level of activity) was higher in villages where natural leaders had been trained. The time spent on facilitation by local actors and government per 10,000 people targeted was approximately 130% higher in villages where natural leaders were trained, and community time on CLTS was 80% higher (Table 5).

Table 5. Implementation details – local actor and community activity during CLTS, by region and treatment.

Treatment	Region	Attended village sanitation / hygiene meeting in past 2 months	Discussed sanitation / hygiene with a neighbor in past 2 months	Local actor hours on facilitation, per 10,000 people*	Community hours on CLTS, per 10,000 people**
CLTS	Central	30%	29%	707	18,084
	Upper West	29%	30%	1,368	23,838
	Volta	43%	52%	3,233	44,569
	Average	30%	34%	1,696	28,037
CLTS + NL training	Central	40%	54%	2,423	44,017
	Upper West	20%	29%	4,319	49,730
	Volta	28%	33%	5,102	53,982
	Average	30%	35%	3,925	49,236

*Local actor hours on CLTS facilitation includes time spent by natural leaders and government in villages, and excludes travel and training time. Numbers are normalized to per 10,000 people targeted.

**Community and hired labor time includes time in meetings and visits, as well as time spent on latrine construction.

Villages in the Upper West region differed from those in the Central and Volta regions in a number of ways (Table 6). The average village size was 67 households in Upper West, compared to a much larger 164 in Central and 122 in Volta. More people lived in each household in Upper West, with more children under the age of five, and the number of households per compound was lower. Families had lived in their villages longer. Fewer villages had prior externally funded WaSH projects, had been provided with free latrines, or materials or money for latrine construction. The villages in both the Upper West and Volta regions had lower population densities than those in the Central region.

Table 6. Characteristics of study population receiving CLTS interventions, by region.

Variable	Central	Upper West	Volta
Village size (number of households)	164	67	122
Compound size (number of households)	2.54	1.82	2.85
Household size (number of people)	3.28	6.44	3.60
Number of children per household	0.49	1.15	0.50
Average family tenure (years in village)	26.8	35.6	25.5
Population density (people / sq. km)*	5900	2000	1700
Prior WaSH project (% of villages)**	100%	45%	79%
Prior HH latrine subsidy (% of villages)**	33%	15%	37%

*Density is based on GPS data from the household census conducted for the follow-up survey. **Data on prior WaSH projects is from situational assessments conducted in 2012 before implementation began.

Discussion

The impact of training natural leaders as an add-on activity during a CLTS intervention in Ghana was a 19.9 percentage point (pp) reduction in open defecation, as compared to villages receiving only conventional CLTS. This should be interpreted as the impact of *training* natural leaders, not as the impact of natural leaders in general, as they existed and were identified in all project villages. The full sample included villages in three dissimilar regions in order to study how the aggregate impact estimate differed from the impact in different settings. The impact was far greater in villages in the Upper West region of Ghana (-38.6 pp), as compared to villages in the Central and Volta regions (-12.4 and -11.1 pp). The natural leader training impact on open defecation was associated with a small impact on use of shared latrines (+4.3 pp), a larger impact on use of private latrines (+18.3 pp), and no significant impact on use of communal latrines.

Latrines built during CLTS were, on average, slightly less likely to be made of durable materials, and less likely to offer users full privacy and protection from weather, as compared to pre-existing latrines. However, pre-existing latrines and those built during CLTS were comparable regarding cleanliness, use of hole covers, and presence of flies, indicating they were similarly maintained and protected users from exposure to fecal matter. Latrines built during CLTS were *more* likely to have handwashing materials present, indicating more attention to hygiene.

Plan conducted similar intensities of facilitation in both treatment groups to ensure that any differences in outcomes could be attributed to training natural leaders. Plan visited villages receiving just CLTS 12.1 times each on average, and villages receiving CLTS + NL training 12.9 times each. The slight difference is due to an extra visit needed to invite natural leaders to the initial training. Community participation at triggering meetings was similar across treatment groups, indicating that community engagement did not diverge before the natural leaders were trained. At the end of the interventions, the percentage of households participating in CLTS was still the same across treatment

groups, indicating that training natural leaders did not lead to the CLTS message reaching a greater proportion of their villages. However, the overall level of activity was much higher in villages where natural leaders were trained. Natural leaders spent more time reinforcing CLTS messages, and community members spent more time discussing sanitation and building latrines.

A small number of trained individuals – natural leaders (less than 2 per 100 community members) – were able to influence the collective sanitation behavior of their communities, without money or latrine materials being provided to them or their villages. Training natural leaders increased overall sanitation-related activity levels and interactions in their villages. While there are no studies that demonstrate an impact of training community members on WaSH behaviors, these findings seem plausible in light of a number of studies that found that social network interactions predict latrine adoption,⁴⁰ and that latrine adoption decisions within villages are interlinked and spur more latrine adoption.^{50,54,55} Trained natural leaders were most able to influence behaviors in villages with indicators of higher social cohesion – in the Upper West region where villages were more remote, smaller, and families had lived in the villages longer. These same villages had lower exposure to externally supported WaSH projects. This aligns with recommendations in the CLTS Handbook,¹⁵ which asserts that, where prior latrine subsidies occurred, an expectation for external support can hinder collective action. The better outcomes in the Upper West region could also be explained by the higher portion of trainees per village. Eight natural leaders were trained per village, and villages in the Upper West region were smaller. Variation in outcomes across different settings is expected for interventions targeting environmental health behaviors, as both the behaviors and exposure to hazards is influenced by social and environmental factors that vary over different settings.

Plan deliberately waited to identify and train natural leaders in Ghana, until villages had been triggered by external facilitators, and natural leaders had multiple opportunities to demonstrate their motivation, by constructing latrines and trying to influence their peers. The effectiveness of the natural

leader training at increasing interactions and impacting behaviors fits with diffusion theory, in which adoption is initiated by external factors, while internal, endogenous factors (such as personal communication) support continued diffusion.³⁹ Existing studies focus on actors that can be identified and trained at the outset of a project, such as health workers, village leaders, teachers, or students. Interventions that focus on training easily identified actors at the outset could be failing due to not training socially relevant individuals.⁴⁰ By targeting individuals based on their title or profession, prior interventions are assuming that high visibility individuals, or those in positions of authority, are the most likely to be influential. Others have hypothesized that the most well connected and highest status individuals will capture benefits of projects, which would imply that there are no “natural” leaders. The CLTS concept of natural leaders, particularly the way they are allowed to emerge after triggering in Ghana, challenges that notion.

This is the first evaluation in WaSH in which a modification or addition to an intervention is compared to an existing approach within a randomized trial. No prior studies have been able to demonstrate impact of training local actors on sanitation or hygiene outcomes. There have been many randomized trials in WaSH, however, they all follow the approach of comparing an intervention to a “do nothing” control group, or comparing entirely different interventions.^{22,56–58} This study was designed to be a rigorous operational research study, in order to investigate ways to improve the efficiency and effectiveness of CLTS, and how effectiveness varies across settings in order to support recommendations regarding targeting.

Limitations

Some of the differences in outcomes between regions could be due to differences between facilitators and trainers. However, the full project team was brought together at the project outset to discuss facilitation techniques, facilitator team size, and frequency of village visits. Facilitation was

monitored monthly to make sure it occurred at similar intensity across regions, and adjustments were made where deviation occurred. Prior to each natural leader training session and review meeting, the project team wrote up a Terms of Reference for that event to ensure consistency. Training sessions led by regional Plan CLTS coordinators were always attended by the project manager to further ensure consistency.

This study does not include a baseline household survey, so balance resulting from randomization could not be demonstrated using baseline descriptive statistics. Random assignment of villages by blocks in each region was used to eliminate selection bias and ensure balance across treatment groups. Variables that are slow to change and not likely influenced by the natural leader training were used to assess balance. Standard errors, confidence intervals, and p-values include study design sampling error and clustering of outcomes within villages.

Conclusions

This study demonstrated that training natural leaders during CLTS in three regions in Ghana can improve CLTS outcomes by reducing open defecation. The training had the greatest impact on open defecation in small, remote rural villages that had had little exposure to externally supported WaSH projects in the past. Latrines built during CLTS tended to be lower quality than pre-existing latrines, but were as well cared for. Targeted training of natural leaders in socially cohesive communities should be considered as an addition to CLTS programs. Training should be sequenced after external facilitators have triggered and performed some follow-up, so that the enrollment into training is limited to individuals who are truly motivated by communal outcomes, and who have demonstrated ability to influence their peers. While CLTS should not be as a standalone strategy for addressing sanitation given the low quality of some of the resulting latrines, with the inclusion of natural leader training, CLTS can play a role in addressing three parts of Goal 6 of the recently adopted SDGs: eliminating open

defecation, expanding capacity-building in developing countries, and strengthening participation within communities.⁵⁹

Behavior change programs in environmental health should consider training community members after the intervention is underway. Waiting to identify trainees can allow for natural leaders to emerge, and to be identified through their demonstrating they are motivated, active, and able to influence peers within their community.

The findings and implications of this study were enabled by a study design suited to operational research in WaSH. Insight into the variation of outcomes across different settings was enabled by the multi-site study design. An understanding of the implementation process and outputs, and the mechanism by which training natural leaders impacted sanitation behaviors, was possible due to situational assessments performed before the intervention, detailed tracking of implementation activities, and surveying natural leaders and households on their activities and interactions. More operational research is needed that evaluates modifications to sanitation and hygiene interventions, and that studies how outcomes vary across different settings, in order to inform decision making on how to efficiently and effectively target sanitation and hygiene programs.

CHAPTER 2. TEACHERS AND SANITATION PROMOTION: AN ASSESSMENT OF COMMUNITY-LED TOTAL SANITATION IN ETHIOPIA

Introduction

While sanitation has improved dramatically in the past decade, globally 2.5 billion people lack access to improved sanitation. An estimated 1 billion lack access to any sanitation facility and practice open defecation,¹ although the actual number is probably much higher.^{2,3} Fecal contamination of the environment from poor sanitation together with poor handwashing are responsible for an estimated 577,000 deaths annually.⁶⁰ Additionally, there is growing evidence that, through environmental enteropathy, open defecation contributes to more malnutrition than previously thought,^{61,62} and could be responsible for approximately half of child stunting.^{4,63,64} There are also rationales for sanitation beyond health. Many households construct latrines for improved social status and dignity,^{6,7} there are potential gender-equity benefits,⁸ increased school attendance for girls,⁹ and economic benefits from time savings and increased productivity.¹⁰

Community-led total sanitation (CLTS) emerged in the year 2000 as a participatory approach to address open defecation, and draws on a variety of emotional triggers such as shame and disgust to elicit action on sanitation issues.¹⁵ CLTS is now a well-established approach that has been implemented in over 50 countries.¹⁶ Many, such as Ethiopia, include it in national policy.¹⁷

The few journal-published evaluations of CLTS or related approaches have consistently shown positive outcomes.^{45,65} Evaluations of India's Total Sanitation Campaign (TSC)—which includes some CLTS features with the addition of hardware subsidies—have shown positive impacts on latrine access,^{20,22,23} and on child health and welfare.^{24,66} Much of CLTS literature is “gray” or unpublished. A

systematic review of 115 gray literature documents found that project settings and processes are well-described, but that there is a preponderance of low quality study designs and data collection methods.⁶⁷

As CLTS has already been applied in over 50 countries, research to inform policy and practice is valuable. Our study is designed as operational research, and focuses on an existing public health program with the aims of generating recommendations with immediate relevance for policy and practice. Our study was collaboratively designed by an implementation organization and a research institute—the non-governmental organization Plan International (Plan) and the Water Institute at the University of North Carolina at Chapel Hill (UNC).

Health extension workers (HEWs) are tasked with facilitating CLTS in Ethiopia, where there have been dramatic reductions in open defecation since CLTS was introduced.^{1,17} Every kebele (community) in Ethiopia has one health post staffed by one to three HEWs who typically are from that geographic area, speak the local language, and share cultural background with residents. A kebele is an administrative unit comprising 20-30 villages and approximately 5000 people. HEWs are responsible for 16 separate tasks including CLTS,⁶⁸ so cannot commit much time to CLTS. Plan has explored training teachers as facilitators of CLTS to alleviate some of the burden on HEWs and enable more frequent follow-up activities, with some signs of success.⁶⁹ The catchment areas for schools and health posts are the same in Ethiopia—the kebele. This enables teachers to facilitate CLTS, as they too are known within their kebele and speak the local language.

Teachers have demonstrated aptitude for promoting healthy water, sanitation, and hygiene (WASH) behaviors previously; for household water treatment and hand washing in Kenya,³² for student hand washing in China,³³ and for schistosomiasis prevention in Tanzania.^{70,71} However, to date there are no studies published on teachers leading sanitation promotion at the community level. We assessed teacher-facilitated CLTS as an alternative to conventional CLTS in Ethiopia. Our study addresses implementation process and challenges as well as sanitation outcomes.

Methods

Program Description

CLTS implementation in Ethiopia consists of the standard three stages from the Handbook on CLTS¹⁵: pre-triggering, triggering, and follow-up. *Pre-triggering* includes community entry and acceptance by leaders. *Triggering* consists of a community meeting where outside facilitators use tools (such as sanitation mapping) designed to “trigger” an emotional response, and a collective desire to improve the situation. Typically, each individual village within a kebele is triggered separately. However, kebeles generally function as a single community. In *follow-up*, facilitators visit villages to monitor progress and guide them in eliminating open defecation. In Ethiopia, follow-up includes emphasis on hygiene.⁷² When ready, a kebele can request certification by the government of open defecation free (ODF) status.⁷³

This study compares CLTS as facilitated by two different groups of local actors. The first group of actors—“conventional CLTS”—comprises HEWs who lead facilitation, and kebele administrators who support them. The second—“teacher-facilitated CLTS”—comprises teachers facilitating CLTS. In October 2012, Plan initiated the interventions by training the two groups of facilitators, who then facilitated CLTS for the following year. The same CLTS tools and activities were used by both groups of facilitators—the only difference was in who facilitated. Plan provided monthly guidance to both groups of facilitators and occasionally observed their facilitation in communities. The implementation in this project was enabled by broad exogenous factors. Plan had prior experience implementing CLTS, training facilitators, and collaborating with the government on sanitation and hygiene. The Government of Ethiopia has included CLTS in national policy, and has institutional support mechanisms in place, such as a Memorandum of Understanding between three ministries for coordination on water, sanitation, and hygiene.⁷⁴

Study Design

This study uses a mixed-methods approach, synthesizing quantitative data from a quasi-experimental design with qualitative data from interviews. Six kebeles were selected from two regions, and manually assigned to receive conventional or teacher-facilitated CLTS (Figure 4). Non-random assignment was chosen as it allowed pre-matching on baseline latrine access, which with six study sites was more likely to result in similar comparison groups than random assignment. Pre-matching is established as a valuable tool for evaluating community-demand-driven sanitation policies.⁷⁵ This method is strengthened by using a difference-in-difference estimator and robust outcome and covariate indicators for analysis,⁷⁵ which were employed in this study.

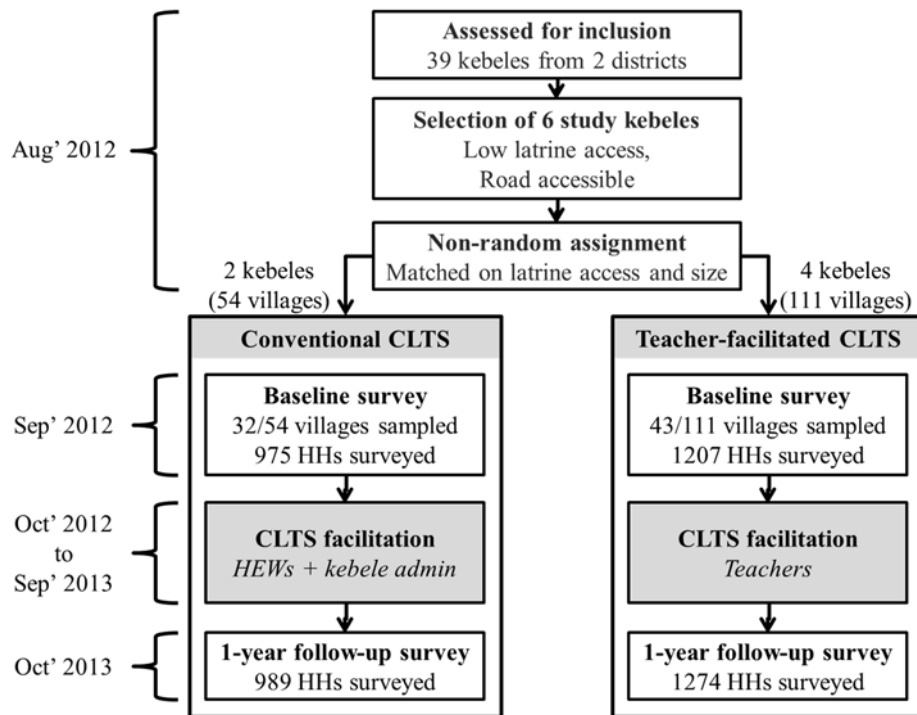


Figure 4. Timeline and sequence of the quasi-experimental study design and execution.

As this study involves non-random assignment of six study sites (kebeles), differences in outcomes between the two interventions cannot necessarily be attributed solely to the different facilitators. Interviews with NGO employees, facilitators, and government, and supplemental data

collected from household surveys, were used to understand the implementation process and to explore possible explanations for differences in outcomes between interventions.

Sampling

Two regions where Plan had prior CLTS experience and government collaboration were selected—Oromia; and the Southern Nations, Nationalities, and People’s (SNNP) Regions. One district with no prior CLTS was selected from each region (Deksis and Dara districts respectively). Three road-accessible kebeles with no major towns and low reported latrine access in the 2011 census were selected from each district.

Seventy-five villages were randomly sampled, all 2444 households within those villages were approached for surveying, and 2182 households at baseline and 2263 at follow-up were surveyed (Figure 4, sampling details in the appendix). The sample size was set to detect a difference between a 30 and 40 percentage point (pp) reduction in open defecation (i.e. a 10 pp difference-in-difference, $\beta=0.8$, $\alpha=0.05$). We used a conservative intra-cluster correlation (ICC) of 0.2.^{20,50}

Data Collection

Kebele characteristics and sanitation outcomes were measured using household surveys and latrine and hand washing station observations. Surveys covered demographics, sanitation, hygiene, interactions, and recall of CLTS events. Indicators were selected from review of prior WaSH research^{15,20,51,52} and input from UNC and Plan. Sanitation outcomes were assessed by asking respondents where they primarily defecated and their hand washing practices. Respondents reporting using a latrine were asked if it was private, shared, or communal. Latrine and hand washing station quality and maintenance were assessed by observation. Data collection within kebeles was completed by an independent contractor with extensive experience in Ethiopia, one team lead per region, and

experienced local surveyors. Household surveys were translated into the local languages (Oromo and Sidama) by the contractor, translations checked by an independent WaSH specialist and rechecked by Plan. Printed survey tools were pre-tested during training, piloted in non-project kebeles, and revised in consultation with UNC. The follow-up survey tool is available in the appendix. Survey team leaders reviewed surveys each evening, and Plan staff were available to answer questions. Surveyors were audited by Plan re-surveying one randomly selected village per kebele (23-40 households per audited village) with 11 questions from the full survey.

The CLTS process was monitored with checklists filled out by Plan, interviews with Plan and district government, teacher and HEW surveys, and questions on interactions in household surveys. Interviews with Plan staff on process and challenges occurred three times during and once after the interventions. Interviews with district government on context occurred just before the interventions. Plan staff and government officers spoke English and were interviewed by the primary author. Surveys on CLTS-related knowledge, attitudes, and practices were administered to teachers and HEWs in Amharic. ODF certification dates were collected from district officials. ODF certification by district government is part of implementation and was not validated by the researchers.⁷³

Analysis

Descriptive statistics from household surveys and observations were used to assess differences between the comparison groups at baseline. The primary outcome was household-level sanitation practice as an ordered categorical variable including (1) open defecation, and use of a (2) communal latrine, (3) shared latrine, or (4) private latrine. Self-reported latrine use was validated by observing latrines, and full, collapsed, and unstable latrines were categorized as open defecation. Sanitation practice definitions and measures are available in the appendix. Latrine quality and access to handwashing materials were also assessed, to investigate associations between latrine quality and CLTS.

A difference-in-difference (or treatment-time) estimator was used to account for baseline differences in outcome variables. Sanitation practice was modelled using an ordered logistic regression as a function of treatment, survey time point (time), treatment-time, and a range of covariates. To avoid issues with potential endogeneity, only baseline values of covariates were used. Analysis was completed in STATA 12/13/SE. The sampling design, including clustering of outcomes within villages, unequal selection probabilities, and non-response rates, was accounted for using the “svyset” command.

This study was reviewed and approved by the UNC Office of Human Research Ethics (study #12-1851). Study approval was obtained from zonal and district health offices within Ethiopia. Informed consent was received from all respondents.

Results

Baseline Statistics

For most variables, the baseline differences between the comparison groups were insignificant (Table 7). In conventional CLTS kebeles, average household size was larger, water collection time was longer, metal roofing was more common, as was participation in village meetings and discussions regarding sanitation and hygiene with neighbors. Household ownership of a usable latrine and hand washing station was also higher in conventional CLTS kebeles, and fewer practiced open defecation. Pre-matching did not fully eliminate baseline sanitation differences likely because it was based on government census data, which was not as accurate as our surveying.

Table 7. Household and respondent characteristics at baseline by comparison group.

Household or respondent characteristic	Comparison group		t-stat	p-value
	Conventional	Teacher-fac.		
Female respondent	73.2%	77.0%	1.74	0.087
Years of education*	2.03	1.72	-1.72	0.089
Household size (people) *	6.05	5.66	-3.64	0.001
Number of children*	0.94	0.94	0.02	0.981
with diarrhea in past 2 weeks*	0.18	0.19	0.27	0.787
Metal roof	28.2%	18.6%	-3.53	0.001
Own radio	25.9%	26.6%	0.24	0.809
Own television	1.2%	0.7%	-0.91	0.367
Number of cell phones*	0.35	0.44	2.40	0.019
Dirty household compound	33.0%	29.7%	-1.19	0.238
Use improved water supply*	51.3%	51.0%	-0.04	0.966
Water collection time (minutes) *	50.4	40.06	-3.77	0.000
Attended village meeting in past 2 months*	51.7%	38.1%	-4.19	0.000
Visited health post in past 2 months*	32.6%	36.8%	1.59	0.117
Discussed sanitation or hygiene with a neighbor in past 2 months*	51.2%	35.8%	-6.15	0.000
Open defecation	37.7%	47.9%	3.75	0.000
Own a:				
usable latrine	60.1%	50.9%	-3.31	0.001
dirty latrine	19.0%	14.5%	-2.01	0.048
clean latrine	28.8%	28.7%	-0.01	0.993
clean latrine + handwashing station	12.3%	7.7%	-2.74	0.008
Owns an improved latrine	22.7%	20.2%	-1.58	0.120
Primarily uses neighbor's latrine*	6.3%	5.4%	-0.71	0.477
Primarily uses public latrine*	1.9%	2.6%	0.81	0.423
Want to own a latrine*	14.8%	23.4%	3.79	0.000
Plan to build a latrine in next year*	14.2%	22.5%	3.89	0.000

*Self-reported by respondent. Remaining variables are surveyor observed. All figures account for unequal selection probability, non-response rates, and village clustering.

Sanitation Outcomes

The difference-in-difference in sanitation practices between the kebeles assigned to teacher-facilitated CLTS and conventional CLTS was modeled using an ordered logistic regression as a function of facilitation approach, and four covariates chosen to address baseline differences between comparison groups (household size, roofing material, water collection time, and discussing sanitation or hygiene with a neighbor in the past two months). These four covariates showed statistically significant

differences at baseline (Table 7), no multicollinearity (the highest variance inflation factor was 1.01), and could logically associate with household sanitation practices. Open defecation is measured as self-reported open defecation plus those with unobserved, full, or unstable-floor latrines.

From baseline to follow-up, the proportion of households practicing open defecation decreased in both the teacher-facilitated and conventional CLTS groups (Figure 5). Conventional CLTS was associated with a 6.9 percentage point greater decrease in open defecation than was teacher-facilitated CLTS in the full sample (six kebeles in the Oromia and SNNP regions of Ethiopia) ($p=0.084$). The difference-in-difference in open defecation was associated with minimal change in use of communal or shared latrines, and a 7.8 percentage point greater increase in use of private latrines associated with conventional CLTS (details and figure in the appendix). Outcomes varied dramatically between regions (Figure 5 and Table 9). In Oromia, conventional CLTS was associated with a 19.9 percentage point greater decrease in open defecation than was teacher-facilitated CLTS ($p=0.005$). In the SNNP region, there were no significant changes in open defecation associated with either facilitation approach. Different outcomes between treatment groups cannot necessarily be solely attributed to the different facilitators, as pre-matching does not guarantee baseline equivalency, and multivariate regression does not guarantee all differences are accounted for.

