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The findings of the study do not express the views of USAID nor does it represent an endorsement from USAID.
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We would also like to thank the respondents in CLTS and non-CLTS communities that had cases of Ebola who opened their homes and their communities to answer our questions, and in many cases, share with us their heartbreaking experiences and their struggles to regain a normal life.
# Acronyms and Abbreviations

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>BCC</td>
<td>Behavior Change Communication</td>
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<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<td>CEG</td>
<td>CLTS and Ebola Grouping</td>
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<td>CGV</td>
<td>Care Group Volunteers</td>
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<td>CHT</td>
<td>County Health Team</td>
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<td>CI</td>
<td>Confidence Interval</td>
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<td>CLTS</td>
<td>Community-Led Total Sanitation</td>
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<tr>
<td>DHT</td>
<td>District Health Team</td>
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<td>EHT</td>
<td>Environmental Health Technician</td>
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<tr>
<td>ETU</td>
<td>Ebola Treatment Unit</td>
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<td>EVD</td>
<td>Ebola Virus Disease</td>
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<td>FGD</td>
<td>Focus Group Discussions</td>
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<td>gCHV</td>
<td>General Community Health Volunteers</td>
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<td>GHI</td>
<td>Global Health Initiative</td>
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<td>GoL</td>
<td>Government of Liberia</td>
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<td>HH</td>
<td>Household</td>
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<tr>
<td>IWASH</td>
<td>Improved Water, Sanitation, and Hygiene</td>
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<tr>
<td>KII</td>
<td>Key Informant Interviews</td>
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<tr>
<td>LDHS</td>
<td>Liberia Demographic and Health Survey</td>
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<td>LIGIS</td>
<td>Liberia Institute for Statistics and Geo-Information Services</td>
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<tr>
<td>LOE</td>
<td>Level of Effort</td>
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<tr>
<td>M&amp;E</td>
<td>Monitoring and Evaluation</td>
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<td>MNCH</td>
<td>Maternal Newborn and Child Health</td>
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<td>MoHSW</td>
<td>Ministry of Health and Social Welfare</td>
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<td>MPW</td>
<td>Ministry of Public Works</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>NGO</td>
<td>Nongovernmental Organization</td>
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<td>NL/NLN</td>
<td>Natural Leader/Natural Leader Network</td>
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<tr>
<td>NTCU</td>
<td>National Technical Coordinating Unit</td>
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<tr>
<td>ODF</td>
<td>Open Defecation Free</td>
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<td>OFDA</td>
<td>Office of Foreign Disaster Assistance (USAID)</td>
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<td>ORS</td>
<td>Oral Rehydration Solutions</td>
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<td>POU</td>
<td>Point of Use (Water Treatment)</td>
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<td>PSI</td>
<td>Population Services International</td>
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<td>RBHS</td>
<td>Rebuilding Basic Health Services</td>
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<tr>
<td>SBCC/BCC</td>
<td>Social &amp; Behavior Change Communication/Behavior Change Communication</td>
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<tr>
<td>SPSS</td>
<td>Statistical Package for Social Sciences</td>
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<tr>
<td>TTM</td>
<td>Trained Traditional Midwife</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children’s Fund</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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<tr>
<td>USG</td>
<td>United States Government</td>
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<tr>
<td>WASH</td>
<td>Water, Sanitation, and Hygiene</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Executive Summary

Context
Global Communities, formerly CHF International, implemented the five-year USAID-funded Improved Water, Sanitation and Hygiene (IWASH) program in three counties in Liberia from February 2010 to April 2015. Global Communities concentrated WASH program activities in portions of Liberia’s most densely populated, non-urban counties, specifically Lofa, Bong and Nimba counties. In addition to supporting households and communities with improved access to suitable water and sanitation services, IWASH engaged heavily in capacity building with multiple Government of Liberia entities, focusing on strengthening County Health Teams (CHTs) to improve the enabling environment for WASH, while enlisting substantive participation from relevant ministries, including the Ministry of Health and Social Welfare (MoHSW) and the Ministry of Public Works (MPW).