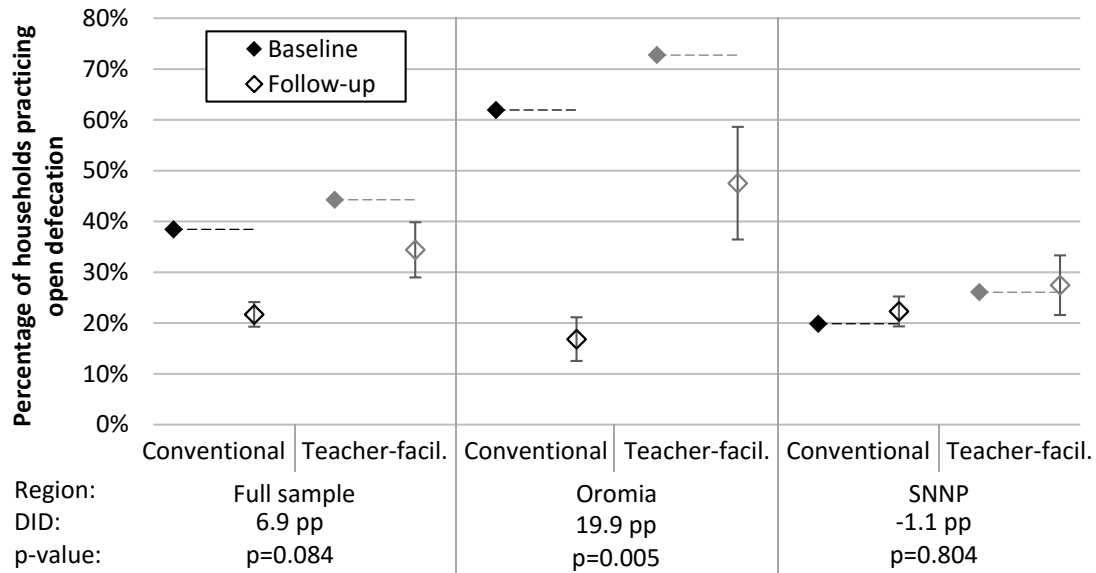


Figure 5. Open defecation before and after conventional and teacher-facilitated CLTS interventions in Ethiopia.

Conventional includes 2 kebeles (54 villages). Teacher-facilitated includes 4 kebeles (111 villages). Kebeles are split evenly between the Oromia and SNNP regions. Horizontal lines are baseline means. Bars are 95% confidence intervals. Open defecation is modeled from an ordered logistic regression parameters with covariates set to their means (full regressions in the appendix). Open defecation is based on survey responses and latrine observations. All analysis accounts for unequal selection probabilities, non-response rates, and village clustering. ICC = 0.278 for open defecation at the village level. "DID" = difference-in-difference.

Across both interventions, open defecation decreased by 15.3 percentage points, through an increase in use of communal latrines (+ 1.9 pp), shared latrines (+4.7 pp), and private latrines (+8.7 pp) (Figure 6).

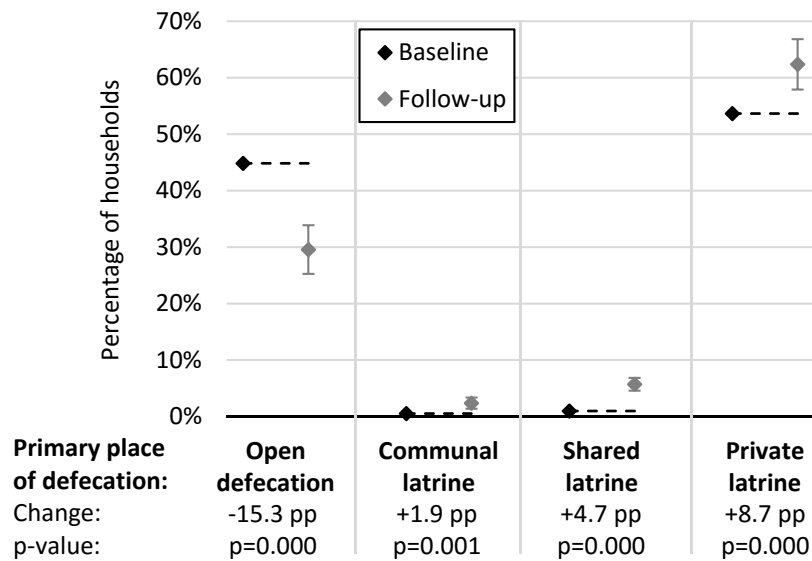


Figure 6. Sanitation practices before and after CLTS interventions in Ethiopia.

Percentages represent 6 kebeles (165 villages). Kebeles are split evenly between the Oromia and SNNP regions. Horizontal lines are extensions of baseline means. Households reporting use of latrines not shown to surveyors, or latrines with unstable flooring, were classified as open defecation. Bars are 95% confidence intervals. All analysis accounts for unequal selection probability, non-response rates, and village clustering.

Across both interventions, household ownership of any observed latrine did not change significantly during the CLTS interventions, nor did ownership of a latrine with durable floor materials, or of an improved latrine (Table 8). However, ownership of latrines with stable and safe flooring, and an intact superstructure increased. Ownership of latrines with indicators of cleaning and with handwashing materials available also increased. Changes in latrine characteristics came about through upgrades of existing latrines, and through some old latrines collapsing and new latrines being built (data not presented).

Table 8. Household ownership of a private latrine, and latrine characteristics, before and after CLTS interventions in Ethiopia.

Variable	Latrine ownership at:		Change	p-value	
	Baseline	Follow-up			
Infrastructure	Any observed latrine	79%	77%	-1.1%	0.476
	Durable flooring material*	21%	17%	-3.3%	0.139
	Stable and safe flooring**	54%	62%	8.7%	0.000
	Fully intact walls	4%	6%	2.3%	0.044
	Intact door	5%	9%	3.5%	0.005
	Protective roof	3%	8%	4.3%	0.000
	Complete privacy	4%	6%	2.5%	0.037
	Improved	17%	16%	-1.4%	0.460
Upkeep	Hole covered	2%	8%	6.5%	0.000
	Clean (no feces on floor)	48%	53%	5.0%	0.046
	Less than ~10 flies	56%	61%	5.1%	0.048
	Handwashing station with water or cleansing material	14%	18%	4.5%	0.044

This analysis covers the 1,684 of 1,692 privately owned latrines that were observed at baseline, and 1,779 of 1,803 at follow-up. Surveyors had descriptions so that latrine categorization was consistent. Percentages and p-values account for unequal selection probability, non-response rates, and village clustering. ICC = 0.317 for household ownership of any observed latrine at the village level. *Concrete or wood. ** The “improved” latrine is a separate variable based on the Joint Monitoring Program definition, though measurement of improved latrines varies globally.^{1,53}

Dates of kebele ODF certification by district government are presented alongside open defecation levels in Table 9. Four kebeles were certified as ODF during the evaluation. The two remaining kebeles in the teacher-facilitated CLTS group were certified ODF in 2014, after the follow-up survey.

Table 9. Baseline and follow-up open defecation levels, and ODF certification dates, by kebele.

Region	Kebele	Baseline (Oct 2012)	Follow-up (Oct 2013)	Change	ODF certification date*
Oromia	Kebele 1 (conventional)	62.0%	13.6%	-48.4%	May 31, 2013
	Kebele 3 (teacher-facilitated)	77.1%	56.6%	-20.5%	June 5, 2014
	Kebele 4 (teacher-facilitated)	66.9%	32.0%	-34.9%	June 5, 2014
SNNP	Kebele 2 (conventional)	21.4%	19.6%	-1.7%	April 19, 2013
	Kebele 5 (teacher-facilitated)	29.9%	26.6%	-3.3%	June 17, 2013
	Kebele 6 (teacher-facilitated)	30.0%	24.9%	-5.1%	May 30, 2013

Proportions account for unequal selection probability and non-response rates. *ODF certification was conducted by district governments. The research team did not observe or validate ODF status.

Implementation Process

For the two conventional CLTS kebeles, Plan trained one to three HEWs and eight leaders per kebele (Table 10). For the four teacher-facilitated CLTS kebeles, Plan trained 10 to 28 teachers and two leaders per kebele. HEWs and teachers led CLTS facilitation. Kebele administrators were trained as they must approve development activities within their kebeles. All trained HEWs and teachers attended each village triggering within their kebele.

Table 10. Implementation details – facilitators trained and leadership attendance at triggerings.

Approach	Kebele	Villages	Teachers trained	HEWs trained	Days/month on CLTS*	Kebele leaders: trained	at triggerings**
Conventional	Kebele 1	24	0	1	0.00	8	1.6
	Kebele 2	30	0	3	4.67	8	1.5
Teacher-facilitated	Kebele 3	32	12	0	2.44	2	0.3
	Kebele 4	22	18	0	1.92	2	0.0
	Kebele 5	31	10	0	1.30	2	0.3
	Kebele 6	26	28	0	3.16	2	0.3

*Teachers and HEWs were surveyed at follow-up on their activity level during the CLTS interventions. The HEW from kebele 1 left between surveys; the health post was not staffed at follow-up. **Kebele administrators' attendance was recorded by Plan. Kebele administrators were not surveyed; their activity level outside of triggerings is not known.

Some challenges were specific to teachers. Kebele leader attendance at teacher-facilitated village triggerings was lower than in villages from conventional CLTS kebeles (Table 10), possibly because kebele leaders do not typically work with teachers. A Plan employee noted that *“HEWs are seen using the kebele structure more effectively, because they spend most of their time in the kebele and have got an already established relationship. Unlike that, teachers seem less effective in using kebele structure—though they are using it...”* Individual teachers were less active than HEWs in CLTS—average 2.4 versus 4.7 days per month. According to a Plan employee, *“... teachers actually take a shorter time for triggering...”* however, *“... due to vacations and exams in schools, teachers have some less time to conduct follow ups than HEWs.”* However, the more numerous teachers collectively spent more time on CLTS than HEWs.

Households had differing levels of engagement in CLTS depending on who facilitated. At follow-up, households in the conventional CLTS kebeles reported higher attendance at triggering meetings, and could recall more activities from the triggering, such as the mapping exercise (Table 11). This could be due partly to baseline differences—at baseline, households in the conventional CLTS kebeles reported being more active in village meetings. However, this does not affect the effect estimates presented here, as baseline activity was included as a covariate in outcome regressions.

Table 11. Household interactions and activities for conventional and teacher-facilitated CLTS kebeles at baseline and follow-up.

	Variable	Comparison group		t-stat	p-value
		Conventional	Teacher-fac.		
Baseline	Attended* a village meeting in past 2 months	52%	38%	-4.19	0.00
	Attended a meeting in past 2 months in which <i>sanitation</i> was discussed	48%	35%	-3.88	0.00
	in which <i>hygiene</i> was discussed	45%	33%	-3.72	0.00
Follow-up**	Attended the CLTS triggering meeting	45%	38%	-1.87	0.066
	Remember specific activities/events from triggering	36%	27%	-2.18	0.032
	Average # of activities/events remembered from triggering	2.3	1.9	-2.58	0.012

*All attendance variables in this table are self-reported by the attendee. **Baseline and follow-up surveys were administered in October 2012 and 2013.

A few challenges were common to all kebeles. All facilitators had competing responsibilities. A Plan employee observed that “... teachers have their own assignments, and they are also expected to do CLTS. The same is true for kebele administration and HEWs.” In January 2013, facilitation stalled for one month in all kebeles while development activities were restricted to a natural resource conservation campaign. Households faced some challenges in latrine construction. According to district officials, the closest place to buy latrine slabs, cement, or PVC would be approximately two hours travel from project kebeles.

Discussion

We found that teachers were willing and active facilitators of sanitation promotion at a community-level in Ethiopia. There have been no prior assessments of teachers leading sanitation promotion at the community-level. Our findings are consistent with previous studies that identified teachers as effective in promoting sanitation and hygiene within schools.^{32,33,70,71} Open defecation decreased during teacher-facilitated CLTS, but the conventional facilitation approach in Ethiopia was associated with a 6.9 percentage point greater decrease in open defecation. The full sample included kebeles in two dissimilar regions, in order to study how effectiveness differed between different settings. In Oromia, both approaches were associated with larger reductions in open defecation than in the full sample, and conventional CLTS was still associated with a larger decrease in open defecation (19.9 percentage point difference-in-difference, $p=0.005$). In the SNNP region, there were no significant changes in open defecation associated with either facilitation approach.

Our study reveals challenges teachers face in leading promotion of community-wide sanitation behavior change. Teachers did not engage local administrators as quickly as did health workers, who drew on their prior relationship with administrators. ODF certification dates (Table 9) show that teacher-facilitated CLTS may have had a delayed impact, with further decreases in open defecation occurring after the follow-up survey. However, ODF certification by district government is not a precise measure of open defecation levels and was not verified by the researchers.

We analyzed four latrine definitions alongside open defecation levels, which revealed the importance of careful consideration of target outcomes, and the importance of data validation. Self-reported and visually confirmed latrine ownership were similar (0.2% difference). However, upon inspection, 24.8% of latrines were unusable due to full pits or unstable flooring. Self-reported latrine ownership is a good proxy for latrine ownership in this setting; however, both are poor proxies for usable latrine access, and their use in evaluations could lead to inaccurate results and conclusions.

The primary purpose of CLTS is eliminating open defecation. Others have found this may mean cheap, nondurable latrines are built and hand washing not fully addressed.^{65,76} We found the same pattern. Open defecation decreased by 15.3 percentage points through increased latrine sharing and unusable latrines being replaced by usable ones. Ownership of more durable “improved” latrines – the standard used in international monitoring^{1,53} – *did not* change significantly. Hand washing materials at latrines increased minimally (4.5 percentage points). Households may have prioritized maintenance and care for facilities over investments in hardware, possibly due to lack of market availability of construction materials and latrine components.

Decreases in open defecation and increases in usable latrine ownership were highest in the Oromia region, where baseline open defecation was highest. This suggests that CLTS alone may be most appropriate where there are high levels of open defecation. Further improvements in sanitation and hygiene may require addressing supply and financing issues.

This study has four potential limitations: non-random assignment of kebeles, a small number of study sites, effect estimates limited to a comparison of interventions, and study duration limited to 1-year. Uncertainty regarding internal validity cannot be completely dispelled with non-random assignment of the six study kebeles. However, comparing multiple regression models suggested pre-matching kebeles was successful at minimizing bias. The effect estimates for teacher-facilitated CLTS compared to conventional CLTS are robust, as they vary little across outcomes and regression models. As no true control group was included, this study compares the effectiveness of two facilitation approaches but does not estimate the effectiveness of CLTS. Changes in outcomes that occurred beyond the 1-year follow-up survey are not captured in this paper.

Conclusions

Teachers may be more valuable to WaSH interventions by supporting health workers and local administrators once a project is initiated, rather than leading the effort. This could be an attractive option where health workers are overburdened, as is the case in Ethiopia. CLTS was not an appropriate intervention where open defecation was lowest. CLTS was associated with increased ownership of clean latrines and handwashing stations, however there was no increase in more durable improved latrines. International monitoring would not have captured the impacts of this CLTS intervention and may not be registering CLTS impacts elsewhere. Advancing to more durable and sustainable latrines may require CLTS in combination or series with programs that target supply chains and financing. An operational research methodology enabled an assessment of the implementation process, multiple outcomes, and variation of outcomes by setting.

CHAPTER 3. PROCESS AND COST ANALYSIS OF FOUR COMMUNITY-LED TOTAL SANITATION INTERVENTIONS IN GHANA AND ETHIOPIA

Introduction

Evidence on the process and cost of water, sanitation, and hygiene (WaSH) programs is used for many purposes: informing policies, program planning and budgeting, cost-effectiveness and cost-benefit studies, and as inputs into research. A number of studies have compiled secondary data to model the costs and benefits of achieving global WaSH targets,⁷⁷⁻⁷⁹ or to compare different interventions.^{80,81} The authors of these studies emphasize that evidence on costs is lacking, and therefore they must extrapolate limited data, make assumptions in the absence of data, or exclude cost categories resulting in potentially misleading incomplete results. Evidence on the process and costs of capacity building and participatory behavior change projects is particularly lacking. Improving process and cost evidence for capacity building and behavior-change is a priority, given that Goal 6 of the recently adopted Sustainable Development Goals includes a focus on behavior (“...end open defecation...”), capacity building (“...expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes...”), and participation (“...support and strengthen the participation of local communities...”).⁵⁹

A number of studies have collected primary data on the cost of sanitation and hygiene behavior change projects.⁸²⁻⁸⁷ These few studies tend to have gaps or methodological deficiencies, a fact acknowledged by the authors. The issues tend to include: lacking management and other software costs, using broad assumptions to fill data gaps, relying on recall by a few respondents to reconstruct costs, and sampling non-representative respondents. Perhaps most importantly, these studies all use top-down costing (TDC) methods. TDC involves dividing a project budget or total expenditures by the

number of units targeted or reached (e.g. villages, households, or individuals). TDC is appealing due to its use of minimal, routinely collected data (project budgets, total expenditures, and population targeted or served), and simplicity of analysis.

TDC has problems with inaccuracy and inappropriateness when applied to WaSH projects. TDC is accurate when the cost of a project is both comprehensively and specifically represented by the project budget and expenditures, and the population served is unambiguous. However, WaSH projects, and indeed in many public health projects, involve complex institutional arrangements, cross-subsidies, and local costs. Complex institutional arrangements such as partnerships between organizations spread costs across organizations, so that no one budget or set of expenditures captures all costs. Inconsistent financial tracking between organizations (or lack of financial tracking) complicates data collection in these cases. Cross-subsidies occur when resources are shared between projects (such as a vehicle or an organization-wide training), and TDC will either over- or underestimate costs depending on whether the project in question covered these shared resources. Local costs occur when local actors or communities bear some costs, which is a common situation in participatory and behavior-change interventions. Neglecting local costs leads to underestimated costs, and can lead to poorly informed policy decisions.⁸⁸

TDC is appropriate when simple, aggregate cost estimates are desired.⁸⁹ However, TDC does not allow for disaggregating costs by category (e.g. management, training, hardware), actor (e.g. government, NGO, community), or over time (e.g. by month or year). Nor does TDC allow for studying variation in costs between different projects or settings. Bottom-up, activity-based costing methods are more appropriate for the complexity of the WaSH sector, but are also more time consuming, complex, and expensive to perform,⁹⁰ which could explain their scarcity in WaSH.

Bottom-up methods involve tracking implementation in order to calculate and assign costs to individual activities. This activities- or ingredients-approach overcomes the challenges associated with costing WaSH projects, namely complex institutional arrangements, cross-subsidies, and local costs.⁹¹

Participatory, behavior-change approaches are inherently flexible and adaptable, and field activities often do not match work plans and budgets. Implementation tracking as part of bottom-up methods captures actual field activities thus accommodating this flexibility, and enabling additional process analysis. Implementation tracking tools can capture metadata such as the date of an activity and actors involved to enable disaggregation. Bottom-up costing methods yield more valuable results for WaSH evaluations, as they allows for studying the drivers of variation in cost, examining economies of scale, and comparing multiple interventions.⁸⁹

Only one study, from Tanzania in 2015, was found that performed a bottom-up cost analysis of a WaSH project.⁸³ The authors conducted an activity-based cost analysis, which improves on prior WaSH studies, and found that sanitation promotion cost \$30 per household targeted, and \$50 when hygiene promotion was included. However, data were collected from a non-representative sample, costs were not disaggregated beyond program and household, and value-of-time was not included for local actors or households.

We performed a bottom-up, activity-based process and cost analysis of four community-led total sanitation (CLTS) interventions in five regions in Ghana and Ethiopia. The cost of WaSH interventions will vary with context, so a multi-site, multi-intervention research approach was used to assess how the findings and implications would transfer to other programs and settings. The interventions were implemented by multiple government agencies together with NGOs, and covered 223 villages and 60,000 people. This study was part of an operational research project funded through a grant from the Bill & Melinda Gates Foundation to Plan International USA and The Water Institute at UNC.

CLTS is an approach to sanitation and hygiene promotion in which a facilitator “triggers” awareness of sanitation issues, then performs follow-up visits to support community efforts to become “open defecation free”.¹⁵ CLTS has been promoted as low cost, as there are rarely hardware subsidies,

and local actors support facilitation as volunteers.¹⁵ CLTS implementation arrangements and facilitation activities vary greatly between countries and organizations.⁹² We developed new data collection and analysis tools as part of this study, tracked the CLTS implementation process, and calculated financial and economic costs. All activities were tracked from the national to village level to measure time spent on facilitation and training, money spent on transportation, time invested by villages, and household spending on latrine construction. This enabled reporting costs disaggregated by intervention, actor, category, geographic area, and over time, which enabled an assessment of the variation in and drivers of cost.

Methods

Project Description

A list of implementation activities and the responsible actors by country and intervention is in the appendix. More detailed descriptions of implementation activities, including challenges faced and enabling conditions, are available online in reports written by Plan.^{47,93} The four interventions were: in Ghana, (1) NGO-facilitated CLTS, and (2) NGO-facilitated CLTS with training for natural leaders added on; and in Ethiopia, (3) health extension worker (HEW) and kebele leader-facilitated CLTS, and (4) teacher-facilitated CLTS. A kebele is the lowest administrative unit in Ethiopia, comprising 20-30 villages and approximately 5000 people in rural areas.

For all four interventions, implementation began with an orientation workshop for district officials. For intervention 1 (Ghana), implementation proceeded with CLTS facilitation by Plan and local NGO (LNGO) staff (Table 12) and there was no formal training of local actors. Intervention 2 (Ghana) included all the activities of intervention 1, with the addition of Plan training natural leaders to support CLTS facilitation. From here on, Plan and their contracted LNGOs will be referred to as Plan. For interventions 3 and 4 (Ethiopia), Plan trained kebele leaders, and either HEWs or teachers, so that they

could lead CLTS facilitation with minimal support. As local actors led facilitation in Ethiopia, LNGOs were not contracted to support Plan. A timeline of activities for each intervention is in the appendix. These four CLTS interventions cover a range of implementation arrangements and modalities as practiced by other organizations and in other countries,⁹⁴ so the findings are relevant beyond this project.

Table 12. Plan’s implementation activities for four CLTS interventions in Ghana and Ethiopia.

Category	Activity	Ghana		Ethiopia	
		NGO CLTS	NGO CLTS + NL training	HEW CLTS	Teacher CLTS
Management	Project management	•	•	•	•
	District government orientation	•	•	•	•
Training	Training kebele leaders			•	•
	Training HEWs			•	
	Training teachers				•
	Training natural leaders		•	•	•
Facilitation	Facilitation	•	•	•	•
	Monitoring	•	•	•	•
	ODF celebration	•	•	•	•

NL = natural leader. HEW = health extension worker.

Context

Both Ghana and Ethiopia have two notable broad exogenous factors that enabled implementation: national government had demonstrated support for CLTS by including it in national policy and establishing institutional support mechanisms, and Plan had prior experience implementing CLTS and working in partnership with the government. This study does not include the cost of establishing the enabling environment. Further contextual information can be found in the situational assessments from the beginning of this project.^{48,74}

Cost Categorization

Program Costs

All program costs were categorized as management, training, or facilitation. Management cost components are paid time, office rent, and office supplies associated with planning, contracting,

coordinating, and reporting on implementation. Training costs cover any activities that included local actors or community members that took place outside project villages, including orientation workshops, training, and review meetings. Facilitation refers to any activities within project villages when a facilitator from *outside the village* is present, including such activities as monitoring and ODF celebrations.

Local Costs

All local costs were categorized as local actor time, community member time, hired labor, or purchased materials. Local actor time includes time spent in training, traveling to training or to villages, meeting with Plan during their village visits, and CLTS related activity when Plan was not present. Community member time includes time spent interacting with Plan, with local actors in Plan's absence, and time spent constructing latrines. Hired labor and purchased materials are financial expenditures by households on latrine construction.

Data Collection and Management

Data collection tools were designed to track implementation activities, and to estimate local actor and community member activity. Tools included checklists for management activities, training, and facilitation, local actor surveys, and household surveys (in the appendix). Checklists were developed by UNC and reviewed by the Plan field staff who would be filling them out. The checklists were designed to be simple and quick to fill out, to ensure compliance and consistency. Monitoring tools used by Plan in their previous CLTS programs were reviewed, and adapted to include instructions and additional indicators.

Local actors and households were surveyed on their interactions, CLTS-related activities, latrine spending, and time spent on CLTS. Discussions and review meetings were held with Plan staff approximately three times per year to clarify details and collect supplementary data where there were

gaps. Plan's quarterly financial reports, and discussions with financial staff, were used to extract unit costs including staff salaries, vehicle purchases, training venue rental, accommodation and meals, per-diems issued, and contracts with district government. Web searches and literature were reviewed for general financial parameters such as official exchange rates and national minimum wages.

Checklist data were entered into Microsoft Access, and checked for errors and gaps, which were corrected through correspondence with Plan staff. Local actor and household surveys were entered into STATA SE12/13 for cleaning and analysis. Checklist data, statistics and parameters from surveys, and financial parameters were exported into Microsoft Excel for calculation of costs.

Analysis

Components of cost are: paid time, office rent and supplies, transportation, training venue rental, accommodation, meals, per-diems, ODF celebration costs, unpaid time (an economic cost), hired labor, and purchased materials. Costs associated with the research are not included in this cost analysis, though the cost of monitoring and data collection associated with the CLTS process is included. The costs in this paper are intended to represent those required to replicate the implementation of the four interventions analyzed. The sources and descriptions of the data used to calculate the components of each cost category are in the appendix.

Financial costs

Paid time includes Plan staff, and government staff when they were paid through contracts with Plan. Time in training and facilitation was aggregated from checklists, and allocated to each intervention, region, actor, and project month using meta-data entered on the checklists. Travel time was estimated using checklist data, discussions with Plan staff, and Google Earth. Management time was estimated from a management checklist given to Plan staff at the end of the interventions. Time was converted to cost by multiplying by the hourly rate for each actor. When the actor was not paid hourly, the following

assumptions about a work-year were used to convert to an hourly rate: a 50-week/2000-hour work year, a 40-hour workweek, and an 8-hour workday.

Transportation costs were adapted from the American Automobile Association (AAA) guidelines for calculating travel costs,⁹⁵ and included vehicle depreciation based on annual mileage and a 15% first-year depreciation rate, a maintenance cost of \$0.0565 per mile and a tire cost of \$0.0138 per mile based on the 2015 AAA 4wd sports-utility-vehicle rate. Vehicle purchase costs were extracted from Plan's financial records, and fuel efficiencies came from an online mileage tracker.^{96,97} Trainees were reimbursed for transportation at a flat rate, which was used to calculate trainee transport costs.

Costs for office rent and supplies, training venue rental, and training materials were extracted from financial records, and allocated based on implementation activities. Unit costs for accommodation and meals during training, and per-diems for Plan and government staff during village visits, were extracted from financial records and multiplied by number of person-days of training or person-days in the field.

Household spending on hired labor and purchased materials for latrine construction was calculated based on self-reported expenditures in household surveys. Hired labor and purchased materials are financial costs, and are included in local cost, as they were not paid for by Plan. In Ghana, households were asked how old their latrines were at the follow-up survey to determine if they were built during the CLTS interventions. In Ethiopia, changes in latrine ownership between baseline and follow-up surveys were used to determine which latrines were built during the CLTS interventions.

Economic costs

Economic costs include value-of-time for local actors and community members when they were engaged in CLTS activities, and for community members when they were constructing latrines (including pit digging). Local actor and community member time when Plan was visiting villages or conducting training was recorded using checklists. Local actor travel time to training sessions was estimated using

checklist data, discussions with Plan staff, and Google Earth. Checklists were not filled out when Plan was not present in villages, so activity at these times was estimated. Local actor surveys during (Ghana) or after (Ethiopia) the interventions included questions about the amount of time spent on CLTS. For community members, estimates of how frequently they visited local actors, attended meetings, or how much time they spent on latrine construction, were based on local actor and household surveys. The value-of-time was based on exact wages for HEWs and local government, and on the national minimum wage for natural leaders and community members. Exact wages were from situational assessments at the beginning of the project, and national minimum wages were found using web searches.

Results

Population numbers and implementation details for the four CLTS interventions are presented in Table 13. In Ghana, Plan’s efforts focused on facilitation, leading to higher numbers of village visits than in Ethiopia, where Plan’s efforts focused on training local actors as facilitators.

Table 13. Descriptive statistics for villages receiving four CLTS interventions.

Variable	Ghana		Ethiopia	
	NGO CLTS	NGO CLTS + NL training	HEW CLTS	Teacher CLTS
Regions	3	3	2	2
Kebeles	-	-	2	4
Villages	29	29	54	111
Households	3,443	3,312	1,624	3,838
Population	14,269	12,936	9,829	21,724
Village visits by Plan	350	375	11	22
Kebele leaders, HEWs, and teachers trained	-	-	20	76
Natural leaders trained	0	230	51	113

NL = natural leader. HEW = health extension worker.

Program Costs

Program costs are presented in Figure 7, broken into management, training, and facilitation. Costs are presented per household targeted to allow for simple comparison between countries and

interventions, and to other studies, as households are the typical unit of analysis in WaSH studies. In Ghana, NGO-facilitated CLTS cost \$30.34 per household, which rose to \$81.56 when natural leader training was added—90% of the increase due to training costs, and 10% to increased management and facilitation costs. In Ethiopia, HEW-facilitated CLTS cost \$19.21 per household targeted, which dropped to \$14.15 for teacher-facilitated CLTS. The portion of program cost from management, training, and facilitation is presented in Table 14 . Training was 4% of the program cost for NGO-facilitated CLTS in Ghana, and rose to 58% of program cost where natural leaders were trained. Training was also over half of program costs in Ethiopia, where trained local actors do the majority of facilitation. Further program cost disaggregation (by country, region, intervention, and cost category), and costs on a per-intervention and per-village basis, are in the appendix.

Transport cost calculation required use of parameters from sources external to this project, such as fuel efficiency and vehicle depreciation. A sensitivity analysis of estimated parameters (available in the appendix) revealed that program costs are most sensitive to changes in estimated travel time to project villages. Changing travel times by +/-50% results in up to a \$0.49 or 0.9% change in program cost in Ghana, and \$0.94 or 6% in Ethiopia.

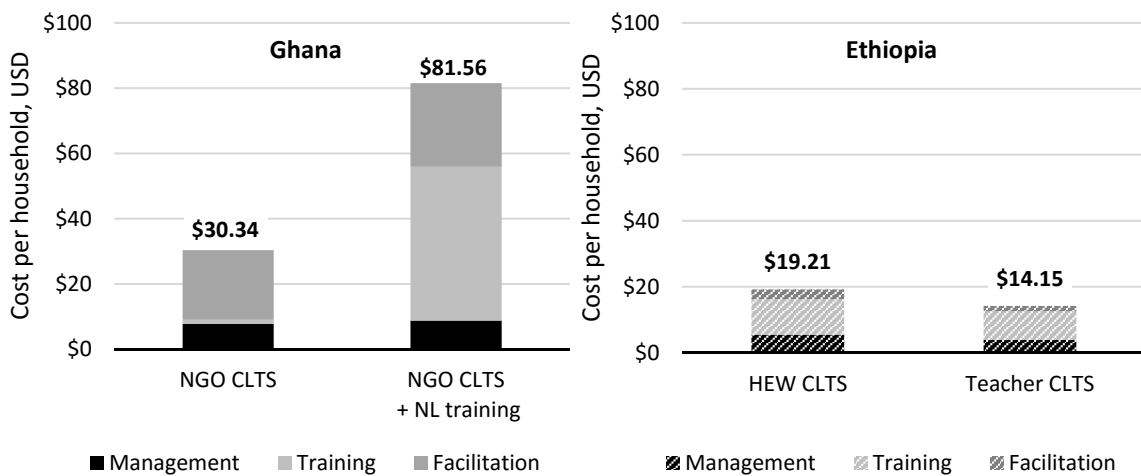


Figure 7. Program cost of four CLTS interventions in Ghana and Ethiopia, per household targeted. All costs in this figure were borne by Plan. NL = natural leader. HEW = health extension worker.

Table 14. Breakdown of program costs for four CLTS interventions in Ghana and Ethiopia.

Country	Intervention	Management	Training	Facilitation
Ghana	NGO CLTS	26%	4%	70%
	NGO CLTS + NL training	11%	58%	31%
Ethiopia	HEW CLTS	28%	56%	16%
	Teacher CLTS	27%	61%	11%

"NL" = natural leader. "HEW" = health extension worker.

The contributions of salary, transport, accommodation and meals, and rent and other to each cost category is presented in Figure 8. Management costs are split relatively evenly between salaries and office expenses. The cost of training local actors is dominated by accommodation and meals, followed by transportation, which are linked to training logistics. Transportation is the greatest contributor to facilitation costs, followed closely by salary.

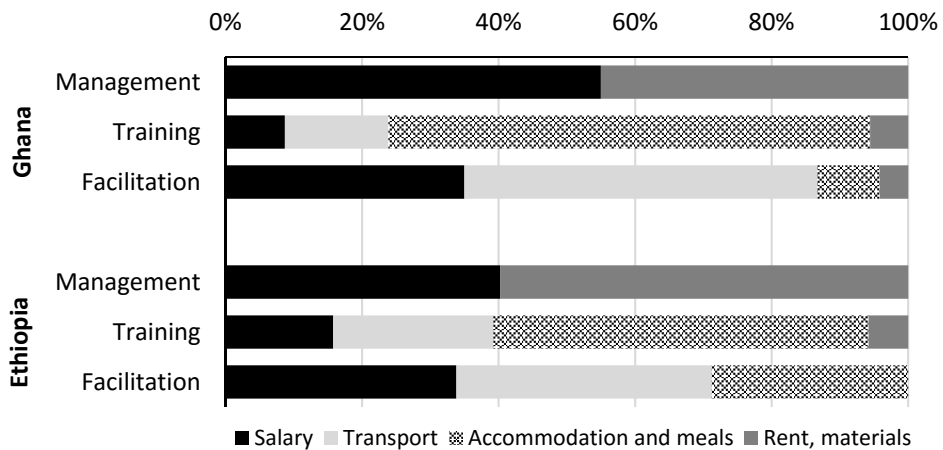


Figure 8. Components of program cost categories for CLTS interventions in Ghana and Ethiopia. All costs in this figure were borne by Plan.

Local Actors and Member Costs

The economic costs and financial costs of CLTS for local actors and community members are shown in Figure 9. Economic cost is the value-of-time spent engaged in the CLTS process or constructing latrines. Financial cost includes spending on hired labor and latrine materials. The combined financial and economic cost of CLTS to local actors and community members in Ghana was \$7.93 per household

targeted in villages receiving NGO-facilitated CLTS, and a substantially higher \$22.36 in villages where natural leaders were trained, due primarily to more households spending on latrines.

The financial and economic cost to local actors and community members in Ethiopia was \$3.41 per household targeted in villages receiving HEW-facilitated CLTS, and a relatively much lower \$2.35 where teachers facilitated. The difference in costs in Ethiopia was due to teacher-facilitated CLTS being associated with lower attendance at community meetings, and fewer households constructing latrines.

Per-household financial expenditures on latrines in Ghana were over 30 times higher than those in Ethiopia.

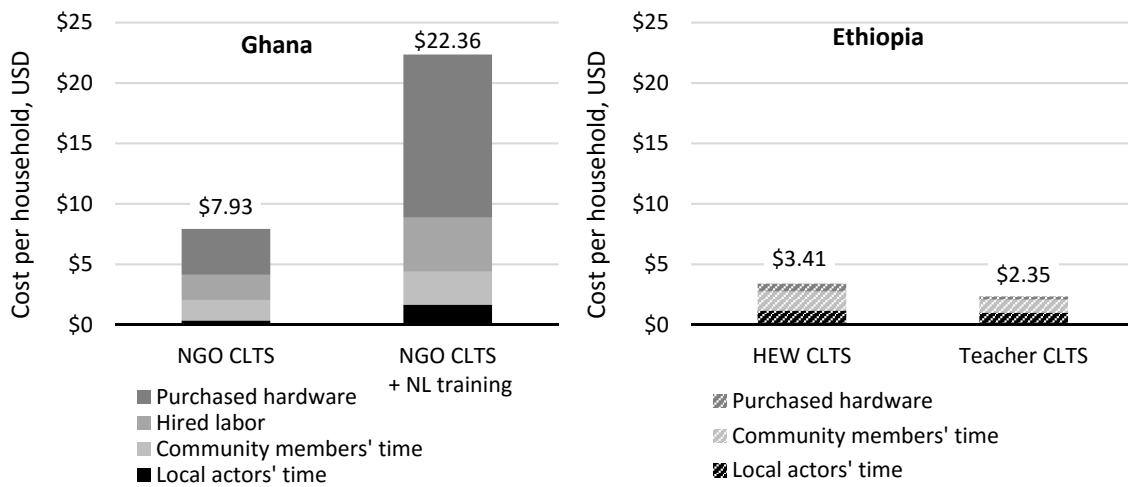


Figure 9. Local actor and community costs of four CLTS interventions in Ghana and Ethiopia, per household targeted.

All costs in this figure were borne by local actors and community members. Local actor and community member time represents economic cost. Hired labor and purchased hardware are financial costs.

In Ghana, household spending on hired labor for latrine construction was approximately one-quarter of the local cost, and purchased latrine materials was approximately half of the local cost (Table 15). In Ethiopia, household spending on latrines was much lower, and the value of local actor and community member time was over 80% of the local cost.

Table 15. Breakdown of local costs for four CLTS interventions in Ghana and Ethiopia.

Country	Intervention	Local actors' time	Community members' time	Hired labor	Purchased hardware
Ghana	NGO CLTS	5%	21%	26%	48%
	NGO CLTS + NL training	7%	12%	20%	60%
Ethiopia	HEW CLTS	35%	46%	0%	19%
	Teacher CLTS	43%	46%	0%	11%

"NL" = natural leader. "HEW" = health extension worker.

Local cost calculation required estimating some parameters, such as travel time and value-of-time for local actors and community members. A sensitivity analysis of estimated parameters (available in the appendix) revealed that local costs were most sensitive to changes in estimated value-of-time for local actors. Changing value-of-time estimates by +/-50% results in a change in program cost of up to \$01.45 or 9.7% in Ghana, and \$1.14 or 42.9% in Ethiopia.

Time Contributions to CLTS

The amount of time contributed to CLTS by different actors is presented in Table 16. For the three interventions in which Plan trained local actors, the local actors collectively spent more time on CLTS facilitation than Plan. In Ghana, in villages where Plan trained natural leaders, local actors spent 2.5 hours on CLTS for every hour that Plan did (including management activities and travel). For every hour that Plan spent on CLTS in Ghana, community members spend a combined 5.9 hours. In villages where Plan trained natural leaders, the ratio of community to Plan hours increased to 7.5.

In Ethiopia, Plan staff spend far more time on training than on facilitation within villages. In Ethiopia, local actors spend a total of 4.7 to 6.8 hours on CLTS for every hour that Plan spends; higher than in Ghana. Community members spent approximately 27 hours on CLTS per hour spent by Plan; over triple the ratio in Ghana.

Table 16. Ratio of actors' hours spent on CLTS implementation.

Approach	Full-time equivalent per 10,000 people			Ratio of total Plan* hours to:	
	Plan*	Local actors	Community	local actor hours	community hours
NGO CLTS	1.4	0.69	8.4	1 to 0.48	1 to 5.9
NGO CLTS + NL training	2.0	5.5	15	1 to 2.8	1 to 7.5
HEW CLTS	0.70	3.3	19	1 to 4.7	1 to 27
Teacher CLTS	0.50	3.4	14	1 to 6.8	1 to 28

*Plan includes contracted local NGOs in Ghana. Local actors includes local government and natural leaders in both countries, and kebele leaders, health extension workers, and teachers in Ethiopia. Community includes hired labor for latrine construction, in addition to all other community participation in and response to CLTS. FTE = full time equivalent. Per 10,000 people targeted is used as the denominator to allow cross-country comparisons.

Individually, trained local actors spent between an average 1.1 and 4.6 hours per week on CLTS (Table 17). Individually, kebele leaders in Ethiopia were the most active local actors, spending up to 12% FTE on CLTS. HEWs in Ethiopia and district government officials in Ghana were the next most active. Untrained natural leaders in Ghana and community members in both countries, however, spent on average less than 11 minutes per week on CLTS on an individual basis (up to 0.45% FTE). Community members also form the biggest group of actors (Table 16), and the amount of time contributed on an individual basis varied greatly.

Table 17. Time spent on CLTS implementation by local actors and community members.

Country	Approach	Average hours per-person per-week* (FTE**)					
		Govt	KLs	HEWs	Teachers	NLs	Community
Ghana	NGO CLTS	2.5*	-	-	-	0.18 (0.45%)	0.04 (0.09%)
	NGO CLTS + NL training	(6.2%)**	-	-	-	1.5 (3.7%)	0.07 (0.16%)
Ethiopia	HEW CLTS	1.1*	2.9 (7.2%)	3.4 (8.5%)	-	-	0.09 (0.23%)
	Teacher CLTS	(2.6%)**	4.6 (12%)	-	2.2 (5.4%)	-	0.07 (0.17%)

"KL" = kebele leaders. "NL" = natural leaders*Average hours-per-week spent on CLTS per person.

**Full-time equivalents, or the percent of a 40-hour "working week" that each actor spends on CLTS.

The hours spent on CLTS implementation and latrine construction by project month is displayed in Figure 10 for Ghana and Figure 11 for Ethiopia. In Ghana, Plan's time on CLTS drops after 12 months, when the LNGO contracts ended and the number of facilitators dropped from 16 to 4. Local actor time

peaks at 6 and 15 months, when initial and refresher natural leader training occurred. Community activity was high for months 3-5 when triggering occurred. The peak at month 8 is due to imprecision in the household survey data collected in month 20, as many households reported constructing their latrine “one year” prior. Thus, the high activity in month 8 likely occurred across multiple months in reality.

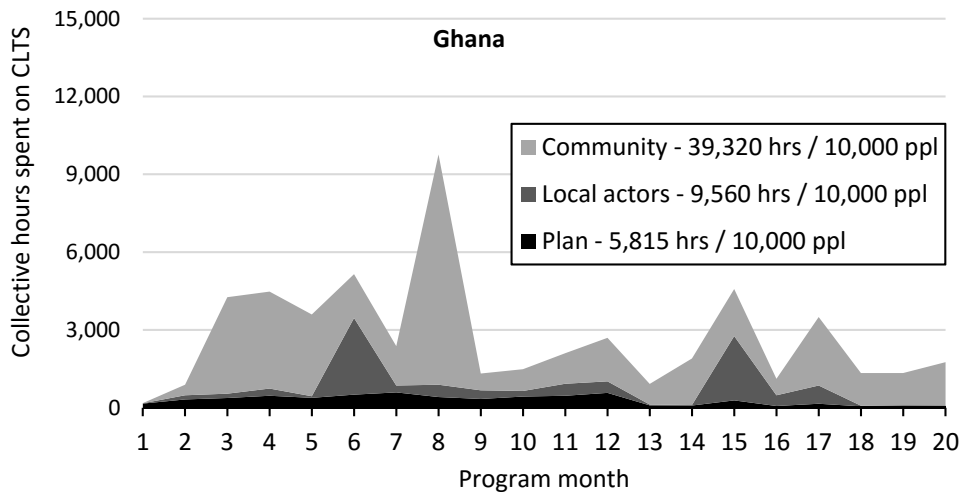


Figure 10. Hours spent on CLTS by different actors per 10,000 people targeted, by month, Ghana.

Plan’s activities ended in month 20 in Ghana. Local actor and community member activity would have continued beyond month 20, but was not tracked.

In Ethiopia, Plan’s time on CLTS is much lower than in Ghana overall, and is more evenly distributed across the project duration. Plan’s activity is highest in months 2 and 3 when kebele leaders, HEWs, and teachers were trained, and in month 13 when natural leaders were trained. Local actor activity peaks in the same months from attending training. Community activity peaks in month four when triggering occurred, and in months 9, 10, and 11 when ODF celebrations occurred in four of six kebeles.

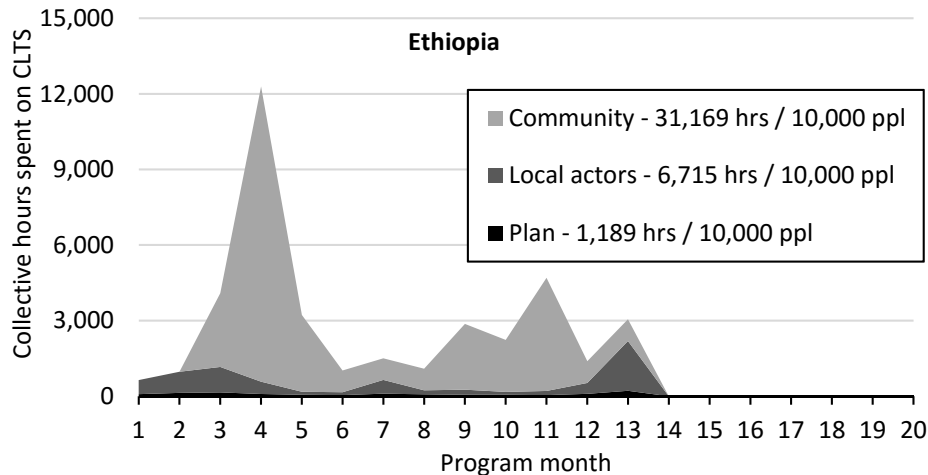


Figure 11. Hours spent on CLTS by different actors per 10,000 people targeted, by month, Ethiopia. Plan’s activities ended in month 13 in Ethiopia. Local actor and community member activity would have continued beyond month 13, but was not tracked.

Discussion

Summary and Interpretation of Ghana Program Costs

In Ghana, the cost of implementing NGO-facilitated CLTS was \$30.34 per household targeted, 70% of which was from facilitation. The addition of natural leader training to NGO-facilitated CLTS raised costs to \$81.56 per household targeted in Ghana. The substantial increase was primarily due to expensive accommodation and meals at training venues, which together were 70% of training costs. Training venues capable of holding 80 natural leaders were scarce in the three project regions, thus there was no competition between hotels, and no low-cost hotel options.

Summary and Interpretation of Ethiopia Program Costs

In Ethiopia, the cost of implementing HEW-facilitated CLTS was \$19.21 per household targeted, which dropped to \$14.15 for teacher-facilitated CLTS. Management and training costs were lower for the teacher-facilitated approach due to economies of scale. In both of the districts included in this project, teachers from two kebeles were grouped together for training, which, on a per kebele basis,

lowered the management cost associated with planning training, venue rental cost, and costs associated with trainers. Only one kebele in each district received HEW-facilitated CLTS, so they could not be grouped for training. Facilitation cost was lower on average in teacher-facilitated CLTS kebeles because the two teacher-facilitated kebeles in Oromia were not verified as ODF, eliminating the cost of ODF celebrations.

Comparison of Ghana and Ethiopia Program Costs

Program cost in Ghana was over three times larger than in Ethiopia on average. Management and training costs in Ghana were approximately double those in Ethiopia. The most striking difference is that facilitation cost in Ghana was ten times higher than in Ethiopia. This occurred because for both interventions in Ethiopia, Plan trained local actors as facilitators, and did not lead any facilitation activities themselves within villages. In contrast, in Ghana, NGO staff led facilitation activities within villages. The program cost differences demonstrate how implementation arrangements can determine costs, and thus determine the scale at which an intervention can be implemented.

Despite the dramatic difference in absolute cost between Ghana and Ethiopia, relative costs were similar in a few meaningful ways. Management was 26-28% of program cost for three of four interventions (the exception being CLTS with natural leader training in Ghana, in which accommodation and meals for training drove up program cost). For all three interventions that included training local actors, training cost was fairly consistent at 56-61% of program cost. In both Ghana and Ethiopia, over half of training cost came from accommodation and meals, with transport for trainees forming the next largest portion of training cost. The largest contributor to facilitation cost was transportation in both Ghana and Ethiopia. Transportation forms such a large portion of CLTS program cost because CLTS projects occur in rural areas in developing countries, where while salaries are low, fuel prices are high, and rough roads necessitate expensive four-wheel drive vehicles. While absolute costs differed between

interventions and countries, the relative cost of management and training were similar, and may reflect relative costs of other software-heavy behavior change approaches.

Training cost involved economies of scale. There is potential for reducing program costs by grouping villages together for training, or by modifying the logistics of training, as availability and choice of training venue was a significant determinant of training cost. Alternatively, more local actors per village could be trained at modest increases in cost, potentially increasing the effectiveness of training, and lowering the time-burden on individual trainees. As logistics were a major determinant of cost for all interventions, total costs could be less in areas with more training venues available, or less remote villages.

Summary and Interpretation of Local Costs

During NGO-facilitated CLTS in Ghana, local actors and community members invested time and money worth \$7.93 per household targeted, which rose to \$22.36 in villages where natural leaders were trained. The portion from household spending was approximately 75% in both cases, demonstrating that trained natural leaders were able to influence increased households spending on latrines. Local actor- and community member-invested time and money was much lower in Ethiopia: \$3.41 per household targeted for HEW-facilitated CLTS, and \$2.35 for teacher-facilitated CLTS. Most of the difference between local cost in Ghana and Ethiopia was due to very low spending on latrines in Ethiopia: \$0.38 per household targeted, compared to \$11.81 in Ghana. Latrines in Ethiopia were built mostly of free, low-durability local materials.

Summary and Interpretation of Time on CLTS

For the one intervention that did not include training local actors (NGO-facilitated CLTS in Ghana), local actors spent half as much time as Plan on CLTS. The three interventions that included

training demonstrated that training local actors is an effective way to leverage their support of facilitation. When training was involved, each hour of Plan’s time led to 2.8 hours of local actor time in Ghana, and 4.7 to 6.8 hours in Ethiopia. Collectively, community members committed the most hours to CLTS, as might be expected given that they are the beneficiaries, and the “community-led” intent of the approach. Each hour of Plan’s time led to 5.9 to 7.5 hours of community time in Ghana, and 27 to 28 hours of community time in Ethiopia. The higher ratios in Ethiopia do not represent a higher level of activity on the part of local actors or communities, but rather Plan spending less time on CLTS to generate the same level of local activity. This is largely due to the interventions in Ethiopia focusing on training local actors as facilitators, as described above.

Individually, trained local actors spent between 2.6% and 12% FTE per person on supporting CLTS facilitation, with kebele leaders and HEWs in Ethiopia committing the most time. CLTS is indeed effective at leveraging investment of time by local actors. However, in doing so, it places a burden on them. The burden could be perceived as excessive for the most active local actors (kebele leaders and HEWS), considering they were not compensated, and, were by definition, employed in a separate job. CLTS is also effective at leveraging investment of time and money by community members. The time-burden on community members was much lower than on local actors, and spending on latrines was voluntary, as facilitators did not promote specific latrine options, and many households did not spend to construct latrines.