In collaboration with the Liberian Ministry of Health and Social Welfare (MoHSW) at both national and county levels, IWASH implemented Community-Led Total Sanitation (CLTS), an internationally-recognized approach to improving sustainable access to sanitation and safe hygiene practices. CLTS “triggers” community disgust toward open defecation practices and subsequently raises community awareness about how feces in the environment can impact health and livelihoods. CLTS identifies Natural Leaders (NLs), community members who encourage their communities to achieve Open Defecation Free (ODF) status, as verified by the Liberian government. Once triggering was initiated, communities were actively monitored by IWASH staff. At the onset of the Ebola Virus Disease (EVD) outbreak in Liberia (March 2014), 284 of 350 triggered communities (81%) had been verified as ODF. During the Ebola crisis, Global Communities continued to trigger more communities. At the close of IWASH Global Communities had triggered 370 communities, 310 of which were verified ODF.

EVD first entered Lofa County from Guinea through Foya district in March 2014 and spread quickly across the county into other IWASH program areas. The Lofa County Health Team reported a total of 928 reported EVD cases – of which 422 were confirmed cases (206 male/216 female) – and 648 deaths in Lofa County alone. As the rate of Ebola transmissions began to decline, and as communities regained some stability, informal word-of-mouth observations and reports from IWASH communities, County Health Team officials and Global Communities’ staff consistently pointed to an absence of Ebola infections in communities where IWASH had implemented CLTS programming, and specifically, in communities that had achieved Open Defecation Free (ODF) status.

In order to confirm unofficial reports, and to identify any critical links between CLTS and the ODF process and reduced Ebola transmission, Global Communities commissioned a research study in January 2015 in two of the six health districts in Lofa County where IWASH was implemented (Voinjama and Kolahun) and where 98 out of 115 IWASH communities had achieved ODF status. The research also examined the broad impact of Ebola on IWASH communities in Lofa County and whether any correlation could be demonstrated between IWASH interventions and EVD preparedness or prevention.

Purpose of the Study
The CLTS/ODF Ebola study conducted in Lofa County was developed to: 1) validate informal claims that IWASH communities with verified ODF status had not experienced any Ebola cases, 2) determine if CLTS-specific interventions can explain any variance in fatality and infection rates in EVD and non-EVD communities, and 3) control for other plausible explanations (other than CLTS) that may explain variance in the incident rate of EVD in similar communities. The study also aimed to identify, if possible, which community-based EVD-specific activities were most effective in disseminating EVD information and promoting disease prevention and response behaviors.

1 Lofa County Health Team data. February 2015
Methods and Analysis

The study incorporated several quantitative and qualitative methods: an initial desk review of secondary data, including the Liberia Demographic and Health Survey (2013), John’s Hopkins’ KAP study (2014), IWASH project reporting and documentation, as well as and GoL information and data resources. The research team conducted a quantitative survey of 551 households residing in both ODF-verified communities and comparable communities with confirmed Ebola caseloads and fatalities. Purposive, proportionate and stratified random sampling techniques informed the final selection of communities. Finally, qualitative methods were incorporated into the research methodology, including Focus Group Discussions with both men and women’s groups across all categories of communities, and with Natural Leaders in each of the selected districts. Researchers also conducted Key Informant Interviews with Global Communities and GoL WASH focal persons.

Summary Findings Specific to ODF/CLTS and Ebola Rates

A more in-depth analysis and presentation of key findings can be reviewed in the full report below. It is important to note that while results below suggest a strong correlation between communities’ achievement of ODF status and EVD-free results, the scope of this study does not prove causality. Additional limitations are outlined in Chapter Three.

Link between CLTS and Community Health Status (Ebola Resistance)

100% of ODF status study communities remained Ebola-free during the Ebola outbreak, and had maintained Ebola-free status at the time of the study. Survey results confirmed that there were no cases of EVD in any of the 104 households residing in verified ODF communities. Overall, households in CLTS communities were 17 times less likely to have any cases of Ebola than households in non-CLTS communities.

Communities that did not participate in any CLTS activities had higher rates of Ebola and more confirmed case fatalities. Survey results confirmed that 236 households (76%) that did not participate in CLTS programs reported confirmed Ebola cases. Of the 239 total CLTS households involved in the survey, 36 reported cases of Ebola (15%).

Research evidence points to a strong correlation between CLTS engagement/ODF status and reduced risk of Ebola. In addition to the lack of Ebola infections, transmission, and death in verified ODF communities, survey results suggest lower levels of Ebola infection in communities that were actively engaged in CLTS but did not achieve full ODF status. Only one out of eight CLTS communities that did not attain verified ODF status (36 households) were affected by Ebola; qualitative analysis revealed that this community had also experienced protracted internal conflict. Survey data therefore suggest that the process of achieving ODF status, which includes significant change in various hygiene behaviors and sanitation practices can provide an enabling environment, and can be interpreted as building protective factors in the community. More research is needed to investigate possible causality.