Placing this Research in the Context of Existing Evidence:

Our results cannot be easily compared to any existing evidence, due to the low quality of existing literature on the cost of sanitation and hygiene programs. Existing studies exclude cost categories, use inappropriate (top-down) costing methods yielding inaccurate results and underestimated costs, and do not disaggregate results as thoroughly as we do. Three studies have

reported on CLTS costs. The first reported that WaterAid CLTS programs in Bangladesh, Nepal, and Nigeria cost \$6-84 per household targeted. They also mention that overhead costs were underreported and likely underestimated, the three countries had incompatible and incomparable financial tracking systems, and due to top-down costing, they describe disaggregated costs as “indicative” only.⁸⁴ The second study reported that government-facilitated CLTS cost \$1 per household reached in Ethiopia (generally cost per household targeted is lower than cost per household reached).⁹⁸ No data collection or cost analysis methods were described. The third study reported that World Bank funded, government-facilitated CLTS in Tanzania cost \$30 per household targeted, rising to \$50 when hygiene promotion was included.⁸³ The Tanzania study used bottom-up costing, so can be interpreted as more accurate and comprehensive than the other two studies. However, it used recall-based data collection from a non-representative sample of respondents, the methods were not thoroughly described, and program costs were not disaggregated.

Two other studies report the costs of sanitation promotion for non-CLTS approaches. A three-country study in South Asia reported software costs at \$2-45 per household targeted, though numerous methodological deficiencies are present, such as one cost estimate for a government-facilitated project excluding paid government time.⁸⁶ A six-country study reported software costs at \$7-144 per household reached, though cost per household targeted was not reported, the study used a top-down costing method, and it is unclear how the data was collected, or what cost categories are included in software costs.⁸⁷

The existing cost evidence for sanitation and hygiene promotion programs provides little value for comparison. Our study is the first comprehensive, accurate, disaggregated cost data for a sanitation or hygiene program.

Methods Contribution

This study involved development of new data collection and analysis tools suited for behavior change programs in water, sanitation, and hygiene. These data collection and analysis tools are an asset to the WaSH sector, as existing tools are not suited for software-heavy interventions like CLTS. Of the little evidence that exists on the cost of implementing WaSH projects, almost none includes the cost of software, or concern behavior change interventions. This gap is particularly important considering that the Sustainable Development Goal 6 targets emphasize training, local participation, and behavior,⁵⁹ all of which are features of CLTS programs. Prior cost analyses of WaSH behavior change projects fall short by excluding some program costs, by using broad-sweeping assumptions, by not including local actor or community member costs, or by relying entirely on recall by non-representative respondents for data collection. This research overcomes these gaps and issues, provides tools that enable further research into the costs of WaSH projects, and provides new evidence on costs that can be used for planning future WaSH projects and investigating the cost effectiveness of CLTS.

Relevance of Findings

Many public health projects that focus on capacity building and behavior change have the same basic components as CLTS: project management, orientations and workshops, training local actors, community education and awareness meetings (i.e. triggering for CLTS), follow-up village and household visits, monitoring, and celebrations for community achievements (i.e. ODF certification and celebration). The tools in this study are relevant beyond WaSH. We developed checklist tools to track activities, and a framework of cost categories and components for analysis, that can be used for bottom-up, activity-based process and cost analysis of other environmental health behavior change projects. The process and cost results and implications are also relevant beyond WaSH. Training in particular is ubiquitous to public health projects, and likely forms a major cost with potential for savings for many projects.

Limitations

Findings in this study are context specific, as costs vary between geographic settings and implementation approaches. To overcome this limitation, this study included four interventions across five regions in two countries and presents disaggregated results, to provide insight into how costs vary by intervention and setting, and how implementation activities drive cost variation.

Estimation of some household economic and financial costs used parameters from household survey data, rather than from comprehensive tracking. Survey sampling error was minimized by using a large sample and experienced local contractors, and a representative sample of households prevented any sampling bias.

Value-of-time estimates for natural leaders and community members were based on minimum wage rates and a value-of-time to minimum wage ratio assumption of 0.5, which could underestimate economic costs. Both time and value-of-time findings were presented for local actors and community members, as they are two different ways of representing local contributions to CLTS. A sensitivity analysis on estimated parameters was also conducted.

Transport cost calculations rely on assumptions for vehicle depreciation, maintenance, travel time, and driving speed. Assumptions were based on real data for vehicles used, and AAA travel cost models. Sensitivity analysis was conducted for all estimated transport parameters. For contracted work (LNGO facilitation, and district government monitoring), cost allocation to management, salary, and transport categories was based on submitted budgets, which may deviate from exact expenditures on each category. However, the total cost of contracts is accurate, as it reflects payments made for services.

Conclusions

An understanding of the process and cost of an intervention supports policy and funding decisions, program planning and management, and project implementation. Evidence on process and cost are important tools for researchers conducting cost effectiveness and cost benefit studies, modeling program scale up, or evaluating and comparing different approaches. This is the first study to present comprehensive and disaggregated costs of WaSH behavior change interventions using a bottom-up costing method. The findings presented in this study should be used to inform policy and planning discussions regarding the costs of CLTS programs, and should be incorporated into cost effectiveness research as the first cost figures for a CLTS intervention.

More evidence as to the process and cost of WaSH interventions is needed, to enable comparisons of approaches, accurate cost-effectiveness studies, and to support policy, financing, and programming decisions. Future WaSH interventions should utilize and adapt the tools developed in this study to track implementation activities and analyze costs. The multi-site, multi-intervention research approach used in this study is an important asset for understanding how research findings would transfer to other programs and geographic settings.

CHAPTER 4: CONCLUSION

Operational Research Methodology

I used an operational research approach, which enabled the findings advanced by this dissertation, and their implications for policy, practice, and research. Operational research is intended to address widespread recurring challenges to implementation, and to provide evidence with immediate implications for policy and practice. Relevant challenges should be identified both through review of existing evidence, and through partnership with practitioners with firsthand knowledge of implementation challenges, which are not always well identified or described in literature. Rigorous research methods that can provide unbiased, accurate evidence should be brought to bear on these challenges. Operational research in WaSH should draw on best practices and lessons learned from other sectors, as there is a wealth of public health and econometric research outside of WaSH.

Many widespread and recurring challenges to WaSH implementation can be summarized as relating to context and process. The implementation process, costs, and outcomes for a single intervention will vary greatly between settings and implementation arrangements. Implementation is affected by broad exogenous factors as well as the capacity and experience of implementing organizations and agencies. Behaviors are mediated by social and economic factors. Outcomes are moderated by environmental factors.

There are numerous sanitation and hygiene approaches available. Organizations attach themselves to branded approaches and promote their approach under the guise of research. The reality is that these approaches often overlap both in their implementation activities and objectives. Practitioners faced with resource limitations and working in diverse contexts end up forced to choose which approach to use based on what country they are in or what organization they work for. Ideally,

these decisions would be supported by evidence, so that practitioners could choose an approach based on their objectives, available resources, and the context in which they work.

Existing evidence is not well matched to these implementation challenges. Studies continue to set out to answer the question, does this program impact health?, with little to no focus on the implementation process or on the context and setting in which the program takes place and how that may affect outcomes. Nearly all prior impact evaluations of WaSH projects report a single effect estimate for each outcome of interest, instead of reporting an aggregate effect estimate alongside estimates for different strata or sub-populations. Additionally, reviews and editorials on WaSH impact evaluations interpret the body of evidence as if all interventions of a similar type should have similar impacts; and neglect to consider variations in the implementation process, target populations, and setting in which these interventions occur as explanatory variables that unite differing impacts into a cohesive and logical story. Frequently the message is: these water supply (or water quality, sanitation, or hygiene) interventions vary from no impact to a dramatic impact on diarrhea (or trachoma, stunting, etc.), leaving us with no improved understanding of the value of this intervention, and whether or not it should be included in policies and guidelines.

We should instead be designing studies to ask the questions: how does the effectiveness of this program vary across different settings? And, what characteristics of these settings drive effectiveness? This type of research could help in deciding where to target different interventions, rather than treating each approach as one-size-fits-all once multiple trials have demonstrated health impact. We should also be designing studies to ask: how can we tweak or modify interventions to improve impacts or reduce costs?, to support project managers deciding how to tailor interventions to their setting. New tools can be used to track implementation, measure outputs, and gain insight into the mechanism by which interventions influence behaviors. An understanding of how and why an intervention works can provide insight into how to improve the intervention or adapt it to address different challenges.

Practitioners and researchers can make different contributions to operational research. Evaluations initiated by implementing organizations tend to focus on large programs as they are typically practiced, but often have fundamental problems such as lacking a counterfactual in the form of a control or comparison group, non-representative survey sampling, or rely on internal rather than independent data collection. Alternatively, high quality studies (from a study design perspective) conducted by researchers often evaluate projects that are implemented in a way that would not be replicated or scaled, in unlikely settings, and neglect to report context and implementation details that would allow findings and implications to be transferable.

Our project was designed around two principles to maintain relevancy and rigor while overcoming some of the most common WaSH research challenges. The first principle was partnership between an implementing organization and a research institute. The partnership with Plan was collaborative, with overlap in roles, to improve the quality of the research, and to promote transparency and shared learning between researchers and implementers. At the outset of this project, we formulated research questions and study designs together. The goal was implementation that allowed for rigorous evaluation, and research that addressed challenges relevant to Plan and their partners, and allowed that implementation to reflect the realities of working on behavior change in low-resource settings. Throughout the project, we worked together to interpret findings, discuss implications, and develop recommendations for policy, practice and research. The second principle was methods appropriate for operational research in WaSH. Each evaluation used a multi-site study design, so that variation in process, cost, and outcomes across different settings could be investigated. Data collection and analysis included context, process, cost, and outcome indicators. This enabled investigation of how context influenced variation, what the resource requirements of implementation were, and how the interventions affected both sanitation and hygiene infrastructure, access, and behaviors.

This approach worked. Over the course of the last 1.5 years of the grant, we held a number of webinars, national and regional workshops, and multinational events where UNC researchers presented findings and, together with Plan, interpreted them and discussed their significance for Plan's future sanitation and hygiene programming. We have developed a range of messages that Plan is using to redesign their global WaSH programs. They are shifting away from a stance that CLTS alone can address sanitation and hygiene issues, and are using these studies to be more targeted in choosing where to use the approach. The cost analysis has revealed inefficient areas of programming. In Ethiopia, Plan is training a combined set of local actors in to alleviate the burden on kebele leaders and HEWs. In Ghana, Plan is working with national government to revise their natural leader training manual, and decide where in Ghana it should be promoted. We have received multiple requests for additional webinars and presentations from other partners in the sector who want to reflect on what our findings mean for their sanitation and hygiene programming.

Summarized Findings

In Ghana, training natural leaders led to a 19.9 percentage point (pp) reduction in open defecation ($p=0.000$). The impact was greatest in villages in the Upper West region of Ghana (-38.6 pp), as compared to villages in the Central and Volta regions (-12.4 and -11.1 pp). Villages in the Upper West region were smaller, more remote, and had little prior exposure to externally supported WaSH projects. Latrines built during CLTS in Ghana tended to be made of lower-durability materials than pre-existing latrines, but were equally well maintained, and more likely to contain handwashing materials.

In Ethiopia, the decrease in open defecation associated with teacher-facilitated CLTS was 6.9 percentage points smaller than for conventional CLTS ($p=0.084$). In villages in the Oromia region, where baseline open defecation was 72.6%, both approaches were associated with larger reductions in open defecation than in the full sample, and conventional CLTS was still associated with a larger decrease in

open defecation (19.9 pp difference-in-difference, $p=0.005$). In villages in the SNNP region, where baseline open defecation was much lower at 30%, there were no significant changes in open defecation associated with either facilitation approach. Teachers had competing responsibilities and initially lacked support from local leaders, which may have lessened their effectiveness. Teachers may be more appropriate for a supporting rather than leading role in sanitation promotion. Household ownership of a stable, usable latrine increased by 8.7 percentage points overall. Latrine cleanliness also improved, as did access to handwashing materials. Ownership of an improved latrine (i.e. with durable flooring materials) did not change during the intervention.

The cost of implementing the CLTS interventions ranged from \$14.15 to \$81.56 per household targeted. For three of the four interventions, over half of the implementation cost was from training, and over half of the training cost was from accommodation and meals. The largest contributor to facilitation costs was transportation in both Ghana and Ethiopia. During the four CLTS interventions, local actors and community members contributed time and money worth \$2.35 to \$22.36 per household targeted. In the three of four interventions that included training, for each hour that Plan spent on CLTS, local actors collectively spent between 2.8 and 6.8 hours. Individually, trained local actors spent between 2.6% and 12% FTE per person on supporting CLTS facilitation, with kebele leaders and HEWs in Ethiopia committing the most time. Across all four interventions, community members spent 5.9 to 28 hours for each hour of Plan's time. Collectively, community members committed the most hours to CLTS, as might be expected given the "community-led" intent of the approach. Spending on latrines in Ethiopia was much lower than in Ghana: \$0.38 compared to \$11.81 per household targeted.

Implications

CLTS and related sanitation promotion interventions have been shown to be effective at reducing open defecation, both in this research and in previous studies. Training local actors is an

effective way to increase efficiency and improve CLTS outcomes; training them encourages participation and can help sustain outcomes. In Ghana, the natural leader training was most successful in small, remote villages with indicators of social cohesion and lower prior exposure to externally supported WaSH projects, and was far less successful elsewhere. In Ethiopia, both CLTS interventions were associated with large reductions in open defecation where baseline open defecation was high and neither intervention was associated with reductions in open defecation where it was low at baseline. CLTS interventions, and training of local actors, should be targeted to appropriate settings where there is potential for impact and some likelihood of success. In both Ghana and Ethiopia, while latrines built during CLTS were well maintained and cleaned, most were not improved, meaning they were constructed from low-durability local materials or did not have stable flooring. CLTS should not be treated as a sanitation strategy on its own, as it is not suited to address sanitation and hygiene issues across settings, and does not always lead to construction of durable latrines.

Targeting CLTS interventions to settings where it is more likely to succeed is a way to improve cost-effectiveness. Villages with high open defecation levels have a high potential for impact. Villages with some degree of homogeneity and cohesion will be more able to work together toward collective outcomes. Villages that have not experienced prior WaSH projects may be more likely to feel self-reliant, as they may have lower expectations for external support. These three conditions often align in the hardest-to-reach districts that have received the fewest projects and have the greatest need. This makes targeting more practical logistically, as many villages within one district can be targeted. This also makes targeting an appealing strategy beyond just increasing cost-effectiveness, as these villages are the “last mile”, and targeting them addresses inequities.

Targeting training of natural leaders to socially cohesive villages should be considered as an addition to CLTS programs. Training should be sequenced after external facilitators have triggered and performed some follow-up, so that the enrollment into training is limited to individuals who are truly

motivated by communal outcomes, and who have demonstrated ability to influence their peers. Other behavior change programs in environmental health could consider training motivated and active community members within villages with some degree of cohesion, to encourage peer-influencing within a community and to reinforce messaging.

Local actors took on a large, mostly uncompensated time burden to support CLTS facilitation. In Ethiopia, kebele leaders and HEWs are expected to lead all CLTS facilitation efforts within their communities. These actors are, by definition, employed full time with other responsibilities (although HEWs do have CLTS as 1 of 16 core tasks in their job description). The burden on kebele leaders and HEWs seemed excessive at around four hours per week, or 10% FTE. In Ethiopia, kebele leader support for CLTS from project initiation was important for the success of the intervention, and they should be included in training so that they can support triggering and subsequent follow-up. To reduce the burden on kebele leaders, teachers could be trained alongside them to support facilitation, provided teachers are not expected to take on the lead role. Increasing the number of trainees per kebele would not add substantial cost, due to economies of scale.

CLTS should be treated as one part of a broader sanitation strategy. The Sustainable Development Goals were recently officially adopted, and came into effect on January 1, 2016. Goal 6 includes a sanitation behavior target (“adequate and equitable sanitation for all and an end to open defecation”). CLTS clearly can play a role in addressing open defecation behavior, by generating collective action and promoting a shift in social norms regarding sanitation. However, the long-term adequacy of CLTS outcomes is not guaranteed, as in both Ghana and Ethiopia, latrines built during CLTS were frequently constructed of non-durable local materials. Latrines built during CLTS also frequently did not offer users full privacy. Without efforts to improve availability of latrine components and construction materials to communities at an affordable price, CLTS outcomes may not fully meet the needs of women and children, and may not be sustained. The two “means of implementation” targets

under SDG Goal 6 are to expand capacity building support for water and sanitation related activities and programs, and to strengthen participation of local communities. CLTS can clearly play a role here as well. The central tenet of CLTS is participation of the entire community in addressing their sanitation and hygiene issues. Many CLTS programs center on training local actors, which in these studies increased sanitation and hygiene activity within communities both during external facilitator presence and in their absence.

Given the importance of setting revealed in these studies both in terms of outcomes and costs, a remaining research priority is a comparison of the settings in this study to conditions cited as favorable or unfavorable in other sanitation and hygiene behavior change studies. This could validate the recommendations on targeting, and form the beginnings of a framework or typology for assessing which interventions are appropriate for which settings. Context cannot be randomly assigned to an intervention, so a single study cannot conclusively attribute outcomes to setting. If more multi-site studies are conducted that specifically report variation of outcomes across settings, a body of evidence to support targeting of interventions will accumulate that will enable systematic analysis and stronger guidelines for practitioners. More evidence on the process and cost of WaSH interventions is also needed, as no other studies were found that comprehensively and accurately measured and reported the costs of a WaSH behavior change intervention.

Final Words

Sanitation and hygiene are complex issues that spread across many sectors. Over the last few decades, their importance for global health and poverty elimination has been increasingly recognized. This has yielded increased funding and research, and yet, the sanitation target in the Millennium Development Goals was not reached by their conclusion in 2015, and some have argued that many who did gain access to improved sanitation are using technologies that do not prevent exposure to

pathogens, that contaminate the environment, and that do not necessarily improve the privacy and safety of women and children.

Despite efforts to turn research into evidence-based practice, some of the most massive and expensive sanitation and hygiene programs are revealing setbacks. Latrines built under India's Swachh Bharat campaign are frequently not used.¹¹ CLTS has been implemented in over 50 countries, with millions living in open-defecation free certified communities, yet our Ethiopia evaluation and UNICEF's Mali evaluation indicate that ODF certification does not mean no open defecation,⁴⁵ and Plan's ODF sustainability study found that many households reverted to open defecation after low quality latrines built during CLTS became unusable.⁷⁶

Certainly there are many complex and intertwined reasons for this situation. One step we can take to improve the link between research and practice is to design operational research studies that are better suited to the challenges that exist in addressing sanitation and hygiene. Much of the existing evidence is of high quality, and has helped to bring global awareness to sanitation and hygiene issues in developing countries. However, more research is needed that evaluates differences in interventions implemented at equivalent sites, and that evaluates equivalent interventions at different sites, to learn about how to target and adapt interventions to improve efficiency and maximize outcomes and sustainability. The way forward is not only more money, more research, more programs, but smarter research and better linkages between research and practice.

APPENDIX 1: CENSUS AND SURVEY SAMPLING COUNTS AND SANITATION PRACTICE VARIABLE

Census and survey sampling counts for village and household levels, by intervention and region, in Ghana.

Intervention	Region	Census		Sampled			Surveyed	
		Villages	HHs*	Villages	HHs	Ratio	HHs	Ratio
CLTS	Central	9	1463	9	358	0.24	353	0.99
	Upper West	10	808	10	234	0.29	234	1.00
	Volta	10	1172	10	307	0.26	288	0.94
CLTS + NL training	Central	9	1495	9	356	0.24	348	0.98
	Upper West	10	540	10	182	0.34	180	0.99
	Volta	10	1277	10	322	0.25	305	0.95
Totals		58	6755	58	1759	0.26	1708	0.97

*"HHs" = households

Sanitation practice as an ordered categorical variable.

Sanitation practice	Primary place of defecation
Open defecation	Anywhere in the open, including in the bush, field, river, or pond. Includes dig and bury, and households reporting using a latrine that surveyors observed to be full or have a collapsed or unstable floor.
Communal latrine	A public latrine accessible to anyone (including school-latrines).
Shared latrine	A latrine shared by multiple households,* including when one compound** shares a latrine, multiple households jointly own a latrine, or a household uses a neighbor's latrine.
Private latrine	A latrine used by only one household, either owned or rented in the case of tenants.

*A household was defined as a single housing unit with one acknowledged male or female head of household.

**A compound is a group of household sharing a patio or courtyard, often composed of extended family in Ghana

APPENDIX 2: GHANA ORDERED LOGISTIC REGRESSION OUTPUTS AND TRANSFORMED PARAMETERS

Ghana ordered logistic regression outputs and transformed parameters

FULL SAMPLE						
Ordered logistic regression parameters						
Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	0.94	0.24	3.86	0.000	0.45	1.43
Intercept 1 (< communal)	-0.35	0.25	-1.38	0.172	-0.85	0.15
Intercept 2 (< shared)	0.81	0.19	4.34	0.000	0.43	1.18
Intercept 3 (< private)	1.49	0.19	7.67	0.000	1.10	1.88
Transformed regression parameters						
Primary place of defecation	Percentage of households	SE	z-stat	p-value	[95% CI]	
NGO CLTS						
Open defecation	41.5%	6.1%	6.85	0.000	29.6%	53.3%
Communal latrine	27.7%	3.5%	8.00	0.000	20.9%	34.5%
Shared latrine	12.5%	1.4%	9.06	0.000	9.8%	15.2%
Private latrine	18.3%	2.9%	6.29	0.000	12.6%	24.1%
NGO CLTS + natural leader training						
Open defecation	21.6%	2.8%	7.61	0.000	16.0%	27.1%
Communal latrine	25.0%	2.9%	8.68	0.000	19.3%	30.6%
Shared latrine	16.8%	1.2%	13.53	0.000	14.4%	19.3%
Private latrine	36.6%	3.4%	10.91	0.000	30.0%	43.2%
Difference						
Open defecation	-19.9%	5.7%	-3.50	0.000	-31.0%	-8.8%
Communal latrine	-2.7%	1.4%	-1.90	0.058	-5.5%	0.1%
Shared latrine	4.3%	1.3%	3.26	0.001	1.7%	6.9%
Private latrine	18.3%	4.5%	4.08	0.000	9.5%	27.1%

CENTRAL REGION

Ordered logistic regression parameters

Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	0.62	0.36	1.72	0.104	-0.14	1.38
Intercept 1 (< communal)	-0.88	0.48	-1.83	0.084	-1.90	0.13
Intercept 2 (< shared)	0.88	0.26	3.36	0.004	0.33	1.44
Intercept 3 (< private)	1.41	0.27	5.27	0.000	0.84	1.97

Transformed regression parameters

Primary place of defecation	Percentage of households	SE	z-stat	p-value	[95% CI]	
NGO CLTS						
Open defecation	29.3%	10.0%	2.94	0.003	9.8%	48.8%
Communal latrine	41.4%	6.6%	6.32	0.000	28.6%	54.3%
Shared latrine	9.6%	1.4%	6.74	0.000	6.8%	12.4%
Private latrine	19.6%	4.2%	4.66	0.000	11.4%	27.9%
NGO CLTS + natural leader training						
Open defecation	18.2%	4.2%	4.38	0.000	10.1%	26.4%
Communal latrine	38.3%	6.1%	6.30	0.000	26.4%	50.2%
Shared latrine	12.2%	0.9%	13.88	0.000	10.5%	14.0%
Private latrine	31.2%	5.2%	6.07	0.000	21.2%	41.3%
Difference						
Open defecation	-11.1%	7.8%	-1.41	0.157	-26.4%	4.3%
Communal latrine	-3.1%	2.0%	-1.59	0.112	-7.0%	0.7%
Shared latrine	2.6%	1.5%	1.73	0.084	-0.3%	5.6%
Private latrine	11.6%	6.7%	1.73	0.083	-1.5%	24.7%

UPPER WEST REGION

Ordered logistic regression parameters						
Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	1.92	0.70	2.75	0.013	0.46	3.38
Intercept 1 (< communal)	1.82	0.56	3.24	0.004	0.64	2.99
Intercept 2 (< shared)	-	-	-	-	-	-
Intercept 3 (< private)	2.16	0.57	3.8	0.001	0.97	3.35

Transformed regression parameters						
Primary place of defecation	Percentage of households	SE	z-stat	p-value	[95% CI]	
NGO CLTS						
Open defecation	86.0%	6.7%	12.77	0.000	72.8%	99.2%
Communal latrine	-	-	-	-	-	-
Shared latrine	3.6%	1.8%	2.06	0.040	0.2%	7.0%
Private latrine	10.4%	5.3%	1.96	0.049	0.0%	20.7%
NGO CLTS + natural leader training						
Open defecation	47.5%	10.6%	4.49	0.000	26.7%	68.2%
Communal latrine	-	-	-	-	-	-
Shared latrine	8.5%	2.3%	3.66	0.000	3.9%	13.0%
Private latrine	44.1%	9.6%	4.60	0.000	25.3%	62.9%
Difference						
Open defecation	-38.6%	12.5%	-3.10	0.002	-63.0%	-14.2%
Communal latrine	-	-	-	-	-	-
Shared latrine	4.9%	2.1%	2.30	0.021	0.7%	9.0%
Private latrine	33.7%	11.1%	3.04	0.002	12.0%	55.5%

VOLTA REGION

Ordered logistic regression parameters						
Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	0.79	0.23	3.43	0.003	0.31	1.27
Intercept 1 (< communal)	-1.02	0.19	-5.32	0.000	-1.42	-0.62
Intercept 2 (< shared)	0.18	0.20	0.92	0.369	-0.23	0.59
Intercept 3 (< private)	1.22	0.16	7.52	0.000	0.88	1.56

Transformed regression parameters						
Primary place of defecation	Percentage of households	SE	z-stat	p-value	[95% CI]	
NGO CLTS						
Open defecation	26.5%	3.7%	7.10	0.000	19.2%	33.8%
Communal latrine	28.0%	4.3%	6.55	0.000	19.6%	36.4%
Shared latrine	22.7%	2.9%	7.79	0.000	17.0%	28.5%
Private latrine	22.7%	2.9%	7.95	0.000	17.1%	28.3%
NGO CLTS + natural leader training						
Open defecation	14.1%	2.5%	5.59	0.000	9.2%	19.0%
Communal latrine	21.2%	3.5%	6.11	0.000	14.4%	28.0%
Shared latrine	25.4%	2.5%	10.05	0.000	20.5%	30.4%
Private latrine	39.2%	4.8%	8.13	0.000	29.8%	48.7%
Difference						
Open defecation	-12.4%	3.7%	-3.34	0.001	-19.7%	-5.1%
Communal latrine	-6.8%	2.3%	-2.98	0.003	-11.3%	-2.3%
Shared latrine	2.7%	1.2%	2.16	0.031	0.2%	5.1%
Private latrine	16.5%	5.0%	3.29	0.001	6.7%	26.3%

All regressions and standard errors account for unequal selection probability, non-response rates, and village clustering of outcomes. Data are from the follow-up household survey in May 2014.

APPENDIX 3: GHANA HOUSEHOLD SURVEY

Ghana household survey, extracted from SurveyCTO software

Question	Answer
SURVEYOR: What region are you in?	Central Region Volta Region Upper West
SURVEYOR: What community are you in? SURVEYOR: What is your name?	
2. SURVEYOR: Did you find the household?	Yes / No
3 SURVEYOR: Please explain why you are unable to locate the household, and give any information about whereabouts (location, phone numbers, etc.)	
4. SURVEYOR: Is someone in the household willing to talk to you?	Yes / No
5 SURVEYOR: What reason did they give for not being willing to speak with you?	
6. SURVEYOR: Ask to speak to the woman in household who is most knowledgeable.	
7. READ: (consent)	
15. ASK: Can I ask you a few questions?	Yes / No
17. ASK: Can I ask the reason you would not like to talk with us?	
18. SURVEYOR: Take a GPS point standing as close to the front door of the household as possible. <i>HINT: The lower the number, the better the accuracy. Wait for the accuracy to be 6m or smaller.</i>	
19. ASK: What is your name?	
20. ASK: How old are you?	
20.5. OBSERVE: Is the respondent male or female?	Male Female
21. ASK: What is your marital status?	Married Consensual union Single Divorced Separated Widowed
22. ASK: What is the highest level of schooling that you have completed?	None Less than primary Primary Junior high school Senior high school 'O' levels A' levels 6th form University Post-secondary other Other - specify
22. Specify other	

23. ASK: What is your religion?	Christian Muslim Traditionalist None Other
23. Specify other	
24. ASK: How many individuals in this household are 18 years and above? <i>HINT: Based on the census, there should be hh_preload adults</i>	
25. ASK: How many individuals in this household are between 5 and 18 years? <i>HINT: Based on the census, there should be hh_preload youth above the age of 5.</i>	
26. ASK: How many individuals in this household are 5 years or younger? <i>HINT: Based on the census, there should be hh_preload children age 5 or younger.</i>	
SURVEYOR: You are starting the HOUSEHOLD section	
27. ASK: How many households are in this compound?	
28. ASK: What is the material of the roofing of this household?	Grass Thatch Wood Mud Bamboo Straw Metal Slate Tiles Asbestos Zinc Cement
29. OBSERVE: How clean is the household compound?	Abundant trash and solid waste strewn around the yard Less than 10 pieces of trash or solid waste evident in the yard No trash or waste, the yard is clean of any debris
30. ASK: How many years has your family lived in this STRUCTURE? <i>HINT: This question is referring to this specific structure. If they needed to rebuild the house at some point, we want to know from the time this structure was built</i>	
31. ASK: How many years has your family lived in this community? <i>HINT: If you are speaking to someone who has recently moved in, you can ask other household members if they have a better idea. Also, this is TOTAL, not consecutive. If the family lived here 5 years, moved away for 10, and now moved back 2 years ago, the answer is 7.</i>	
32. ASK: Do you have a functioning TV In the house?	Yes / No
33. ASK: Do you have a functioning radio in the house?	Yes / No
34. ASK: How many people in this household have a cellphone?	
SURVEYOR: You are starting the OPINIONS section	

35. ASK: What do you think is the most important issue in your community?	Schools/education Health Roads/transportation Electricity Water supply Sanitation and/or hygiene facilities Housing Employment Politics Agriculture Communication (including cell phones) Market Access to financial services Football Community center Security Signboards No priorities Other
36. ASK: Is there open defecation in your community?	Yes / No
37. ASK: Do you think that open defecation in your community is causing diseases?	Yes / No
38. ASK: Who do you think should pay for improving sanitation in your community?	Family/household Community leaders Government (central, region, municipal, district) NGOs/partners Church, mosque, or other religious group Not sure Other
38. Specify other	
SURVEYOR: You are starting the DRINKING WATER section	
39. ASK: What is the main source of DRINKING water for members of your household?	River/stream Pond/lake Open spring Protected spring Open well Protected well Borehole Rainwater Public tap Private tap Water vendor Bottled water/sachet water Other
39. Specify other	

40. ASK: In the last 2 weeks, was water unavailable from this source for a day or longer?	Yes / No
41. ASK: Do you share this water source with other households?	Yes / No
42. ASK: Do you pay to use this water source?	Yes / No
43. ASK: Is the water source in this household's dwelling or yard?	Yes / No
44. ASK: How long does it take to walk to it? <i>IN MINUTES</i>	
45. ASK: Do you have to queue or wait to get water at this source?	Yes / No
46. ASK: How long do you typically have to wait to get water at this source? <i>IN MINUTES HINT: If they use bottle or sachet water, the time it takes them to walk to the store where they buy it</i>	
47. ASK: Is this water source usable year round?	Yes / No
48. ASK: When your main source of drinking water is not available, where do you get your drinking water?	River/stream Pond/lake Open spring Protected spring Open well Protected well Borehole Rainwater Public tap Private tap Water vendor Bottled water/sachet water Other
48. Specify other	
49. ASK: Do you currently treat your drinking water? <i>HINT: This means if they specifically do something to the water in their household.</i>	Yes / No
50. ASK: How do you treat your drinking water? SELECT ALL THAT APPLY	Chlorination Filtration with ceramic device (such as a clay pot, or candle filter) Filtration with biosand filter Filtration with cloth Solar disinfectoin Boiling Chemical coagulant (such as aluminum salt or iron salt) Camphor balls Other
50. Specify other	
51. ASK: Do you store your drinking water?	Yes / No
52. ASK: May I see the container where you store your drinking water?	Allowed Not allowed
53. ASK: Is the water in this container used ONLY for drinking and/or cooking? <i>HINT: If it is used for other things than the answer here should be 'no'</i>	Yes / No

54. OBSERVE: Does the container have a wide or narrow mouth? <i>HINT: Use your ruler to measure if it is larger or smaller than 10 cm</i>	Wide mouth (more than 10 centimeters across) Narrow mouth (less than 10 centimeters across)
55. OBSERVE: Does the container have a spigot?	Yes / No
56. OBSERVE: Does the container have a lid or fitted cover? <i>HINT: A polythene bag that is tied on counts here. A board resting on top that is not secured does not count. The cover should be fitted to the container somehow, either by snap, or ties, or screw-on.</i> SURVEYOR: You are starting the SANITATION section	Yes / No
57. ASK: Where do members of your family usually go to defecate? <i>HINT: In this case, write what the respondent says, even if the latrine does not meet the full definition from last time. If they call it a latrine, for this question, it's a latrine.</i>	Bush, field, river, or pond Rubbish dump, "bola" Dig and bury Latrine at their own household that they own entirely Latrine at their own household that they own partially Latrine at their own household, where they are renters Latrine at neighbour's household Communal or public latrine School latrine Other
57. Specify other	
58. ASK: How much time does it take on average to get to the place you defecate? <i>IN MINUTES</i>	
59. ASK: How many months has your family had this latrine? <i>HINT: 1 year = 12 months 1.5 years = 18 months 2 years = 24 months 3 years = 36 months</i>	
60. ASK: How much money did you spend on this latrine? <i>IN NEW GHANA CEDIS</i>	
61. ASK: What specifically did you spend that money on? SELECT ALL THAT APPLY <i>HINT: If they hired someone to do the work entirely, check the individual materials, and then choose Other-specify, and write in "hired contractor"</i>	Cement Pre-made slab/squat plate Wood Sheet metal (for walls or roof, etc) Labor/help for digging or construction other
61. Specify other	
62. ASK: How many total hours has your family spent building this latrine? <i>HINT: This answer can be zero. Also, cooking for labourers counts as hours towards building the latrine.</i>	

63. ASK: Did anyone besides your family help you to build this latrine? <i>HINT: If they hired a contractor to do all the building, select YES</i>	Yes / No
64. ASK: Who helped you to build this latrine? SELECT ALL THAT APPLY <i>HINT: This means construction. Money, materials, and knowledge don't count in this case. If they hired a contractor, specify this in Other</i>	Neighbours or other community members Community leaders Plan natural leaders District officials (from health office or other) Church, mosque, or other religious group NGOs/partners Other
64. Specify other	
65. ASK: For how many hours did your neighbours or other community members help you build your latrine?	
66. ASK: For how many hours did community leaders help you build your latrine?	
66. ASK: For how many hours did Plan natural leaders help you build your latrine?	
67. ASK: For how many hours did district officials help you build your latrine?	
68. ASK: For how many hours did members of your religious group help you build your latrine?	
69. ASK: For how many hours did partners or NGO workers help you build your latrine?	
70. ASK: For how many hours did the other people help you build your latrine?	
71. ASK: What kind of latrine is the latrine your family usually uses? <i>HINT: If they don't have a quick answer, you can provide them with examples of the choices.</i>	Bucket toilet Pit latrine Composting toilet Pour flush toilet or water closet latrine Other
71. Specify other	
72. ASK: Do you share this latrine with other households?	Yes / No
73. ASK: How many households do you share this latrine with? <i>HINT: If they can't give a specific number, enter -1</i>	
74. ASK: Are all of these households from within your compound?	Yes / No
75. ASK: Is there a lock on the door of the latrine?	Yes / No
76. ASK: Can you use this facility at all hours of the day and night?	Yes / No
77. ASK: Do you have to queue or wait to use this latrine?	Always Sometimes Never
78. ASK: On average, how long do you have to queue/wait?	
79. ASK: Since the last year's rainy season (2013), did your latrine become unusable?	Yes / No

80. ASK: Why was it unusable? SELECT ALL THAT APPLY	<ul style="list-style-type: none"> Roof, wall, or door problems Slab problems Pit overflow or flooding No water in tank Flushing mechanism broke down Bowl overflow/clogged Pipe breakdown Safety concerns Other
80. Specify other	
81. ASK: During that period, how many weeks was it unusable?	
82. ASK: Do any members of your family defecate in the bush, field, or nearby river when away from home?	Yes / No
83. ASK: Do you plan on changing your latrine before next year's (2015) rainy season?	Yes / No / Maybe
84. ASK: In what way do you plan to change your latrine? SELECT ALL THAT APPLY	<ul style="list-style-type: none"> New slab/squat plate New or upgraded walls New roof New door New/replacement latrine New/replacement pit Adding ventilation Other
84. Specify other	
85. ASK: Who will pay for the changes to your latrine? SELECT ALL THAT APPLY	<ul style="list-style-type: none"> Me, my family, or my household Neighbour or friend Community members or leaders Plan natural leaders NGOs or outside organizations Government, health worker, or other officer or water or health Landlord Church, mosque, or other religious group The latrine won't cost any money Other
85. Specify other	
86. ASK: Do you want to have your own household latrine?	Yes / No

87. ASK: Why do you not want to have a latrine? SELECT ALL THAT APPLY

- Expensive
- Materials not available
- Satisfied with neighbour or shared latrine
- Does not see benefit in having a latrine
- Aesthetics (including smell, appearance, etc.)
- Environment (including lack of space, poor soil, etc.)
- Culturally unacceptable
- Will be leaving community
- Other

87. Specify other

88. ASK: Why do you want to have a latrine? SELECT ALL THAT APPLY

- Dignity, appearance, or social status
- Health related reasons
- Time or distance spent walking to latrine
- Increased safety
- Age (getting old)
- Poor or no community latrine available
- Other

88. Specify other

89. ASK: What is your reason for not having a latrine? SELECT ALL THAT APPLY

- Expensive
- Construction materials are not available in the market
- Latrine slabs are not available at the market
- There is no one with technical capacity
- Does not see benefit in having own latrine
- Higher priorities than a latrine
- Culturally unacceptable
- No land or space
- Bad environment (sandy soil, wet soil, etc.)
- Too close to water supply
- Renting current house, or no permission to build
- Prefers brush
- No permission
- New house
- Latrine just broke down
- Other

89. Specify other

90. ASK: Do you plan on building a latrine before next year's (2015) rainy season?	Yes / No
91. ASK: Who will pay for the construction of the latrine? SELECT ALL THAT APPLY	Me, my family, or my household Neighbour or friend Community members or leaders Plan natural leaders NGOs or outside organizations Government, health worker, or other officer or water or health Landlord Church, mosque, or other religious group The latrine won't cost any money Other
91. Specify other SURVEYOR: You are starting the CHILD section	
92. ASK: The last time a child 5 years or younger in your house passed stool, where did he/she defecate?	Used chamberpot or potty Used diaper Went in clothes Went in compound/yard Went outside the premises Used own latrine Used public latrine Don't know Other
92. Specify other	
93. ASK: The last time a child in your house passed stool, where were his/her feces disposed?	Dropped into latrine Buried Solid waste/trash/rubbish dump In yard Outside premises/bush Public latrine Thrown into pond/river Don't know Other
93. Specify other	
94. ASK: In the past 2 weeks, how many of the children in this household under the age of 5 have had diarrhea?	
95. ASK: For the most recent case of diarrhea, was the child taken for treatment?	Yes / No

96. ASK: For the most recent case of diarrhea, where was the child taken for treatment?	Health facility Traditional healer Home based treatment Prayer camp Pharmacy, chemical store, drug store Friend or neighbour Other
96. Specify other	
97. ASK: For the most recent case of diarrhea, was the child given any medication or rehydration solution? SELECT ALL THAT APPLY	Coconut milk Soft drinks or minerals with salt (Coca Cola, Fanta, Sprite, Malta Guinness, etc ...) Lucozade or equivalent Akpateshie with salt Oral rehydration solution (ORS, salts, salt solution) Zinc tablets Traditional or herbal mixes (from herbalist or spiritualist) From a church, mosque, religious institution (anointing oil, etc.) Other
97. Specify other	
SURVEYOR: You are starting the HYGIENE section	
98. ASK: Have you been taught about hygiene and handwashing?	Yes / No
99. ASK: Who taught you about hygiene and handwashing? SELECT ALL THAT APPLY	School teachers Children or students Health workers NGO Media (radio or TV) Community members Plan natural leaders Church, mosque, or other religious group Family members Community leaders Plan natural leaders Other
99. Specify other	

100. ASK: Please mention all of the occasions when it is important to wash your hands. SELECT ALL THAT APPLY	Before eating After eating Before praying Before breastfeeding or feeding a child Before cooking or preparing food After defecation/urination After cleaning a child that has defecated/changing a child's nappy When my hands are dirty After cleaning the toilet or potty Other
100. Specify other	
101. ASK: Do you and your family members wash your hands at all of these times?	Always Sometimes Never
SURVEYOR: You are starting the INTERACTIONS section	
102. ASK: Have you attended any community meetings in the past 2 months?	Yes / No
103. ASK: Did this meeting include any discussion of sanitation or latrine issues?	Yes / No
104. ASK: Did this meeting include any discussion of hygiene or handwashing?	Yes / No
105. ASK: What specific sanitation and hygiene issues were discussed? SELECT ALL THAT APPLY	Latrine construction Community latrines Handwashing stations Important times for handwashing Health problems Clean environment Cleansing agents (water, ash, soap, ...) Other
105. Specify other	
106. ASK: Have you discussed sanitation or handwashing issues with any of your neighbours in the past 2 months?	Yes / No
107. ASK: Does your community provide any assistance for households that cannot afford to build their own latrines?	Yes / No
108. ASK: In the last 2 months, have you visited a health center or clinic?	Yes / No
109. ASK: In the last 2 months, has a Health Worker visited your house?	Yes / No
SURVEYOR: You are starting the LATRINE OBSERVATION section	
110. ASK: May I please see the latrine you use?	Allowed Not allowed
111. OBSERVE: Does the path to the latrine appear to have been walked on recently?	Yes (grass is trampled, wet footprints are visible, or the brush has recently been cleaned) Not applicable (there is no visible path specifically to the latrine)

112. OBSERVE: Is there visibly anal cleansing material in the latrine or in the pit?	Yes / No Not possible to access or see
113. OBSERVE: Are there flies present inside the latrine?	Yes - more than 10 flies Yes - less than 10 flies No flies evident
114. OBSERVE: What is the floor made of?	Sticks or branches and dirt or clay Wooden boards Concrete Plastic Tiles Other
114. Specify other	
115. OBSERVE: What is the slab made of?	Sticks or branches and dirt or clay Wooden boards Concrete Plastic Other
115. Specify other	
116. OBSERVE: What is the condition of the walls?	Walls are completely deteriorated or collapsed Walls are partially deteriorated Walls are in good condition and appear durable
117. OBSERVE: What is the condition of the door?	Door is absent, or door does not close properly Door is present and can be closed
118. OBSERVE: What is the condition of the roof?	No roof, or roof in complete disrepair with large gaps that offer no protection Roof present but leaky Roof present and provides protection from sun and rain
119. OBSERVE: Does the latrine have a ventilation pipe into the pit?	Yes, there is a ventilation pipe with a screen over the top Yes, there is a ventilation pipe, but it is not screened
120. OBSERVE: Is there a hole cover?	No hole cover present Hole cover defective, broken, or not used Hole cover placed over hole and tight fitting

121. OBSERVE: What is the condition of the floor/slab?	Slab is significantly eroded, deteriorated to the point of being a safety concern Hole significantly eroded or other small gaps or cracks in slab. Not yet a safety hazard Slab more or less intact. No danger of children or adults slipping on uneven eroded surfaces, or of a foot or leg entering the pit through enlarged hole or other gaps in the slab.
122. OBSERVE: What privacy does the latrine have?	User visible from outside (no walls, or walls do not provide privacy to user Cosmetic issues in need of repair, even though user is not visible from the outside Walls in sufficient repair to provide privacy.
123. OBSERVE: How clean is the hole/opening area of the latrine?	Dry and clean Dry but smeared with shit Wet but no smeared shit Wet and smeared with shit
124. OBSERVE: Is there a handwashing station inside the latrine or within 10 paces of the latrine?	Yes / No
SURVEYOR: You are starting the HANDWASHING section	
125. OBSERVE: Is there water at this hand washing station?	Yes / No
126. OBSERVE: What device is used for water at this hand washing station?	Tap Tippy tap Bucket Wash basin Water tank Other
126. Specify other	
127. OBSERVE: Is there a hand washing material at this hand washing station? SELECT ALL THAT APPLY	None Soap Detergent Ash Mud/sand Other
127. Specify other	
128. ASK: Do you use any material to wash your hands after you use the latrine?	Yes / No
129. ASK: Can you show it to me?	Yes / No

130. OBSERVE: What type of material is this? SELECT ALL THAT APPLY

Question relevant when: $\${station_soap_show}=1$

Soap
Detergent
Ash
Mud/sand
Other

130. Specify other

131. OBSERVE: Does the washing station look like it has been recently used?

Yes / No

APPENDIX 4: GHANA NATURAL LEADER SURVEY

Ghana natural leader survey

Section 1: Identification			
1.	District Name	«District»	
2.	Community Name	«Community»	
3.	Respondent ID	«UniqueID»	
4.	Date	_ _ _ _ / _ _ _ _ Y Y Y Y M M D D	
5.	Surveyor Name		

I certify that I have read the consent information to the respondent and that the respondent has agreed to proceed with answering the survey.

Signature: _____

Section 2: Demographics			
6.	Observe: What is the respondent's sex?	1. <input type="radio"/> Male 2. <input type="radio"/> Female	
7.	How old are you?	_ _ years	
8.	How many years have you lived in this community?	_ _ years	
9a	What do you think is the <i>highest</i> priority for your community? <ul style="list-style-type: none"> • Do not read the answers. • Check only one response. • If multiple answers are given, ask them to pick the most important one. 	1. <input type="radio"/> Schools 2. <input type="radio"/> Health facilities 3. <input type="radio"/> Roads 4. <input type="radio"/> Electricity 5. <input type="radio"/> Housing 6. <input type="radio"/> Water supply 7. <input type="radio"/> Sanitation facilities 8. <input type="radio"/> Hygiene or handwashing 9. <input type="radio"/> Employment	
9b		10. <input type="radio"/> Other:	
10.	Does your household own a latrine?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
11.	How long have you had this latrine?	_ _ months	

Section 3: Knowledge

12a	<p>Please mention all of the occasions when is it important to wash your hands:</p> <ul style="list-style-type: none"> • <i>Do not read the answers. Circle all responses.</i> • <i>After they have finished responding, ask “are there any more occasions?”</i> • <i>If the respondent indicates that (s)he does not know, do not probe for additional responses.</i> 	<input type="checkbox"/> Before eating	
12b		<input type="checkbox"/> After eating	
12c		<input type="checkbox"/> Before praying	
12d		<input type="checkbox"/> Before breastfeeding or feeding a child	
12e		<input type="checkbox"/> Before cooking or preparing food	
12f		<input type="checkbox"/> After defecation or urination	
12g		<input type="checkbox"/> After cleaning a child that has defecated/changing a child’s nappy	
12h		<input type="checkbox"/> When my hands are dirty	
12i		<input type="checkbox"/> After cleaning the toilet or potty	
12j		<input type="checkbox"/> After returning from social or public functions	
12k		<input type="checkbox"/> After returning home from work, the farm, or the market	
12L		<input type="checkbox"/> Does not know	
12m		<input type="checkbox"/> Other:	
13a	<p>Please describe how do you wash your hands:</p> <ul style="list-style-type: none"> • <i>Do not read the answers.</i> • <i>Check all responses.</i> 	<input type="checkbox"/> Wet hands	
13b		<input type="checkbox"/> Rub with soap, ash, or detergent	
13c		<input type="checkbox"/> Amount of time to wash specified	
13d		<input type="checkbox"/> Rinse hands	
13e		<input type="checkbox"/> Amount of time to rinse hands specified	
13f		<input type="checkbox"/> Dry hands	
13g		<input type="checkbox"/> Other:	

14a	<p>Can you tell me the different steps on the sanitation ladder?</p> <ul style="list-style-type: none"> Do not read the answers. Check all responses. After they have finished responding, ask “are there any more steps?” If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Open defecation	
14b		<input type="checkbox"/> Dig and bury, or cat sanitation	
14c		<input type="checkbox"/> Simple pit latrine, dug latrine	
14d		<input type="checkbox"/> Improved latrine, ventilated latrine	
14e		<input type="checkbox"/> Pour flush, water sealed, flush	
14f		<input type="checkbox"/> Does not know	
14g		<input type="checkbox"/> Other:	
15a	<p>Please tell me some of the negative impacts of open defecation on your community:</p> <ul style="list-style-type: none"> Do not read the answers. Check all responses. After they have finished responding, ask “are there any more impacts?” If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Diseases or other health impacts	
15b		<input type="checkbox"/> Treatment costs for sickness	
15c		<input type="checkbox"/> Lost labor, employment, or work	
15d		<input type="checkbox"/> Absenteeism from school	
15e		<input type="checkbox"/> Dirty, smelly environment, or other aesthetic impacts	
15f		<input type="checkbox"/> Physical risks, such as snake bites	
15g		<input type="checkbox"/> Sexual assault, rape	
15h		<input type="checkbox"/> Loss of social status or reputation	
15i		<input type="checkbox"/> Lost dignity and self-respect	
15j		<input type="checkbox"/> Does not know	
15k		<input type="checkbox"/> Other:	
16a	<p>Please tell me the ways by which someone can come into contact with his/her own feces or the feces of other members of the community.</p> <ul style="list-style-type: none"> Do not read the answers. Circle all responses. After they have finished responding, ask “are there any more ways?” If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Fingers	
16b		<input type="checkbox"/> Flies	
16c		<input type="checkbox"/> Fields	
16d		<input type="checkbox"/> Fluids	
16e		<input type="checkbox"/> Food	
16f		<input type="checkbox"/> Does not know	
16g		<input type="checkbox"/> Other:	

17.	Were you there when «Lngo» came and triggered your community?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
18a	Can you tell me what activities the «Lngo» did when they triggered your community? <ul style="list-style-type: none"> • Do not read the answers. • Circle all responses. • After they have finished responding, ask “were there any more activities?” • If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Visiting Open Defecation sites (walk of shame)	
18b		<input type="checkbox"/> Visiting refuse dumps	
18c		<input type="checkbox"/> Fly and water demonstration (putting a stick or hair into feces then water)	
18d		<input type="checkbox"/> Food demonstration (putting food near feces with flies)	
18e		<input type="checkbox"/> Mapping exercise (mapping community, mapping latrines)	
18f		<input type="checkbox"/> Medical cost calculation (cost of illness, cost of diarrhea)	
18e		<input type="checkbox"/> Does not know	
18h		<input type="checkbox"/> Other:	