Natural Leaders may have a key role in reducing Ebola risk at the community level. Training by a NL is a specific element that is exclusively connected with IWASH CLTS communities in the surveyed districts. Statistical analysis of multiple factors in the household survey showed that “Training by a Natural Leader” emerged ahead of other factors as an important and unique difference between communities where Ebola was present and non-Ebola communities, and implies increased community adoption of standard hygiene practices. The vast majority (91.5%) of households in communities directly affected by Ebola had not benefited from training by a Natural Leader.

Further research is required to determine which behaviors, practices and relationships specifically influence Ebola and disease resistance in general. As noted above, survey data indicate that the process of achieving ODF status may strengthen protective factors in the community. Given that communities also commit to specific and measurable actions to achieve verified ODF status, behavioral indicators are likely to be higher in CLTS/ODF communities than in communities where these actions are not taken. The study was unable to identify which specific behaviors or processes
might have been more important than others; further analysis is required to fully understand the importance and contribution of each measure to ensuring community health and reducing Ebola risk.

**Community Perspectives Regarding Ebola Response and Resistance**

*CLTS communities credit behavior change and good hygiene practices as reasons for the lack of Ebola in their community.* ODF communities reported that they were “already doing the preventive hygiene behaviors before EVD” because of the training they received through CLTS. In comparison, EVD-affected communities expressed that denial regarding the actual nature of the disease was a most influential reason for delayed adoption of improved hygiene behaviors.

*Trust is an important feature of IWASH programming and strengthened protective factors in the community.* CHT and DHT officials reported that initial responses to radio messaging varied widely between communities, and heavy resistance persisted in some areas, specifically towards attempts made by the CHT to reach the sick as part of the overall response effort. According to the CHT, IWASH communities were more receptive to and complied more readily with information regarding EVD prevention than non-IWASH communities.

*In the context of Ebola response, the level of trust in the information source may directly influence community acceptance and adoption of guidelines and directives.* All communities in the survey, regardless of CLTS or EVD status, identified radio broadcasting as their first source of EVD information, followed by health workers, NGOs and family and peers. Both CLTS and non-CLTS communities cited health workers as the most trusted source of information. Retrospective responses revealed a change and evolving reliance on various information sources among communities with EVD, who changed the sources of information they responded to over the course of the epidemic. During the survey, more than four months after the last case of Ebola in Lofa County, both CLTS/ODF and EVD communities listed (in this order) “health workers,” “radio” and “NGO”s as the most trusted sources of information.²

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² This technical summary was compiled by Global Communities so that readers can access the most salient points of the study. More substantive context, explanation and analysis is available in the following chapters.
Background on the IWASH project, CLTS and Ebola in Lofa County

The five-year USAID-funded IWASH program was implemented by Global Communities, formerly CHF International, from 2010 to April 2015. The purpose of IWASH was to support accelerated achievement of the Millennium Development Goals (MDGs) related to water, sanitation, and hygiene in Liberia. After the first year of the project, USAID requested that Global Communities reduce the geographic scope of the project and focus on portions of Bong, Nimba, and Lofa counties - Liberia's most densely populated non-urban counties. Global Communities was also asked to adjust their program focus on building the capacity of the GoL at multiple levels, including the CHT to improve the enabling environment for WASH.

In response to USAID requestes, Global Communities expanded stakeholder engagement to include additional relevant ministries in addition to the Ministry of Health and Social Welfare (MoHSW) including the Ministry of Public Works (MPW). Realignment of the project supported the tenets of both USAID/Forward and the Global Health Initiative (GHI) that are the basis of USAID’s development strategy in Liberia.

An external midterm evaluation in FY2013 recommended further streamlining of project activities to focus on sustainable sanitation by using the internationally-recognized Community Led Total Sanitation approach. CLTS is a community social mobilization methodology that taps into the community’s own assets, including existing community human resources called Natural Leaders (NL). Prior to the EVD outbreak, Global Communities triggered CLTS in 350 communities in the three counties. Following triggering, communities were actively monitored and encouraged to reach Open Defecation Free (ODF) status. Global Communities added an innovative approach by organizing the NLs into Natural Leader Networks (NLN) that were still in place after IWASH field activities were completed. In addition to promoting CLTS, some Natural Leaders were trained to be “WASH Entrepreneurs,” with skills in soap making and hand pump repair to provide some to some NLs and/or NLNs and also promote communities’ ability to sustain hygiene behaviors they had learned. IWASH followed the CLTS methodology and supported the GoL to adapt CLTS to the Liberian context that became Liberian national policy. Guidelines and protocols developed with GoL are currently used by other members of the Liberia WASH Consortium as their primary approach to improved sanitation.

IWASH invested a significant Level of Effort (LOE) in developing the enabling environment for the Liberian WASH sector. Capacity-building provided by Global Communities to the CLTS National Technical Coordinating Unit (NTCU) has enabled the development and management of a CLTS national database and implementation map. This additional capacity has enabled the GoL to adopt CLTS as national policy, and subsequently allowed the GoL to commit their own resources to assess progress of CLTS by all implementing partners. This process also developed methods to formally verify when communities have completed all CLTS steps and attain ODF status. By the time of the Ebola outbreak in early 2014, 284 of those communities had successfully become ODF. During the Ebola crisis, Global Communities continued to trigger more communities. At the close of IWASH Global Communities had triggered 370 communities, 310 of which were verified ODF.

Lofa County, one of the three IWASH focus counties, is one of the 15 counties of Liberia has an area of 9,982 km² with a total population of 270,114. It is the fourth most populated political subdivision and the second largest county in the country by area. Global Communities implemented CLTS in Kolahun and Voinjama health districts, two of the six health districts in Lofa County.

The first case of Ebola in Liberia originated in Guinea, entered Liberia through adjoining Foya District in February 2014 and quickly spread to other districts in the county. The last confirmed EVD case in Lofa County was in November 2014. As of March 2015, there had been a total of 928 reported Ebola cases, 422 confirmed cases (206 male/216 female) and 648 deaths in Lofa County. As of March 2015, no new cases had been identified in Lofa County for several months and

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5 Quandu Gboni, an additional administrative district in Lofa County is part of Voinjama Health District
6 Lofa County Health Team data, February 2015
only a few new cases remained hospitalized in Monrovia. The Ebola Treatment Unit (ETU) outside of Voinjama City was empty. The borders between Liberia, Guinea, and Sierra Leone were reopened in February 2015, while intensive anti-Ebola sanitation and hygiene promotion campaigns were ongoing in both former IWASH and non-IWASH communities. Schools were reopened and the MoHSW had resumed immunization campaigns to catch up to make up for reduced routine immunization coverage that resulted from disruptions in health services during the EVD epidemic.

**Purpose of the study**

IWASH participant communities, Global Communities’ monitoring and the County Health Team officials in Lofa County had all reported that none of the 98 CLTS ODF communities had any cases of EVD during the outbreak, even when comparable nearby communities that had not participated in CLTS had confirmed EVD cases. In fact, Global Communities received reports from health workers that there had been no cases of EVD in any of the 284 IWASH communities that had achieved ODF status. The question arose as to whether CLTS that led to ODF status had somehow acted as a protective factor against infection and transmission of Ebola.

The CLTS/ODF Ebola study carried out in Lofa County was developed to: 1) validate claims that there had been no EVD cases in CLTS ODF communities in the sample area, 2) determine if CLTS-specific interventions were likely to explain differences between EVD and non-EVD communities and 3) control for other plausible explanations (other than CLTS) for the differences between EVD-incidence in similar communities. The study was also intended to identify, if possible, which community-based EVD-specific activities were most effective in disseminating EVD information and promoting disease prevention and response behaviors. Specific interventions that were considered include hand washing with soap or chlorine, safe burial practices, isolating sick people and rapid care seeking for anyone exhibiting symptoms.

The WHO has determined that one important lesson learned from the EVD epidemic was that “community engagement is the one factor that underlies the success of all other control measures. It is the linchpin for successful control. Contact tracing, early reporting of symptoms, adherence to recommended protective measures, and safe burials are critically dependent on a cooperative community.” CLTS depends on complete community engagement. CLTS ODF communities were already experienced in partnering with CLTS implementers to achieve common objectives (ODF status).

Poor access to clean water and sanitation are significant factors that influence most humanitarian emergencies. Findings from study should contribute to developing the evidence-base of WASH-related factors that contributed to the spread (and prevention) of EVD, and will hopefully be used to understand the relationship between strong WASH programs and improving health status, even in the absence of EVD. Lessons learned from the study should be used to inform future programs in developing community resilience for routine disease prevention as well as strengthen community capacity to respond to emergencies where water and sanitation conditions are factors.