Section 4: Attitudes

19a	Who all do you think should bear the cost of improving sanitation in your community? <ul style="list-style-type: none"> • Do not read answers. • Check all that apply. 	<input type="checkbox"/> Family/household	
19b		<input type="checkbox"/> Community leaders (chief, elders)	
19c		<input type="checkbox"/> Government (Central, Regional, Municipal, or District)	
19d		<input type="checkbox"/> NGOs or development partners	
19e		<input type="checkbox"/> Church or religious leaders	
19f		<input type="checkbox"/> Does not know	
19g		<input type="checkbox"/> Other:	
20.	Do you think (name of this community) needs guidance from others, such as government or NGOs, to become Open Defecation Free?	1. <input type="radio"/> Yes 2. <input type="radio"/> No 3. <input type="radio"/> Unsure	
21.	Please indicate your agreement with the following statement: “I feel that I can help my community to become Open Defecation Free.”	1. <input type="radio"/> Strongly agree 2. <input type="radio"/> Agree 3. <input type="radio"/> Neutral/no opinion 4. <input type="radio"/> Disagree 5. <input type="radio"/> Strongly disagree	

22.	Would you like to have another community/chief come to visit your community to look at your latrines?	1. <input type="radio"/> Yes → 2. <input type="radio"/> No →	
23a	<i>As a follow up to question # XX: Why not?</i> • <i>Check all that apply.</i>	<input type="checkbox"/> Toilets are dirty or smelly	
23b		<input type="checkbox"/> Toilets are unsafe	
23c		<input type="checkbox"/> No toilets	
23d		<input type="checkbox"/> Environment	
23e		<input type="checkbox"/> Other:	
24a	<i>As a follow up to question # XX: Why?</i> • <i>Check all that apply.</i>	<input type="checkbox"/> Toilets are clean	
24b		<input type="checkbox"/> Proud of my community	
24c		<input type="checkbox"/> I can teach them something	
24d		<input type="checkbox"/> Other:	
25.	Do you think your community is • <i>Read the options to the respondent.</i> • <i>Check only one response.</i>	1. <input type="radio"/> Very dirty 2. <input type="radio"/> Dirty 3. <input type="radio"/> Neutral/no opinion 4. <input type="radio"/> Clean 5. <input type="radio"/> Very clean	
26.	How satisfied are you with the sanitation condition of your community right now? • <i>Read the below to the respondent.</i> • <i>Check only one response.</i>	1. <input type="radio"/> Completely satisfied 2. <input type="radio"/> Somewhat satisfied 3. <input type="radio"/> Neutral/no opinion 4. <input type="radio"/> Somewhat dissatisfied 5. <input type="radio"/> Completely dissatisfied	

Section 5: Practice

27.	Are you on any CLTS committees or teams?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
28.	What is the name of this committee or team?		
29.	Do you have any assigned job or role on this team?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
30.	What is your assigned job or role on this team?		
31.	Have you met with any community leaders to discuss CLTS, sanitation, or hygiene in the last 6 months?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	

32a	Which leaders? <ul style="list-style-type: none"> • <i>Do not read answers.</i> • <i>Check all that apply.</i> 	<input type="checkbox"/> Chief	
32b		<input type="checkbox"/> Assistant chief	
32c		<input type="checkbox"/> Elders	
32d		<input type="checkbox"/> Women's leader	
32e		<input type="checkbox"/> Assembly man	
32f		<input type="checkbox"/> Religious leader	
32g		<input type="checkbox"/> Teacher	
32h		<input type="checkbox"/> Other:	
33.	Have you organized any meetings on sanitation and hygiene in the last 6 months?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
34.	How many meetings?	___ ___ meetings	
35.	Did you lead any of these meetings?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
36a	What was discussed during these meetings? <ul style="list-style-type: none"> • <i>Check all that apply.</i> 	<input type="checkbox"/> Latrine construction	
36b		• <input type="checkbox"/> Paying for latrines/financing	
36c		• <input type="checkbox"/> Helping the poorest	
36d		• <input type="checkbox"/> Handwashing technique	
36e		• <input type="checkbox"/> Monitoring	
36f		• <input type="checkbox"/> Education awareness	
36g		• <input type="checkbox"/> Other:	
37.	Since «Lingo» first visited your community, how many days per week have you been involved in CLTS activities?	• ___ ___ days per week	
38a	If you were not involved in CLTS activities on those days, what would you have been doing instead? <ul style="list-style-type: none"> • <i>Check all that apply.</i> 	• <input type="checkbox"/> Farming	
38b		• <input type="checkbox"/> Teaching	
38c		• <input type="checkbox"/> Nothing	
38d		• <input type="checkbox"/> Other:	
39.	Have you met with anyone from outside your community to discuss CLTS, sanitation, or hygiene in the last 6 months?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	

40a	Who did you meet with from outside your community?	<input type="checkbox"/> Plan	
40b		<input type="checkbox"/> Pronet, Fobet, or Adsen (or local NGO)	
40c		<input type="checkbox"/> District government, environmental health officer, or district assembly	
40d		<input type="checkbox"/> Other:	
41.	Have you helped any households in your community with sanitation related issues in the last 6 months?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
42.	How many households did you help?	• __ __ households	
43a	In what ways have you helped other households? • <i>Check all that apply.</i>	<input type="checkbox"/> Training	
43b		<input type="checkbox"/> Providing materials	
43c		<input type="checkbox"/> Providing labor	
43d		<input type="checkbox"/> Latrine design or construction guidance	
43e		<input type="checkbox"/> Referring them to someone else who could help	
43f		<input type="checkbox"/> Financial/money	
43g		<input type="checkbox"/> Other:	
44.	Do you visit households to count the number of latrines in your community?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
45.	How often do you visit households to count latrines?	__ __ times per month	
46	How many households in your community have their own latrines?	__ __ houses have latrines	
47.	Does your community have a CLTS/ODF action plan?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
48.	Does your action plan have a date when you will become ODF?	1. <input type="radio"/> Yes 2. <input type="radio"/> No →	
49.	What is the date? <i>If the respondent cannot remember, leave blank.</i>	__ __ __ __ / __ __ / __ __ Y Y Y Y M M D D	

50.	<p>READ: “As a reminder, everything you share with us is strictly confidential, and will not be shared with anyone from Plan or «Lingo».”</p> <p>In your opinion, what are the benefits of having Plan and «Lingo» come to your community?</p> <ul style="list-style-type: none"> • <i>Write down all responses.</i> • <i>After they have finished responding, ask “<u>are there any more benefits?</u>”</i> 	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
51.	<p>In your opinion, what are the disadvantages (or downsides / drawbacks) of having Plan and (LNGO) come to your community?</p> <ul style="list-style-type: none"> • <i>Write down all responses.</i> • <i>After they have finished responding, ask “<u>are there any more downsides?</u>”</i> 	<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

Section 6: FOR PILOT COMMUNITIES ONLY

53a	<p>READ: "All the remaining questions pertain to the CLTS Natural Leader training session that was led by Plan Ghana. Please think back to this training session."</p> <p>What were the different topics taught at the training session?</p> <ul style="list-style-type: none"> • Do not read the answers. • Circle all responses. • After they have finished responding, ask "were there any more topics?" • If the respondent indicates that (s)he does not know, do not probe for additional responses. 	1	<input type="checkbox"/> Self - help	
53b		2	<input type="checkbox"/> Social mobilization	
53c		3	<input type="checkbox"/> Team building	
53d		4	<input type="checkbox"/> Leadership	
53e		5	<input type="checkbox"/> Communication	
53f		6	<input type="checkbox"/> Community entry process	
53g		7	<input type="checkbox"/> Conflict prevention and management	
53h		8	<input type="checkbox"/> Safe human excreta disposal	
53i		9	<input type="checkbox"/> Sanitation ladder	
53j		10	<input type="checkbox"/> Implementation of CLTS	
53k		11	<input type="checkbox"/> Handwashing with soap	
53L		12	<input type="checkbox"/> Can't remember any	
53m		13	<input type="checkbox"/> Other:	
54a	<p>Show the respondent the list of topics.</p>		<i>Most important</i>	
54b	<p>Out of the topics taught, which were the three most important topics to you?</p>		<i>Second important</i>	
54c	<ul style="list-style-type: none"> • Please use the number from the list of topics above and write them in here. 		<i>Third important</i>	
55.	<p>Have you taught anyone in your community anything you learned from the training?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No →</p>		

56a	<p>What did you teach them? <i>Do not read the answers. Circle all responses.</i></p>	<input type="checkbox"/> Self - help	
56b		<input type="checkbox"/> Social mobilization	
56c		<input type="checkbox"/> Team building	
56d		<input type="checkbox"/> Leadership	
56e		<input type="checkbox"/> Communication	
56f		<input type="checkbox"/> Community entry process	
56g		<input type="checkbox"/> Conflict prevention and management	
56h		<input type="checkbox"/> Safe human excreta disposal	
56i		<input type="checkbox"/> Sanitation ladder	
56j		<input type="checkbox"/> Implementation of CLTS	
56k		<input type="checkbox"/> Handwashing with soap	
56L		<input type="checkbox"/> Can't remember any	
56m		<input type="checkbox"/> Other:	
57a	<p>In what ways has the training session helped you improve your community? <i>Do not read responses. Check all that apply.</i></p>	<input type="checkbox"/> Give the community pride/respect	
57b		<input type="checkbox"/> Create a better environment for women	
57c		<input type="checkbox"/> Create a better environment for children	
57d		<input type="checkbox"/> Create a cleaner community	
57e		<input type="checkbox"/> Improve health in the community	
57f		<input type="checkbox"/> Bring the community together	
57g		<input type="checkbox"/> Other:	

APPENDIX 5: CENSUS AND SURVEY SAMPLING COUNTS AND SANITATION PRACTICE VARIABLE

Census and survey sampling counts for kebele, village, and household (HH) levels, by intervention and region, in Ethiopia.

Approach	Region	Kebele	Census		Sampled		HHs surveyed	
			Villages	HHs	Villages	HHs	Baseline	Follow-up*
Conventional	Oromia	Kebele 1	24	651	18	515	479	490
	SNNP	Kebele 2	30	973	14	530	496	499
Teacher-facilitated	Oromia	Kebele 3	32	1000	11	335	285	320
		Kebele 4	22	586	13	333	280	308
	SNNP	Kebele 5	31	1212	9	363	324	322
		Kebele 6	26	1040	10	368	318	324

*Baseline and follow-up surveys were administered in October 2012 and 2013.

Sanitation practice as an ordered categorical variable.

Sanitation practice	Primary place of defecation
Open defecation	Anywhere in the open, including in the bush, field, river, or pond. Includes dig and bury, and households reporting using a latrine that surveyors observed to be full or have a collapsed or unstable floor.
Communal latrine	A public latrine accessible to anyone (including school-latrines).
Shared latrine	A latrine shared by multiple households,* including when one compound** shares a latrine, multiple households jointly own a latrine, or a household uses a neighbor's latrine.
Private latrine	A latrine used by only one household, either owned or rented in the case of tenants.

*A household was defined as a single housing unit with one acknowledged male or female head of household.

**A compound is a group of household sharing a patio or courtyard.

APPENDIX 6: ETHIOPIA ORDERED LOGISTIC REGRESSION OUTPUTS AND TRANSFORMED PARAMETERS

Ethiopia ordered logistic regression outputs and transformed parameters

FULL SAMPLE						
Ordered logistic regression parameters						
Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	-0.24	0.12	-2.01	0.049	-0.48	0.00
Time	0.81	0.12	6.81	0.000	0.57	1.05
Treatment*time	-0.40	0.18	-2.23	0.029	-0.75	-0.04
HH size (people)	0.02	0.01	1.37	0.174	-0.01	0.05
Metal roof (%)	0.57	0.11	5.44	0.000	0.36	0.78
Water collection time (round trip, minutes)	0.00	0.00	2.38	0.020	0.00	0.01
Spoke abt san/hyg w/ neighbor in past 2 mnths (%)	0.59	0.11	5.55	0.000	0.38	0.80
Intercept 1 (< communal)	-0.47	0.10	-4.91	0.000	-0.66	-0.28
Intercept 2 (< shared)	-0.40	0.10	-4.17	0.000	-0.60	-0.21
Intercept 3 (< private)	-0.26	0.10	-2.75	0.008	-0.45	-0.07
Transformed regression parameters						
Primary place of defecation	Percentage of households		Difference	p-value	[95% CI]	
	Baseline	Follow-up				
HEW CLTS						
Open defecation	38%	22%	-17%	0.000	-22%	-12%
Communal latrine	2%	1%	0%	0.000	-1%	0%
Shared latrine	3%	3%	-1%	0.000	-1%	-1%
Private latrine	57%	75%	18%	0.000	13%	23%
Teacher CLTS						
Open defecation	44%	34%	-10%	0.001	-16%	-4%
Communal latrine	2%	2%	0%	0.017	0%	0%
Shared latrine	4%	3%	0%	0.045	0%	0%
Private latrine	51%	61%	10%	0.001	4%	16%
Difference-in-difference						
	DID	SE	t-stat	p-value	[95% CI]	
Open defecation	6.9%	4.0%	1.73	0.084	-0.9%	14.7%
Communal latrine	0.3%	0.1%	2.85	0.004	0.1%	0.5%
Shared latrine	0.6%	0.2%	4.13	0.000	0.3%	0.9%
Private latrine	-7.8%	4.2%	-1.87	0.061	-	16.0%

All regressions and standard errors account for unequal selection probability, non-response rates, and village clustering of outcomes. Data are from the baseline and follow-up household surveys in November 2012 and 2013.

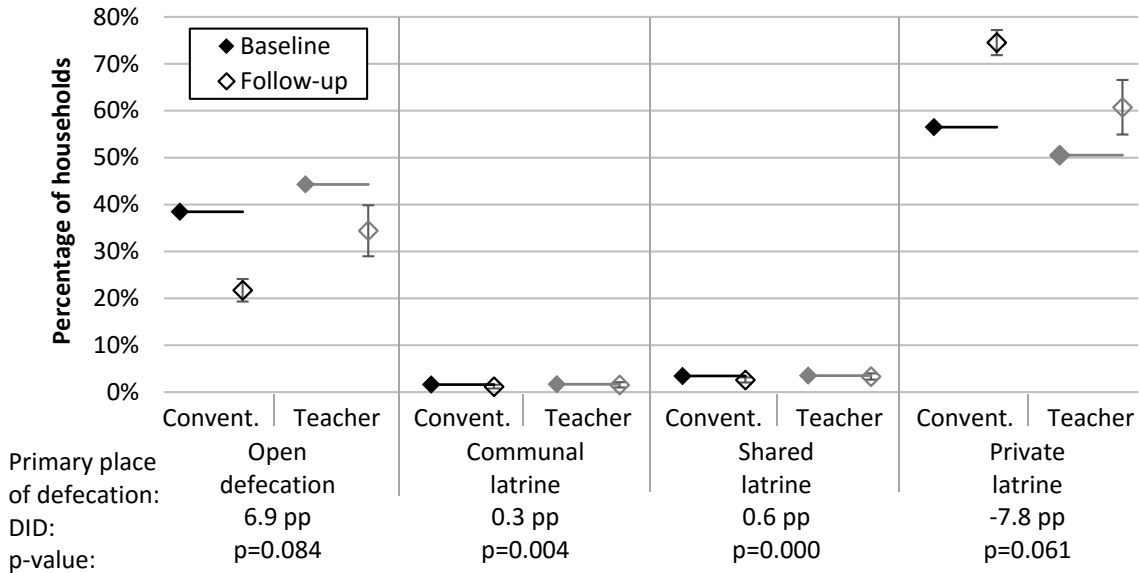
OROMIA						
Ordered logistic regression parameters						
Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	-0.49	0.23	-2.11	0.041	-0.97	-0.02
Time	2.08	0.26	8.1	0.000	1.56	2.60
Treatment*time	-1.00	0.33	-3.05	0.004	-1.67	-0.34
HH size (people)	0.02	0.02	0.87	0.391	-0.02	0.06
Metal roof (%)	0.54	0.24	2.24	0.031	0.05	1.03
Water collection time (round trip, minutes)	0.00	0.00	-1.02	0.316	-0.01	0.00
Spoke abt san/hyg w/ neighbor in past 2 mnths (%)	0.18	0.17	1.07	0.293	-0.17	0.54
Intercept 1 (< communal)	0.49	0.18	2.73	0.009	0.13	0.85
Intercept 2 (< shared)	0.49	0.18	2.74	0.009	0.13	0.85
Intercept 3 (< private)	0.64	0.18	3.52	0.001	0.27	1.01
Transformed regression parameters						
Primary place of defecation	Percentage of households		Difference	p-value	[95% CI]	
	Baseline	Follow-up				
HEW CLTS						
Open defecation	62%	17%	-45%	0.000	-55%	-35%
Communal latrine	0%	0%	0%	0.314	0%	0%
Shared latrine	3%	2%	-1%	0.000	-2%	-1%
Private latrine	35%	81%	46%	0.000	36%	56%
Teacher CLTS						
Open defecation	73%	48%	-25%	0.000	-35%	-15%
Communal latrine	0%	0%	0%	0.340	0%	0%
Shared latrine	3%	4%	1%	0.000	0%	1%
Private latrine	24%	49%	24%	0.000	15%	34%
Difference-in-difference						
	DID	SE	t-stat	p-value	[95% CI]	
Open defecation	19.9%	7.1%	2.81	0.005	6.0%	33.7%
Communal latrine	0.0%	0.0%	1.00	0.318	0.0%	0.1%
Shared latrine	2.1%	0.4%	4.81	0.000	1.3%	3.0%
Private latrine	-22.0%	7.1%	-3.12	0.002	-36%	-8.2%

All regressions and standard errors account for unequal selection probability, non-response rates, and village clustering of outcomes. Data are from the baseline and follow-up household surveys in November 2012 and 2013.

SNNP						
Ordered logistic regression parameters						
Variable	Coefficient	SE	t-stat	p-value	[95% CI]	
Treatment	-0.35	0.17	-2.09	0.045	-0.70	-0.01
Time	-0.15	0.13	-1.12	0.272	-0.41	0.12
Treatment*time	0.08	0.23	0.33	0.741	-0.39	0.54
HH size (people)	0.11	0.03	4.54	0.000	0.06	0.16
Metal roof (%)	0.21	0.12	1.78	0.086	-0.03	0.44
Water collection time (round trip, minutes)	0.00	0.00	-0.15	0.880	0.00	0.00
Spoke abt san/hyg w/ neighbor in past 2 mnths (%)	-0.03	0.13	-0.26	0.799	-0.29	0.23
Intercept 1 (< communal)	-1.39	0.12	-11.5	0.000	-1.64	-1.15
Intercept 2 (< shared)	-1.27	0.12	-10.38	0.000	-1.52	-1.02
Intercept 3 (< private)	-1.11	0.12	-9.39	0.000	-1.35	-0.87
Transformed regression parameters						
Primary place of defecation	Percentage of households		Difference	p-value	[95% CI]	
	Baseline	Follow-up				
HEW CLTS						
Open defecation	20%	22%	2%	0.255	-2%	7%
Communal latrine	2%	2%	0%	0.259	0%	0%
Shared latrine	3%	3%	0%	0.277	0%	1%
Private latrine	75%	72%	-3%	0.256	-8%	2%
Teacher CLTS						
Open defecation	26%	27%	1%	0.708	-6%	9%
Communal latrine	2%	3%	0%	0.712	0%	0%
Shared latrine	3%	3%	0%	0.703	0%	1%
Private latrine	68%	67%	-2%	0.708	-10%	7%
Difference-in-difference						
	DID	SE	t-stat	p-value	[95% CI]	
Open defecation	-1.1%	4.2%	-0.25	0.804	-9.4%	7.3%
Communal latrine	-0.1%	0.3%	-0.39	0.699	-0.6%	0.4%
Shared latrine	-0.1%	0.3%	-0.41	0.683	-0.7%	0.5%
Private latrine	1.3%	4.8%	0.27	0.790	-8.1%	10.7%

All regressions and standard errors account for unequal selection probability, non-response rates, and village clustering of outcomes. Data are from the baseline and follow-up household surveys in November 2012 and 2013.

APPENDIX 7: SANITATION PRACTICE BEFORE AND AFTER CONVENTIONAL AND TEACHER-FACILITATED CLTS INTERVENTIONS IN ETHIOPIA



Sanitation practice before and after conventional and teacher-facilitated CLTS interventions in Ethiopia.

Conventional includes 2 kebeles (54 villages). Teacher-facilitated includes 4 kebeles (111 villages). Kebeles are split evenly between the Oromia and SNNP regions. Horizontal lines are baseline means. Bars are 95% confidence intervals. Open defecation is modeled from an ordered logistic regression parameters with covariates set to their means (full regressions in the **appendix**). Open defecation is based on survey responses and latrine observations. All analysis accounts for unequal selection probabilities, non-response rates, and village clustering. ICC = 0.278 for open defecation at the village level. “DID” = difference-in-difference.

APPENDIX 8: ETHIOPIA FOLLOW-UP HOUSEHOLD SURVEY

Ethiopia follow-up household survey

Section 1: Identification		
1	District Name	«District»
2	Kebele Name	«Community»
3	Village Name	«Village»
4	Household ID	«UniqueID»
5	Date	2013 / ___ ___ / ___ ___ M M D D
6	Surveyor Name	

Section 2: Demographics		
7	Observe: What is the respondent's sex?	3. <input type="radio"/> Male 4. <input type="radio"/> Female
8	What is your age?	___ ___ years
9	Are you married?	1. <input type="radio"/> Yes 2. <input type="radio"/> No
10	What is the highest grade in school that you completed?	___ ___ grade
11	Observe: Does the house have a metal roof?	1. <input type="radio"/> Yes 2. <input type="radio"/> No
12	Observe: How clean is the household compound?	1. <input type="radio"/> Abundant trash and solid waste strewn around the yard 2. <input type="radio"/> Less than 10 pieces of trash or solid waste evident in the yard 3. <input type="radio"/> No trash or waste; the yard is clean of any debris
13	How many years has your family lived in this household?	___ ___ years
14	How many years have you lived in this community?	___ ___ years

- Before moving to the next survey question, check to make sure the response to question 13 is lower than or equal to the response to question 14.
- If response 13 is higher than response 14, ask both questions again starting with question 14.