**Study Population**

The study was carried out in Lofa County, one of the three counties covered by IWASH programs. In Lofa County, IWASH was implemented by Global Communities in two of the six health districts, Voinjama and Kolahun. The two districts combined have a total of 435 communities with an estimated 21,587 households, of these IWASH project implemented CLTS in 115 communities with a population of 34,235 in 6,865 households. By February 2014, 98 of IWASH CLTS communities had been verified by the GoL as having met the criteria to be verified ODF.

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7 Ebola Virus Disease (EVD) and Ebola are used interchangeably in this report
8 *What needs to happen in 2015*, World Health Organization, January 2015
Study Design and Methodology

The study incorporated a variety of quantitative and qualitative methods that included: Review of available data and key relevant documents such as the Liberia Demographic and Health Survey (2013), John’s Hopkins’ KAP study (2014), project documents and GoL documents. A quantitative survey of 551 households was conducted in ODF communities and EVD communities. Qualitative methods included FGDs with men and women’s groups in 14 ODF and EVD communities and non-EVD communities and one group of NLs in each district. KIIIs were conducted by Global Communities and GoL WASH focal persons. Data were also collected and FGDs conducted in CLTS communities that did not reach ODF as well and also in non-CLTS communities to be used in analyzing the findings for confounding factors.

**Figure 1. Distribution of Survey Sample (according to CLTS, ODF, EVD status)**

**Quantitative Methods**

*Sampling techniques*

Purposive, proportionate and stratified random sampling techniques were used to select the respondents for household survey. Both districts were equally represented in the study. CLTS communities were matched with non-CLTS communities according to geographical location and proximity to each other, population size and tribe. From among the CLTS communities, those that had been verified as ODF were identified. To control for possible confounding factors and ensure matched communities were comparable, households in non-CLTS and non-EVD communities were also represented in the sample for an original total of four different categories: 1) Project beneficiaries (CLTS communities) who had reached ODF status (ODF); 2) project beneficiaries (CLTS communities) no longer progressing towards ODF (non-ODF); 3) non-project communities affected by EVD; and 4) non-project communities that were not affected by EVD.
From the household survey data one CLTS but non-ODF community with EVD was identified and a fifth comparison group (36 households) was added for the purpose of analysis. The full breakdown in household terms can be seen in the chart above. In all, the study included 10 ODF communities (no cases of EVD); eight CLTS but non-ODF communities (including one EVD-affected community); and 25 non-CLTS communities, of which 23 were EVD-affected. A list of all study communities according to district, CLTS and ODF status is available upon request.

Sample size and sampling method

Using William Cochran’s formula for cross sectional surveys, a minimum sample size of 534 households was required. This estimation was based on a 95% confidence interval, a tolerance of 5% margin of error, with the assumption that 50% of the households were exposed to EVD, and 20% of household questionnaires would be invalid for some reason. Because a random sampling of communities may not have yielded sufficient ODF communities, additional ODF communities were added to make the final sample size 551 households (see Figure 1).

Since Global Communities’ CLTS intervention measured community’s collective behavior rather than individual behavior, the study applied population level matching. Data was collected from a sample of households within a community, but analyzed at the community level. A multiple-stage sampling technique was used to identify the households to participate in the survey. First, two health districts (Voinjama and Kolahun) in Voinjama County were purposely selected because the IWASH program was implemented in these locations. Communities were then stratified into two groups: Those who had benefited from the Global Communities project and those who had not; communities were then compared to a list provided by LGIS for the sampling frame. From the CLTS strata, both CLTS and CLTS/ODF communities were randomly selected for the study and matched with similar communities from the non CLTS strata based on geographical location, proximity to one other, ethnic group and population size.

Global Communities and CHT CLTS focal persons and CHT health data focal persons provided a list of communities with confirmed EVD cases. Once both control and project communities had been identified, the number of households per community was proportionately determined (i.e. larger communities contributed larger samples and vice versa). Finally, individual households for the survey were identified through systematic random sampling (Reference is available upon request.)

In the community, the survey team engaged the community elder or area chief to show the center of the village, where the survey team randomly selected a direction by spinning a pen on the ground and following the direction of the pen to the first household. Subsequent households were identified through systematic random sampling where a skip pattern was determined based on the number of households in the community versus the sample size expected from the particular community.