15a	What do you think is the <i>highest</i> priority for your community? <ul style="list-style-type: none"> • Do not read the answers. • Check only one response. • If multiple answers are given, ask them to pick the most important one. 	11. <input type="radio"/> Schools 12. <input type="radio"/> Health facilities 13. <input type="radio"/> Roads 14. <input type="radio"/> Electricity 15. <input type="radio"/> Water supply 16. <input type="radio"/> Sanitation facilities 17. <input type="radio"/> Hygiene or handwashing 18. <input type="radio"/> Housing 19. <input type="radio"/> Employment
15b		20. <input type="radio"/> Other (specify):
16	Do you have a television in your house?	1. <input type="radio"/> Yes → go to question 17 2. <input type="radio"/> No → go to question 18
17	Can you show me the TV?	1. <input type="radio"/> Shown 2. <input type="radio"/> Not show, or not able to show it

18	Do you have a radio in your house?	1. <input type="radio"/> Yes → go to question 19 2. <input type="radio"/> No → go to question 20	
19	Can you show me the radio?	1. <input type="radio"/> Shown 2. <input type="radio"/> Not show, or not able to show it	
20	How many people normally live in this household?	___ ___ people	
21	How many individuals are 18 years and above?	___ ___ people	
22	How many individuals are between 5 years and 18 years?	___ ___ people	
23	How many individuals are 5 years and below?	___ ___ people	
<ul style="list-style-type: none"> • Before moving to the next question, check that responses 21 + 22 + 23 = 20, if the responses do not match, ask them again starting with question 20 • If the answer to question 23 is 0 → go to question 27 			
24	In the last two weeks, how many of your children 5 years of age or younger have had diarrhea?	___ ___ children	
<ul style="list-style-type: none"> • If the answer to question 24 is 0 → go to question 27 			
25	Was he/she taken to a health facility for treatment?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
26	Was he/she given any medicine or rehydration solution?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
27	Do you think people not using latrines are a health risk in your village?	3. <input type="radio"/> Yes 4. <input type="radio"/> No	
28a	Who do you think should bear the cost of improving sanitation in your village? <ul style="list-style-type: none"> • Do not read the answers. • Circle all responses. • After they have finished responding, ask “are there any more occasions?” • If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Family / household	
28b		<input type="checkbox"/> Kebele administration	
28c		<input type="checkbox"/> Government (woreda, zone, region, and/or federal)	
28d		<input type="checkbox"/> NGOs / partners	
28e		<input type="checkbox"/> Other (specify):	

Section 3: Water			
29a	What is the main source of drinking water for members of your household?	1. <input type="radio"/> River/stream	
		2. <input type="radio"/> Pond/lake	
		3. <input type="radio"/> Open spring	
		4. <input type="radio"/> Protected spring	
		5. <input type="radio"/> Open well	
		6. <input type="radio"/> Protected well	
		7. <input type="radio"/> Tubewell/borehole	
		8. <input type="radio"/> Rainwater harvesting	
		9. <input type="radio"/> Public tap	
		10. <input type="radio"/> Piped water into dwelling or yard	
		11. <input type="radio"/> Water vendor	
		12. <input type="radio"/> Bottled water	
29b		13. <input type="radio"/> Other (specify):	

30	In the last two weeks, was water unavailable from this source for a day or longer?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
31	Do you share this water source with other households?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
32	Do you pay to use this water source?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
33	If this source is not in your dwelling or yard, how long does it take to walk to it?	___ ___ ___ minutes	
34	Do you have to queue or wait to get water at this source?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
35	How long do you typically have to wait to get water at this source?	___ ___ ___ minutes	
36	Is this water source usable year round?	1. <input type="radio"/> Yes → go to question 38 2. <input type="radio"/> No → go to question 37	
37a	Where do you get drinking water when your main source is not available?	1. <input type="radio"/> River / stream 2. <input type="radio"/> Pond/lake 3. <input type="radio"/> Open spring 4. <input type="radio"/> Protected spring 5. <input type="radio"/> Open well 6. <input type="radio"/> Protected well 7. <input type="radio"/> Tubewell/borehole 8. <input type="radio"/> Rainwater harvesting 9. <input type="radio"/> Public tap 10. <input type="radio"/> Piped water into dwelling or yard 11. <input type="radio"/> Water vendor 12. <input type="radio"/> Bottled water 13. <input type="radio"/> Main source is always available	
37b		14. <input type="radio"/> Other (specify):	
38	Do you currently treat your drinking water?	1. <input type="radio"/> Yes → go to question 39 2. <input type="radio"/> No → go to question 40	
39a	How do you treat your drinking water?	1. <input type="radio"/> Chlorination 2. <input type="radio"/> Filtration with a ceramic device (such as a clay pot, or a candle filter) 3. <input type="radio"/> Filtration with a biosand filter 4. <input type="radio"/> Solar disinfection 5. <input type="radio"/> Boiling 6. <input type="radio"/> Chemical coagulant (such as aluminum salt or iron salt)	
39b		7. <input type="radio"/> Other (specify):	
40	Do you store your drinking water?	1. <input type="radio"/> Yes → go to question 41 2. <input type="radio"/> No → go to question 46	
41	May I see the container(s) where you store it?	1. <input type="radio"/> Allowed 2. <input type="radio"/> Not allowed	
42	Is this container used only for storing drinking water?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
43	Observe: Does the container have a wide or narrow mouth?	1. <input type="radio"/> Wide mouth (more than 10 centimeters across) 2. <input type="radio"/> Narrow mouth (less than 10 centimeters across)	

44	Observe: Does the container have a spigot?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
45	Observe: Does the container have a lid or fitted cover?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	

Section 4: Sanitation			
46a	Where do members of your family usually go to defecate? • (circle only one response)	1. <input type="radio"/> Bush, field, river, or pond→go to question 73 2. <input type="radio"/> Dig and bury→go to question 73 3. <input type="radio"/> Latrine at their own household→go to question 47 4. <input type="radio"/> Neighbor's household→go to question 58 5. <input type="radio"/> Communal or public latrine→go to question 58	
46b		6. <input type="radio"/> Other (specify):→go to question 58	
47	May I see the latrine you use please?	1. <input type="radio"/> Allowed→go to question 48 2. <input type="radio"/> Not allowed→go to question 49	
• If allowed to see the latrine, walk to the latrine with the respondent			
48	Observe: Has the path to the latrine been walked on recently?	1. <input type="radio"/> Yes(grass is trampled, wet footprints are visible, or the path has recently been cleared) 2. <input type="radio"/> No	
49	How much money did you spend to build this latrine?	__ __ __ __ Birr	
50a	What did you buy to construct your latrine? • Circle all responses.	<input type="checkbox"/> Cement	
50b		<input type="checkbox"/> Pre-made slab/squat plate	
50c		<input type="checkbox"/> Wood	
50d		<input type="checkbox"/> Sheet metal (for walls or roof, etc)	
50e		<input type="checkbox"/> Labor/help for digging or construction	
50f		<input type="checkbox"/> Other (specify):	
51	How many total hours did it take your family to build this latrine?	__ __ hours	
52	Did anyone besides of your family help you to build this latrine?	1. <input type="radio"/> Yes→go to question 53 2. <input type="radio"/> No→go to question 55	
53a	Who helped you to build this latrine? • Circle all responses.	<input type="checkbox"/> Neighbors, other community members	
53b		<input type="checkbox"/> Village leaders	
53c		<input type="checkbox"/> Kebele administration	
53d		<input type="checkbox"/> Woreda officials (from health office or other)	
53e		<input type="checkbox"/> Church, mosque, or other religious group	
53f		<input type="checkbox"/> NGOs/partners	
53g		<input type="checkbox"/> Other (specify):	
54	For how many hours did they help you build your latrine?	__ __ hours	
55	Do you plan on changing your latrine before the start of the next rainy season?	1. <input type="radio"/> Yes→go to question 56 2. <input type="radio"/> No→go to question 58	

56a	In what way do you plan to change your latrine? • Circle all responses.	<input type="checkbox"/> New slab/squat plate	
56b		<input type="checkbox"/> New walls	
56c		<input type="checkbox"/> New roof	
56d		<input type="checkbox"/> New door	
56e		<input type="checkbox"/> New/replacement latrine	
56f		<input type="checkbox"/> New/replacement pit	
56g		<input type="checkbox"/> Other (specify):	
57a	Who will pay for the changes to your latrine? • Circle all responses.	<input type="checkbox"/> Me, my family, or my household members	
57b		<input type="checkbox"/> Neighbor or friend	
57c		<input type="checkbox"/> Community members, or chief	
57d		<input type="checkbox"/> An NGO or outside organization	
57e		<input type="checkbox"/> The government, Health Extension Worker, or other officer of water or health	
57f		<input type="checkbox"/> The latrine will not cost any money	
57g		<input type="checkbox"/> Other (specify):	
58a	What kind of latrine is the latrine your family usually uses? • Circle only one response	1. <input type="radio"/> Bucket toilet	
58b		2. <input type="radio"/> Simple Pit latrine	
		3. <input type="radio"/> Ventilated improved pit latrine (VIP)	
		4. <input type="radio"/> Composting toilet	
		5. <input type="radio"/> Pour flush toilet	
		6. <input type="radio"/> Septic tank	
		7. <input type="radio"/> Other (Specify):	
59	Do you share this latrine with other households?	1. <input type="radio"/> Yes → go to question 60 2. <input type="radio"/> No → go to question 63	
60	How many households do you share this latrine with?	___ ___ households	
61	Are these households where only relatives of yours live?	1. <input type="radio"/> Yes → 57 2. <input type="radio"/> No → 56	
62	Is this toilet used by people that you do not know?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
63	Can you use this facility at all hours of the day and night?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
64	How much time does it take on average to get to the place you defecate?	___ ___ ___ minutes	
65	Do you have to queue/wait to use this latrine?	1. <input type="radio"/> Yes → go to question 66 2. <input type="radio"/> No → go to question 67	
66	On average, how long do you have to queue/wait?	___ ___ ___ minutes	
67	Since the beginning of the rainy season, did your latrine become unusable?	1. <input type="radio"/> Yes → go to question 68 2. <input type="radio"/> No → go to question 70	
68a	Why was it unusable? • Circle all responses.	<input type="checkbox"/> Roof problems	
68b		<input type="checkbox"/> Slab problems	
68c		<input type="checkbox"/> Pit overflow	
68d		<input type="checkbox"/> No water in tank	
68e		<input type="checkbox"/> Flushing mechanism broke down	
68f		<input type="checkbox"/> Bowl overflow/clogged	
68g		<input type="checkbox"/> Pipe breakdown	
68h		<input type="checkbox"/> Other (specify):	

69	During that period, how many weeks was it unusable?	__ __ weeks	
70	Do any members of your family defecate in the bush, field, or nearby river when away from home?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
71a	The last time a child 5 years or younger in your house passed stool, where did he/she defecate? • If the household does not have any children below 5 years of age → go to question 63	1. <input type="radio"/> Used potty → go to question 73 2. <input type="radio"/> Used diaper → go to question 72 3. <input type="radio"/> Went in his/her clothes → go to question 72 4. <input type="radio"/> Went in house/yard → go to question 72 5. <input type="radio"/> Went outside the premises → go to question 73 6. <input type="radio"/> Used own sanitation facility → go to question 73 7. <input type="radio"/> Used public latrine → go to question 73 8. <input type="radio"/> Don't know → go to question 72	
71b		9. <input type="radio"/> Other (specify): → go to question 72	
72a	The last time a child in your house passed stool, where were his/her feces disposed?	1. <input type="radio"/> Dropped into toilet facility 2. <input type="radio"/> Buried 3. <input type="radio"/> Solid waste/trash 4. <input type="radio"/> In yard 5. <input type="radio"/> Outside premises 6. <input type="radio"/> Into sink or tub 7. <input type="radio"/> Thrown into waterway 8. <input type="radio"/> At the well 9. <input type="radio"/> Don't know	
72b		10. <input type="radio"/> Thrown elsewhere (specify):	

Section 5: Sanitation, part 2			
<ul style="list-style-type: none"> • If the household has their own latrine at their household, skip to question 80 • If the household does NOT have their own latrine, continue with question 73 			
73	How much time does it take on average to get to the place you defecate?	__ __ __ minutes	
74	Do you want to have your own household latrine?	1. <input type="radio"/> Yes → go to question 76 2. <input type="radio"/> No → go to question 75	
75a	Why do you not want to have a latrine? • Circle all responses.	<input type="checkbox"/> Expensive → go to question 77	
75b		<input type="checkbox"/> Materials not available → go to question 77	
75c		<input type="checkbox"/> Satisfied with neighbor or shared latrine → go to question 77	
75d		<input type="checkbox"/> Does not see benefit in having a latrine → go to question 77	
75e		<input type="checkbox"/> Culturally unacceptable → go to question 77	
75f		<input type="checkbox"/> Other (specify): → go to question 77	
76a	Why do you want to have a latrine? • Circle all responses.	<input type="checkbox"/> Dignity, appearance, or social status	
76b		<input type="checkbox"/> Health related reasons	
76c		<input type="checkbox"/> Time or distance spent walking to a latrine	
76d		<input type="checkbox"/> Safety from others when walking to a shared latrine or the bush	
76e		<input type="checkbox"/> Other (specify):	

77a	What is your reason for not having a latrine? <ul style="list-style-type: none"> Circle all responses. 	<input type="checkbox"/> Expensive	
77b		<input type="checkbox"/> Construction material are not available in the market	
77c		<input type="checkbox"/> Latrine slabs are not available in the market	
77d		<input type="checkbox"/> There is no one with technical capacity	
77e		<input type="checkbox"/> Does not see any benefits in having their own latrine	
77f		<input type="checkbox"/> There are higher priorities than a latrine	
77g		<input type="checkbox"/> Culturally unacceptable	
77h		<input type="checkbox"/> Other (specify):	
78	Do you plan on building a latrine by the start of the next rainy season? 1. <input type="radio"/> Yes → go to question 79 2. <input type="radio"/> No → go to question 80		
79a	Who will pay for the construction of your latrine? <ul style="list-style-type: none"> Circle all responses. 	<input type="checkbox"/> Me, my family, or my household members	
79b		<input type="checkbox"/> Neighbor or friend	
79c		<input type="checkbox"/> Community members, or chief	
79d		<input type="checkbox"/> An NGO or outside organization	
79e		<input type="checkbox"/> The government, Health Extension Worker, or other officer of water or health	
79f		<input type="checkbox"/> The latrine will not cost any money	
79g		<input type="checkbox"/> Other (specify):	

Section 6: Hygiene			
80	Have you been taught about hygiene and handwashing? 1. <input type="radio"/> Yes → go to question 81 2. <input type="radio"/> No → go to question 82		
81a	Who taught you about hygiene and handwashing? <ul style="list-style-type: none"> Circle all responses. 	<input type="checkbox"/> School teachers	
81b		<input type="checkbox"/> Children or students	
81c		<input type="checkbox"/> Health Extension Workers	
81d		<input type="checkbox"/> Health Army	
81e		<input type="checkbox"/> Other (specify):	
82a	Please mention all of the occasions when is it important to wash your hands. <ul style="list-style-type: none"> Do not read the answers. Circle all responses. After they have finished responding, ask "are there any more times?" If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Before eating	
82b		<input type="checkbox"/> After eating	
82c		<input type="checkbox"/> Before praying	
82d		<input type="checkbox"/> Before breastfeeding or feeding a child	
82e		<input type="checkbox"/> Before cooking or preparing food	
82f		<input type="checkbox"/> After defecation/urination	
82g		<input type="checkbox"/> After cleaning a child that has defecated/changing a child's nappy	
82h		<input type="checkbox"/> When my hands are dirty	
82i		<input type="checkbox"/> After cleaning the toilet or potty	
82j		<input type="checkbox"/> In the morning	
82k		<input type="checkbox"/> Other (specify):	
83	Do you and your family members wash your hands at all of these times? 1. <input type="radio"/> Always 2. <input type="radio"/> Sometimes 3. <input type="radio"/> Never		

Section 7: Latrine Observations

- If the household has a latrine that you are allowed to observe, continue with question 84
- If the household does NOT have a latrine, or has NOT allowed you to see their latrine, skip to question 100

84	Observe: Is there visibly used anal cleansing material in the latrine or in the pit?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
85	Observe: Are there fresh or recent feces evident in the pit?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	
86	Observe: Are there flies present inside the latrine?	1. <input type="radio"/> Yes – more than 10 flies 2. <input type="radio"/> Yes – less than 10 flies 3. <input type="radio"/> No	
87a	Observe: Construction: What are the floor and slab made of?	1. <input type="radio"/> Sticks or branches and dirt or clay 2. <input type="radio"/> Wooden boards 3. <input type="radio"/> Concrete 4. <input type="radio"/> Plastic	
87b		5. <input type="radio"/> Other (specify):	
88	Observe: Construction: What are the walls made of?	1. <input type="radio"/> Walls are completely deteriorated or collapsed 2. <input type="radio"/> Walls are made of a temporary material such as straw or palm leaves 3. <input type="radio"/> Walls are made of durable material such as wooden boards, concrete, or adobe	
89	Observe: Construction: What is the quality of the door?	1. <input type="radio"/> Door is absent, or door does not close properly. 2. <input type="radio"/> Door is present and can be closed.	
90	Observe: Construction: What is the quality of the roof?	1. <input type="radio"/> No roof, or roof in complete disrepair with large gaps that offer no protection 2. <input type="radio"/> Roof present but leaky 3. <input type="radio"/> Roof present and provides protection from sun and rain	
91	Observe: Maintenance: Is there a hole cover?	1. <input type="radio"/> No hole cover present 2. <input type="radio"/> Hole cover defective, broken, or not used 3. <input type="radio"/> Hole cover placed over hole and tight fitting	
92	Observe: Maintenance: What is the quality of the slab?	1. <input type="radio"/> Slab is significantly eroded, deteriorated to the point of being a safety concern. 2. <input type="radio"/> Hole significantly eroded or other small gaps or cracks in slab. Not yet a safety hazard. 3. <input type="radio"/> Slab more or less intact. No danger of children or adults slipping on uneven eroded surfaces, or of a foot or leg entering the pit through enlarged hole or other gaps in the slab.	
93	Observe: Maintenance: What privacy does the latrine have?	1. <input type="radio"/> User visible from outside (no walls, or walls do not provide privacy to user). 2. <input type="radio"/> Cosmetic issues in need of repair, even though user is not visible from the outside. 3. <input type="radio"/> Walls in sufficient repair to provide privacy.	

94	Observe: Maintenance: How clean is the hole/opening area of the latrine?	1. <input type="radio"/> Dry and clean 2. <input type="radio"/> Dry but smeared with shit 3. <input type="radio"/> Wet but no smeared shit 4. <input type="radio"/> Wet and smeared with shit	
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Section 8: Washing Station Observations			
95	Observe: Is there a hand washing station inside the latrine or within 10 paces of the latrine?	1. <input type="radio"/> Yes → go to question 96 2. <input type="radio"/> No → go to question 100	
96	Observe: Is there water at this hand washing station?	1. <input type="radio"/> Yes → go to question 97 2. <input type="radio"/> No → go to question 98	
97a	Observe: What device is used for water at this handwashing station?	1. <input type="radio"/> Tap 2. <input type="radio"/> Tippy tap 3. <input type="radio"/> Bucket 4. <input type="radio"/> Wash basin	
97b		5. <input type="radio"/> Other (specify):	
98a	Observe: Is there a handwashing material at this hand washing station inside/near the latrine? • Circle all responses	1. <input type="radio"/> None 2. <input type="radio"/> Soap 3. <input type="radio"/> Detergent 4. <input type="radio"/> Ash 5. <input type="radio"/> Mud/sand	
98b		6. <input type="radio"/> Other (specify):	
99	Observe: Does the washing station look like it has been recently used?	1. <input type="radio"/> Yes 2. <input type="radio"/> No	

Section 9: Interactions			
100	Were you at the meeting when triggering/igniting happened in your community? <ul style="list-style-type: none"> If the subject doesn't understand the question, ask "did you participate in the community triggering/igniting for sanitation and hygiene?" If the subject still doesn't understand the question, mark "2 No". 	1. <input type="radio"/> Yes → go to question 101 2. <input type="radio"/> No → go to question 102	

101a	<p>Can you tell me what activities happened that day at the triggering/igniting?</p> <ul style="list-style-type: none"> • Do not read the answers. • Circle all responses. • After they have finished responding, ask “were there any more activities?” • If the respondent indicates that (s)he does not know, do not probe for additional responses. 	<input type="checkbox"/> Visiting open defecation sites (transect walk)	
101b		<input type="checkbox"/> Visiting refuse dumps	
101c		<input type="checkbox"/> Community mapping (mapping houses, latrines, refuse sites, open defecation sites)	
101d		<input type="checkbox"/> Shit calculation (calculating the amount of shit produced by the community)	
101e		<input type="checkbox"/> Fecal-oral contamination discussion (shit flow)	
101f		<input type="checkbox"/> Glass of water demonstration (putting a stick or hair into feces then water)	
101g		<input type="checkbox"/> Food demonstration (putting food near feces with flies)	
101h		<input type="checkbox"/> Medical cost calculation (calculating the cost of illness, diarrhea, treatment)	
101i		<input type="checkbox"/> Community action planning	
101j		<input type="checkbox"/> Does not remember	
101k		<input type="checkbox"/> Other (specify):	
102	<p>Have you discussed sanitation or handwashing issues with any of your neighbors in the past 2 months?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No</p>	
103	<p>Does your village or kebele provide labor for households that cannot afford to build their own latrines?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No</p>	
104	<p>Does your village or kebele provide construction materials for households that cannot afford to build their own latrines?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No</p>	
105	<p>In the last 2 months, have you visited your kebele’s health post?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No</p>	
106	<p>In the past 2 months, has a Health Extension Worker visited your house?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No</p>	
107	<p>In the past 2 months, has a teacher visited your house to talk about sanitation or hygiene?</p>	<p>1. <input type="radio"/> Yes</p> <p>2. <input type="radio"/> No</p>	

APPENDIX 9: PROJECT ACTIVITIES AND RESPONSIBLE PARTIES, BY COUNTRY AND INTERVENTION

Project activities and responsible parties, by country and intervention

Activity	Ghana		Ethiopia	
	NGO CLTS	NGO CLTS + NL training	HEW CLTS	Teacher CLTS
Project management	Plan LNGO	Plan LNGO	Plan	Plan
District government orientation	Plan	Plan	Plan	Plan
Training kebele leaders	-	-	Plan	Plan
Training HEWs	-	-	Plan	-
Training teachers	-	-	-	Plan
Training natural leaders	-	Plan Regional govt	Plan	Plan
Attending trainings	-	Natural leaders	Kebele leaders HEWs Natural leaders	Teachers Kebele leaders Natural leaders
Pre-triggering community visits	Plan	Plan	Plan	Plan
Community triggering	LNGO Plan	LNGO Plan	Plan	Plan
Post-triggering follow-up visits	LNGO Plan District govt	LNGO Plan	Plan	Plan
Sanitation status monitoring	Natural leaders LNGO District govt Plan	Natural leaders LNGO District govt Plan	HEWs Kebele leaders District govt Plan	Teachers Students Kebele leaders District govt Plan
ODF verification	District govt	District govt	Kebele leaders HEWs	Kebele leaders Teachers
ODF certification	Regional govt	Regional govt	District govt	District govt
Attending meetings	Community Natural leaders	Community Natural leaders	Community Kebele leaders HEWs Natural leaders	Community Teachers Kebele leaders Natural leaders
Home visits	Natural leaders LNGO Plan	Natural leaders LNGO Plan	Kebele leaders HEWs Natural leaders	Teachers Kebele leaders Natural leaders
Latrine construction	Community Natural leaders	Community Natural leaders	Community	Community

APPENDIX 10: IMPLEMENTATION TIMELINE FOR FOUR CLTS INTERVENTIONS, GHANA AND ETHIOPIA

Implementation timeline for four CLTS interventions, Ghana and Ethiopia

Ghana		
Period	NGO facilitated CLTS + NL training	NGO facilitated CLTS
Nov 2012 - Jan 2013	District orientation	District orientation
Oct 2012 - Jan 2013	Pre-triggering	Pre-triggering
Dec 2012 - Mar 2013	Triggering	Triggering
Mar 2013	-	Natural leader training
Jan 2013 - Mar 2014	Follow-up	Follow-up
May 2013	-	Natural leader review meeting
Sep 2013	-	Natural leader review meeting
Sep - Dec 2013	ODF certification and celebrations	ODF certification and celebrations
Dec 2013	-	Natural leader refresher training
Feb 2014	-	Natural leader review meeting

Ethiopia		
Period	HEW facilitated CLTS	Teacher facilitated CLTS
Sep 2012	District orientation	District orientation
Oct 2012	Pre-triggering	Pre-triggering
Nov 2012	HEW and kebele leader training	Teacher and kebele leader training
Nov 2012 - Jan 2013	Triggering	Triggering
Dec 2012 - May 2013	Follow-up	Follow-up
Mar 2013	HEW and kebele leader review meeting	Teacher review meeting
Jun - Nov 2013	ODF certification and celebrations	ODF certification and celebrations
Sep 2013	Natural leader training	Natural leader training

APPENDIX 11: COST CATEGORIES, SUB-CATEGORIES, DATA SOURCES, AND DATA DESCRIPTIONS

Cost categories, sub-categories, data sources, and data descriptions

Category and sub-category		Data source	Description
Management	Managers time	Management checklist	Time spent on different management activities
		Financial data	Salary of project manager
	Field staff time	Management checklist	Time spent on different management activities
		Financial data	Salary of field staff
Office rent	LNGO contracts	Funds allocated to office rent and utilities	
Office supplies	Financial data	Cost of purchased office supplies	
Training	Trainer time (including travel time)	Checklists	Location of each training Trainers present on each day Days and hours / day in training
		Discussions with project team, google earth	Travel distance and time to training venues
		Financial data	NGO staff salaries (Plan)
		Government contracts	Rate paid to government trainers
	Transportation	Checklists	Number of transportation days
		Discussions with project team, google earth	Travel distance and time to transport trainers and trainees
		Financial data	Fixed reimbursement costs for trainee transportation Purchased vehicle cost
		Web search American Auto Association (AAA)	Historical fuel prices Guideline and general parameters for transportation costing
	Venue, accomodation, meals, miscellaneous	Financial data	Amount paid
		Discussions with project team	Daily rate paid for accommodation (Ethiopia only)
	Per-diems	Checklists	Total person-days spent in training
Financial data Discussions with project team		Total paid for per-diems per training event Per-diem rate per person-day	

Category and sub-category	Data source	Description		
Facilitation	Plan and LNGO facilitator time (including travel time)	Checklists	NGO staff present for each community visit Duration of each community visit Field days, and communities visited each day	
		Discussions with project team, google earth	Travel distance and time to project districts, and between communities	
		Financial data	Plan staff salaries	
		LNGO contracts	NGO staff salaries	
	Government official time	Checklists	Communities visited by government by date for contracted work	
		Government contracts	Contract amount for monitoring and ODF certification activities	
	Transportation	Checklists	Field days, and communities visited each day	
		Discussions with project team, google earth	Travel distance and time to project districts, and between communities	
		Financial data	Purchased vehicle cost	
		Web search	Historical fuel prices	
Meals	American Auto Association (AAA)	Guideline and general parameters for transportation costing		
	Checklists	Number of person-days in the field		
ODF celebration costs	Discussions with project time	Per-diem rate for field days		
	Checklists	Communities that had ODF celebrations, and dates of celebrations		
Local actor time	Valuation of time (for all local actor activities)	Financial data	Materials purchased and amount paid	
		Web search	Government employee wages and national minimum wages	
	In training	Literature	Value-of-time to wage ratios	
		Checklists	Number of each local actor Dates and duration of training sessions	
	Traveling to training; traveling to villages (government only)	Checklists	Location of each training Local actors present on each day Government present for community visits	
		Discussions with project team, google earth	Travel distance and time to training venues Travel distance and time to project districts, and between communities	
		During Plan and LNGO community visits	Checklists	Communities visited Number of each local actor present Duration of each community visit
			Local actor surveys	Hours per month on CLTS activities
	Community meetings and home-visits in NGO's absence	Checklists	Number of each local actor trained from each community	
		Household census and surveys	Population of each community	

Category and sub-category	Data source	Description	
Community activity	Valuation of time (for all community activity)	Web search Literature	National minimum wages Value-of-time to wage ratios
	During Plan and LNGO community visits	Checklists	Communities visited Number of community members present during community visits Duration of community visits
		Household surveys	Percent of community attending CLTS meetings
		Discussions and review meetings with project team	Filling in gaps regarding community attendance
	During local actor meetings and home-visits	Local actor surveys	Hours per month of local actor engagement with community members
		Checklists	Number of each local actor trained from each community
		Household surveys	Percent of community attending CLTS meetings
	Latrine construction time	Household surveys	Hours spent on constructing their latrine
			Hours of unpaid help received for latrine construction
	Latrine spending	Hired labor	Household surveys
Purchased materials		Household surveys	Total amount spent on materials for latrine construction
	Portion of latrines that were built during the CLTS interventions		

APPENDIX 12: UNIT COSTS AND DATA SOURCES

Unit costs and data sources

Parameter	Value*	Notes	Source and assumptions
Ghana			
<i>Exact financial costs</i>			
Plan project manager	\$8.34 / hour	Uses a 50-week, 2000-hour workyear assumption.	Plan financial records.
Plan project coordinator	\$3.56 / hour	Uses a 50-week, 2000-hour workyear assumption.	Plan financial records.
Plan per-diem	\$10.99 - \$16.51 / day	For Plan staff on field days. Per-diem was paid at a fixed rate, variation is due to the changing exchange rate.	
Plan office and supplies costs	\$506.96 / month	For 58 villages, over an 18-month period	Plan financial records.
Training venue rental	\$31.70 - \$337.20 / day	Venue rental costs varied by region and town size. Smaller training sessions were held in district towns, which had lower rates than region capitals.	Plan financial records
Meals	\$6.03 - \$30.70 / person-day	During training. Meal costs varied by region and town size.	Plan financial records
Accommodation	\$17.73 - \$47.81 / night	Accommodation costs varied by region and town size.	Plan financial records
Trainee transport	\$2.36 - \$21.10 / trip	Trainees were reimbursed for transportation at fixed rates, depending on the distance and region	Plan financial records
Government contract for monitoring	\$1,880 - \$3,874	For follow-up monitoring visits to 20 villages. Contract amounts vary by region.	Government contract budgets, Plan financial records
Government contract for ODF certification	\$2,228 - \$7,760	For follow-up monitoring visits to 20 villages. Contract amounts vary by region.	Government contract budgets, Plan financial records

Parameter	Value*	Notes	Source and assumptions
Ghana			
<i>Unit costs involving estimation or extrapolation</i>			
Plan transport	\$0.80 / mile	Toyota Hilux	Purchase cost - Plan financial records. Depreciation, maintenance, and tire cost assumptions from AAA "Your Driving costs" 2015. MPG (21.3) from Fuelly.com for 2012 Toyota Hilux. Historical fuel prices in Ghana from a web search.
Plan transport	\$24.01 / hour	Toyota Hilux	Above value with an average 30 miles per hour assumption.
Plan transport	\$0.33 / mile	Motorcycle	Purchase cost - Plan Ghana financial records. Depreciation, maintenance, and tire cost assumptions from AAA "Your Driving costs" 2015 Edition. Forty miles per gallon assumed. Fuel prices from Trading Economics.
Plan transport	\$9.94 / hour	Motorcycle	Above value with an average 30 miles per hour assumption.
Project management by local NGO	\$310.08 - \$413.44 / month	For 20 villages, over 12-month contracts. Contract amounts vary by region.	Local NGO proposal budget, Plan financial records
Local NGO office rent, utilities, supplies	\$363.44 - \$457.36 / month	For 20 villages, over 12-month contracts. Contract amounts vary by region.	Local NGO proposal budget, Plan financial records
Local NGO facilitator	\$6.01 - \$9.75 / hour	For 20 villages, over 12-month contracts. Contract amounts vary by region.	Local NGO proposal budget, Plan financial records
Local NGO other field costs	\$206.72 - \$438.42	For 20 villages, over 12-month contracts. Contract amounts vary by region.	Local NGO proposal budget, Plan financial records
Transportation - Local NGO team	\$64.65 - \$102.93 / hour		Based on travel time and budget for transportation in local NGO proposals
District government official	\$3.13 / hour	Average compensation rate used by Plan during training	Plan financial records

Parameter	Value*	Notes	Source and assumptions
Ghana			
<i>Cost parameters with sources external to this project</i>			
National minimum wage	\$2.12 - \$3.19 / day	Pre-2015 official minimum wage in Ghana. Wage varies with changing exchange rate.	US Department of State
Value-of-time to minimum wage ratio	0.5	Used for natural leaders and community members.	High end of range in Whittington (2012) and Jeuland (2010)
Laborer wage	\$0.50 - \$1 / hour	Low end used for Upper West only	Based on primary author's prior work in Ghana
GHS / USD exchange rate	1.88 - 2.83	The exchange from the first day of each month was used	XE.com
Ethiopia			
<i>Exact financial costs</i>			
Plan project manager	\$5.64 / hour	Uses a 50-week, 2000-hour workyear assumption.	Plan financial records.
Plan project coordinator	\$4.93 / hour	Uses a 50-week, 2000-hour workyear assumption.	Plan financial records.
Plan office and supplies costs	\$1,083.54 / month	For 6 kebeles, over a 13-month period	Plan financial records.
Training venue rental	\$29.01 - \$105.67 / day	Costs varied by region and location, and were more expensive in the SNNP region.	Plan financial records
Meals	\$1.32 - \$10.61 / person-day	The low end was for training in kebeles. Meals were at the high end of the range for most training sessions.	Plan financial records
Accommodation	\$7.13 - \$7.54 / night	Trainees were reimbursed at a fixed rate. The range is due to exchange rate.	Plan financial records
Trainee transport	\$7.13 - \$7.54 / night	Trainees were reimbursed at a fixed rate. The range is due to exchange rate.	Plan financial records
ODF certification	\$1,325.62 - \$1690.53 / kebele	Includes per-diems for government verification team, and materials for ODF celebration	Plan financial records

Parameter	Value*	Notes	Source and assumptions
Ethiopia			
<i>Unit costs involving estimation or extrapolation</i>			
Plan transport	\$1.18 / mile	Toyota Landcruiser	Purchase cost - Plan Ethiopia financial records. Depreciation, maintenance, and tire cost assumptions from AAA "Your Driving costs" 2015 Edition. Miles per gallon (13.8) taken from Fuely.com for a 2012 Toyota Landcruiser. Historical fuel prices in Ethiopia from a web search.
Plan transport	\$35.42 / hour	Toyota Landcruiser	Above value with an average 30 miles per hour assumption.
<i>Cost parameters with sources external to this project</i>			
Health Extension Worker wage	\$47.97- \$50.71 / month	Used for health extension workers and teachers (who, by definition, were fully employed)	Interviews with district health officers during the situational assessment in 2012. (Crocker 2015)
Health extension worker supervisor	\$65.14 - \$68.87 / month	Used for district government and kebele leaders (who, by definition, were fully employed)	Interviews with district health officers during the situational assessment in 2012.
Public sector minimum wage	\$22.19 - \$23.46 / month	Used for natural leaders and community members.	US Department of State
Value-of-time to minimum wage ratio	0.5	Used for natural leaders and community members.	High end of range in Whittington (2012) and Jeuland (2010)
ETB / USD exchange rate	17.9 - 18.9	The exchange from the first day of each month was used	XE.com

*Values are all presented in USD. Those that were originally in GHS were converted using the exchange rate for the first day of the month in which they occurred.

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APPENDIX 13: DISAGGREGATED PROGRAM, LOCAL ACTOR, AND COMMUNITY COSTS

Disaggregated program, local actor, and community costs

Country	Region	Treatment	Program costs			Local actor and community costs			TOTAL	Notes
			Management	Training	Facilitation	Local actors	Community activity	Hardware		
Ghana	Central	NGO CLTS	\$8,797	\$1,199	\$28,573	\$314	\$1,500	\$4,319	\$45,797	9 villages
Ghana	Central	NGO CLTS + NL training	\$9,525	\$38,427	\$32,281	\$1,523	\$3,655	\$23,501	\$110,747	9 villages
Ghana	Upper West	NGO CLTS	\$9,308	\$928	\$18,270	\$372	\$1,450	\$1,282	\$33,801	10 villages
Ghana	Upper West	NGO CLTS + NL training	\$10,037	\$62,874	\$23,209	\$1,995	\$2,025	\$2,452	\$106,452	10 villages
Ghana	Volta	NGO CLTS	\$8,853	\$1,949	\$26,584	\$555	\$2,888	\$7,501	\$52,175	10 villages
Ghana	Volta	NGO CLTS + NL training	\$9,582	\$54,627	\$29,562	\$2,027	\$3,291	\$18,765	\$126,970	10 villages
Ghana	Central	NGO CLTS	\$977	\$133	\$3,175	\$35	\$167	\$480	\$5,089	per village
Ghana	Central	NGO CLTS + NL training	\$1,058	\$4,270	\$3,587	\$169	\$406	\$2,611	\$12,305	per village
Ghana	Upper West	NGO CLTS	\$931	\$93	\$1,827	\$37	\$145	\$128	\$3,380	per village
Ghana	Upper West	NGO CLTS + NL training	\$1,004	\$6,287	\$2,321	\$200	\$203	\$245	\$10,645	per village
Ghana	Volta	NGO CLTS	\$885	\$195	\$2,658	\$55	\$289	\$750	\$5,218	per village
Ghana	Volta	NGO CLTS + NL training	\$958	\$5,463	\$2,956	\$203	\$329	\$1,876	\$12,697	per village
Ghana	All	NGO CLTS	\$26,958	\$4,076	\$73,428	\$1,241	\$5,837	\$13,101	\$131,773	29 villages
Ghana	All	NGO CLTS + NL training	\$29,145	\$155,928	\$85,052	\$5,545	\$8,971	\$44,718	\$344,169	29 villages
Ghana	All	Both	\$56,103	\$160,004	\$158,480	\$6,786	\$14,808	\$57,819	\$475,942	58 villages
Ghana	All	NGO CLTS	\$930	\$141	\$2,532	\$43	\$201	\$452	\$4,544	per village
Ghana	All	NGO CLTS + NL training	\$1,005	\$5,377	\$2,933	\$191	\$309	\$1,542	\$11,868	per village
Ghana	All	Both	\$967	\$2,759	\$2,732	\$117	\$255	\$997	\$8,206	per village
Ghana	All	NGO CLTS	\$7.83	\$1.18	\$21.33	\$0.36	\$1.70	\$3.81	\$38.27	per household
Ghana	All	NGO CLTS + NL training	\$8.80	\$47.08	\$25.68	\$1.67	\$2.71	\$13.50	\$103.92	per household
Ghana	All	Both	\$8.31	\$23.69	\$23.46	\$1.00	\$2.19	\$8.56	\$70.46	per household

Country	Region	Treatment	Program costs			Local actor and community costs			TOTAL	Notes
			Management	Training	Facilitation	Local actors	Community activity	Hardware		
Ethiopia	Oromia	HEW CLTS	\$4,345	\$9,979	\$2,820	\$1,084	\$1,435	\$911	\$20,573	1 kebele
Ethiopia	Oromia	Teacher CLTS	\$7,434	\$17,279	\$1,118	\$1,885	\$1,886	\$633	\$30,235	2 kebele
Ethiopia	SNNP	HEW CLTS	\$4,345	\$7,638	\$2,071	\$842	\$1,110	\$159	\$16,166	1 kebele
Ethiopia	SNNP	Teacher CLTS	\$7,434	\$15,951	\$5,107	\$1,974	\$2,265	\$380	\$33,110	2 kebeles
Ethiopia	All	HEW CLTS	\$8,690	\$17,617	\$4,891	\$1,926	\$2,546	\$1,070	\$36,739	2 control kebeles
Ethiopia	All	Teacher CLTS	\$14,867	\$33,229	\$6,225	\$3,859	\$4,151	\$1,013	\$63,345	4 pilot kebeles
Ethiopia	All	Both	\$23,557	\$50,847	\$11,116	\$5,785	\$6,697	\$2,083	\$100,084	6 kebeles
Ethiopia	All	HEW CLTS	\$4,345	\$8,809	\$2,445	\$963	\$1,273	\$535	\$18,369	per kebele
Ethiopia	All	Teacher CLTS	\$3,717	\$8,307	\$1,556	\$965	\$1,038	\$253	\$15,836	per kebele
Ethiopia	All	Both	\$3,926	\$8,474	\$1,853	\$964	\$1,116	\$347	\$16,681	per kebele
Ethiopia	All	HEW CLTS	\$5.35	\$10.85	\$3.01	\$1.19	\$1.57	\$0.66	\$22.62	per household
Ethiopia	All	Teacher CLTS	\$3.87	\$8.66	\$1.62	\$1.01	\$1.08	\$0.26	\$16.50	per household
Ethiopia	All	Both	\$4.31	\$9.31	\$2.04	\$1.06	\$1.23	\$0.38	\$18.32	per household

APPENDIX 14: ANALYSIS OF COST SENSITIVITY TO ESTIMATED PARAMETERS

Analysis of cost sensitivity to estimated parameters (per household targeted)

Parameter and base value	Change assessed	Program costs			Change in program cost	Local costs				Change in local cost
		Management	Training	Facilitation		Local actors	Community activity	Hired labor	Hardware	
Base cost		\$8.31	\$23.69	\$23.46		\$1.00	\$2.19	\$3.25	\$8.56	
Fuel efficiency (21.3 mpg for car, 40 mpg for motorcycle)	+50%	-	-	-\$0.04	-0.1%	-	-	-	-	0.0%
	-50%	-	+\$0.01	+\$0.12	0.2%	-	-	-	-	0.0%
Depreciation (15% for car, 20% for motorcycle)	+50%	-	+\$0.01	+\$0.18	0.3%	-	-	-	-	0.0%
	-50%	-	-\$0.01	-\$0.18	-0.3%	-	-	-	-	0.0%
Maintenance and tires (\$0.06 and 0.01 per mile)	+50%	-	-	+\$0.03	0.1%	-	-	-	-	0.0%
	-50%	-	-	-\$0.03	-0.1%	-	-	-	-	0.0%
Annual mileage (10,000 miles for car, 6,000 for motorcycle)	+50%	-	-\$0.01	-\$0.12	-0.2%	-	-	-	-	0.0%
	-50%	-	+\$0.02	+\$0.36	0.7%	-	-	-	-	0.0%
Average drive speed (30 mph)	+50%	-	+\$0.01	+\$0.27	0.5%	-	-	-	-	0.0%
	-50%	-	-\$0.01	-\$0.27	-0.5%	-	-	-	-	0.0%
Travel times (1-2 hrs to district, 15-20 min btwn villages)	+50%	-	-\$0.08	+\$0.57	0.9%	+\$0.09	-	-	-	0.6%
	-50%	-	+\$0.13	-\$0.62	-0.9%	-\$0.09	-	-	-	-0.6%
Time-cost, government (\$3.13 / hour)	+50%	-	+\$0.29	-	0.5%	+\$0.15	-	-	-	1.0%
	-50%	-	-\$0.29	-	-0.5%	-\$0.15	-	-	-	-1.0%
Value-of-time, NLS, community members (\$0.19 / hour)	+50%	-	-	-	0.0%	+\$0.35	+\$1.1	-	-	9.7%
	-50%	-	-	-	0.0%	-\$0.35	-\$1.10	-	-	-9.7%
Community activity when Plan is not present (23.6 hours / village / month)	+50%	-	-	-	0.0%	+\$0.04	+\$0.11	-	-	1.0%
	-50%	-	-	-	0.0%	-\$0.04	-\$0.11	-	-	-1.0%

Parameter and base value	Change assessed	Program costs			Change in program cost	Local costs				Change in local cost
		Management	Training	Facilitation		Local actors	Community activity	Hired labor	Hardware	
Base cost		\$4.31	\$9.31	\$2.04		\$1.06	\$1.23	\$0.38		
Ethiopia	Fuel efficiency (13.8 mpg)	+50%	-	-\$0.05	-\$0.06	-0.7%	-	-	-	0.0%
		-50%	-	+\$0.14	+\$0.19	2.1%	-	-	-	0.0%
	Depreciation (15%)	+50%	-	+\$0.2	+\$0.27	3.0%	-	-	-	0.0%
		-50%	-	-\$0.20	-\$0.27	-3.0%	-	-	-	0.0%
	Maintenance and tires (\$0.06 and 0.01 per mile)	+50%	-	+\$0.02	+\$0.02	0.3%	-	-	-	0.0%
		-50%	-	-\$0.02	-\$0.02	-0.3%	-	-	-	0.0%
	Annual mileage (10,000 miles)	+50%	-	-\$0.14	-\$0.18	-2.0%	-	-	-	0.0%
		-50%	-	+\$0.41	+\$0.53	6.0%	-	-	-	0.0%
	Average drive speed (30 mph)	+50%	-	+\$0.29	+\$0.38	4.3%	-	-	-	0.0%
		-50%	-	-\$0.29	-\$0.38	-4.3%	-	-	-	0.0%
	Travel times (various times)	+50%	-	+\$0.41	+\$0.44	5.4%	+\$0.07	-	-	2.6%
		-50%	-	-\$0.41	-\$0.44	-5.4%	-\$0.07	-	-	-2.6%
	Value of time, (community: \$0.07/hour, local actors: \$0.29 - \$0.40 /hour)	+50%	-	-	-	0.0%	+\$0.53	+\$0.61	-	42.9%
		-50%	-	-	-	0.0%	-\$0.53	-\$0.61	-	-42.9%
Community activity, when Plan is not present	+50%	-	-	-	0.0%	-	+\$0.05	-	1.9%	
	-50%	-	-	-	0.0%	-	-\$0.05	-	-1.9%	

APPENDIX 15: MANAGEMENT CHECKLIST

Management checklist

Category	Sub-category	Activity	Time estimate
Implementation management	Work planning	Scheduling trainings and field visits	___ hours per week
		Planning and organizing trainings	___ hours per week
		Other workplanning	___ hours per week
	Procurement and purchasing	Renting training venues	___ hours per week; for ___ weeks preceding each training
		Renting vehicles	___ hours per week; for ___ weeks preceding each training
		Issuing per-diems	___ hours per training session
	Oversight of LNGO	Other procurement and purchasing	___ hours per week
		Meetings	___ hours per week
		Communication (email and phone)	___ hours per week
		Review of LNGO field activities and reports	___ hours per week
	Reporting	Other LNGO management and oversight	___ hours per week
		Progress reporting	___ hours per month
		Financial reporting	___ hours per month
		Meetings with RICCS, DICCS, EHSD, CWSA	___ hours per month
		Other reporting	___ hours per week
Non-implementation activities	NL training manual development	Input and review of draft manuals	___ hours per week; for ___ weeks
		Other training manual development work	___ hours per week; for ___ weeks
	Research	Hosting USA teams (including prep for visits)	___ hours per day during visit; ___ days of visits
		Communication with research team (Email/Skype)	___ hours per week
		Filling checklists and sending them by email	___ hours per month
		Collecting and reviewing LNGO-filled checklists	___ hours per month
		Support of household surveying	___ hours per week; for ___ weeks
		Oversight of surveying (including reporting to UNC)	___ hours per week; for ___ weeks
		Reviewing research documents	___ hours per month
		Other research support	___ hours per week
	Dissemination	Conferences (including travel, prep, attendance)	___ total days
		Webinars	___ total hours
		Other dissemination	___ hours per month
	Anything not BMGF project	Fundraising efforts	___ hours per month
Other trainings (e.g. gender mainstreaming)		___ days per [month / quarter] (circle one)	
Other WaSH projects (e.g. PanAfric CLTS grant)		___ hours per week	
Any other time spent not on the Gates CLTS grant		___ hours per week	

APPENDIX 16: CHECKLISTS 1 AND 2 FOR TRAINING AND FOR COMMUNITY VISITS, GHANA VERSION

Checklists 1 and 2 for Training and for community visits, Ghana version

INTRODUCTION

Description

Plan International Ghana CLTS-coordinators are responsible for filling out four checklists. This document contains two checklists. The first checklist is for documenting Natural Leader training activities. The second checklist is for documenting community visits. These checklists will be used to record the participants, time, and activities of implementation. This information helps us to report to partners the details of implementation. This information will also support the evaluation and comparison of the two CLTS approaches. Because the information collected in the community visit checklist will be used to compare the two approaches, there must be separate checklists for each community visited on any given day.

Responsibilities

Plan International Ghana CLTS-coordinators are responsible for collecting the relevant data for these two checklists. The Water Institute at UNC (specifically ___) is responsible for creating the checklists, and answering any questions or concerns regarding the checklists and the data collection.

Instructions (read first):

Checklist 1: Training Natural Leaders

1. Fill out Checklist 1 at the end of every day of training of Natural Leaders.
2. This checklist is *only* to be used for the training of Natural Leaders that is done outside of the communities.
3. This checklist is *not* to be used by the LNGOs, or during community visits.
4. The checklist should be printed out and filled out by hand, or entered directly into a laptop.
5. Once training of Natural Leaders has been completed, the checklists should be entered into the computer and emailed to ___
6. The checklist has different sections to be filled out. A description of each section is below:

Checklist 1:

Training

ENTRY	INSTRUCTIONS
Date	Write the date.
PU/District	Circle one: _____ Central/AAK Volta/Hohoe Upper West/Wa East
Start time	Write the time that trainees begin arriving.
End time	Write the time that all discussions end and trainees are free to leave for the day
Communities represented	List all of the communities from which Natural Leaders are present, AND: <ul style="list-style-type: none">• For each community, write the number of Natural Leaders in attendance.
Plan staff present	List all Plan staff attending the training

Other NGO or LINGO staff present	List all non-Plan NGO people attending the training
Government present	List all government people attending the training.
Any other people present	List anyone not already mentioned that is attending the training. NOTE: <i>nobody</i> from any of the control communities should be present.
Knowledge and information presented	Write any information presented during the day of training. Examples include CLTS steps, CLTS triggering tools, health benefits of sanitation, etc.
Skills trained	Write any skills taught to trainees that involves interaction or practicing of the skills. Examples include conflict resolution, organizing meetings, drawing community maps.
Discussions held	Write any unplanned discussions held. Examples include: “discussed helping poor households”, “discussed how to deal with resistant or angry community members”, etc.
Any other topics or activities	Write anything else that was taught during the day of training that is not already mentioned above.
Additional notes	Write any other notes that are relevant. Examples include: “some Natural Leaders did not pay attention and did not participate”, “the training session ended early because of a power outage”, etc.

Checklist 2: Community visits

1. Fill out Checklist 2 at the end of each community visit.
2. If multiple communities are visited on one day, one checklist should be filled out for each community visited.
3. The checklist should be filled out immediately after leaving the community, not at the end of the day.
4. The checklist should be printed out and filled out by hand, or entered directly into a laptop.
5. Once a month, the checklists should be entered into the computer and emailed to ____
6. Details on each item in the community checklist are given below:

Checklist 2: Community visits (DO NOT USE ONE CHECKLIST FOR MULTIPLE COMMUNITIES. If multiple communities are visited on the same day, fill out one checklist for each community visited)

ENTRY	INSTRUCTIONS
Date	Write the date.
PU/District	Circle one: _____ Central/AAK Volta/Hohoe Upper West/Wa East
Community visited	Write the name of the community visited
Arrival time	Write the time of arrival to the community.
Departure time	Write the time of departure from the community.
Plan staff present	List of the Plan staff that were on the visit.

Other NGO or LINGO staff present	List all non-Plan NGO people who were on the visit.
Government present	List all government people present. This could include the district health officers if they are present, or anyone from a health center or clinic outside of the community.
Purpose of visit	<p>Circle one: Pre-triggering Triggering Follow-Up ODF Verification ODF Celebration </p> <p>(Definitions of each item are below)</p> <ul style="list-style-type: none"> • Pre-triggering includes any visits to the communities before triggering occurs. This could be for visiting with leadership to gain approval for the project, visiting communities to set up a triggering date, etc. • Triggering includes all of the triggering tools: social mapping, transect walk, shit and food experience, shit calculation, medical expense calculation, etc. • Follow-up includes all activities in the communities post-triggering: working on a community action plan, supporting committees, training natural leaders, visiting household latrines, etc. Monitoring visits count as follow-up with the exception of monitoring done as part of an ODF verification team, which should be listed as ODF verification. • ODF verification should be listed for visits to communities done specifically to check on whether or not a community has achieved ODF status. • ODF celebration should be listed when a celebration is occurring after a community has been declared ODF.
Interactions with leadership	List any interactions with leadership. Leadership here includes the chief, assistant chief, assembly man, school director, or any religious leaders. Examples of interactions include visiting the chief or assistant chief to set a time for a triggering visit, visiting the school director to discuss school sanitation, visiting with the assembly man to organize a meeting to discuss the community action plan, etc.
Discussions with committees/groups	List any interactions or discussions with committees or groups. An example committee would be the ODF committee, an example group would be a school health club. Example discussions would be: checked on community action plan, discussed conflict resolution, discussed organizing meetings, etc.
Community Action Plan details	Write any major changes made to community action plans.
Interaction with households /individuals	List the number of households or individuals visited, and describe what was discussed. Examples could include discussions on latrine construction, finding materials for latrines, helping neighbors, etc.
Latrine and OD observations	List the number of latrines visited, and the number of open defecation sites visited.
Other activities	List any other activities carried out in the community not discussed above.
Additional notes	Write any notes that are relevant. This could include mentioning if rain has washed away some latrines, if the leadership is not supportive of CLTS, etc.

**Checklist 1:
Training**

Date	
PU/District	Circle one: Central/AAK Volta/Hohoe Upper West/Wa East
Start time	
End time	
Communities represented	
Plan staff present	
Other NGO or LNGO staff present	
Government present	
Any other people present	
Knowledge and information presented	
Skills trained	
Discussions held	
Any other topics or activities	
Additional notes	

Checklist 2: Kebele and village visits

Date	
PU/District	Circle one: Central/AAK Volta/Hohoe Upper West/Wa East
Community visited	
Arrival time	
Departure time	
Plan staff present	
Other NGO or LINGO staff present	
Government present	
Purpose of visit	Circle one: Pre-triggering Triggering Follow-Up ODF Verification ODF Celebration
Interactions with leadership	
Discussions with committees/groups	
Community Action Plan details	
Interaction with households /individuals	
Latrine and OD observations	
Other activities	
Additional notes	

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