Data sources

Both primary and secondary data sources were used for this survey. Primary data was collected using a questionnaire administered to the head of household by a locally-hired enumerator in the local language. The tool was based on the major CLTS activities and collected information regarding household demographic characteristics, standard WASH survey indicators such as household knowledge and practices in relation to water, sanitation and hygiene. The survey also included specific Ebola-related questions such as knowledge on Ebola signs and symptoms, transmission and prevention. Secondary data sources included project reports and databases as well as CHT-provided records and included a list of communities where CLTS has been implemented and also lists of communities that had experienced a case of Ebola infection.

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10 Assumptions had to be built in. The percentage of households that were exposed to EVD is unknown. Experience with field surveys has shown that some households selected for the survey may decline to participate or there may be errors in data collection.
Data Quality Control

**Data collection tool:** The household questionnaire was pre-tested by enumerators in non-study communities before use to check for any inconsistencies, ambiguity or incomprehension. Any challenges identified while piloting the tool were addressed before the survey began.

**Training of enumerators:** Two days of training was provided to locally-hired, experienced enumerators to familiarize them with the survey methodology and the data collection tool. Training topics included an overview of the survey and study ethics, as well as a detailed question-by-question review of the household survey questionnaire that had been translated into local languages. Training was meant to ensure that questions were asked and recorded correctly and uniformly to minimize the likelihood of errors and interviewer bias. To reduce potential bias, survey enumerators were not made aware of specific community categories or EVD/ODF status.

**Supervision of enumerators:** A team of 14 enumerators was deployed to assist in administering the household questionnaire. The enumerators worked in pairs. For each two pairs, there was a team-leader who worked closely with the enumerators for quality assurance.

**Reviewing data collection tools:** Enumerators were instructed to review each questionnaire before leaving a household to ensure that all questions had been asked and appropriately recorded on the questionnaire. Team leaders reviewed all questionnaires from their teams before sending them to Global Communities Office for computer data entry.

**Internal audit:** At the office, random checks were conducted on completed questionnaires and any data recording anomalies were communicated to the team leaders and enumerators to prevent the same mistakes the next day. Data was cleaned before it was analyzed.

**Informed consent:** Enumerators received verbal informed consent prior to any data collection to ensure that the survey was conducted in an ethical manner without violation of the rights of study subjects, and also to assure the respondents that the information they were providing for the survey would be kept confidential.

**Data processing and analysis**

Data was collected on demographic and socio-economic factors, as well as multiple standard indicators used in WASH surveys to ensure that communities were comparable and to control for multiple possible confounding factors outside of CLTS that may have been the actual reasons for variances between EVD and non-EVD communities.

**Analyzing Quantitative Data**

The “Null Hypothesis,” a common statistical approach, was used to confirm that any differences between CLTS/ODF and EVD communities were not merely due to chance.\(^\text{11}\) Data were entered into a computer and cleaned using Predictive Analysis Statistical Software (PASW™). Simple frequency and cross tabs were run to detect inconsistencies. Any errors identified at the cleaning stage were corrected by comparing the data in the questionnaires with those in the PASW™ dataset.

Both univariate descriptive and inferential statistics were used to analyze the data using the following procedures: 1) Univariate descriptive analysis: frequencies, proportions, percentages and means of variables were computed. 2) Bivariate analysis: Pearson’s Chi Square test was conducted to test the association between the dependent variable (presence of Ebola case in community) and possible explanatory variables that were identified during the literature review. 3) Multivariate analysis: Logistic regression was performed to identify predictors of Ebola. Only variables that were found

to be significantly associated with Ebola during bivariate analysis stage were included in the regression model.\textsuperscript{12} For more information on the model, please see Household Survey Report\textsuperscript{13}. Adjusted odd ratios were calculated, with 95% confidence intervals with levels of statistical significance set at p<0.05.

**Qualitative Methods**

Key project and government documents as well as WASH and health references and available relevant data were reviewed.\textsuperscript{14} FGDs based on the study research questions were conducted in both EVD and non-EVD communities in both health districts. FGDs within communities were separated by gender and consisted of 5-10 members per group. KIIIs were conducted with Global Communities staff, current and former MoHSW and CHT informants and the Paramount Chief of Quandu Gbone (part of Voinjama health district). Respondents included county and district CLTS focal persons and members of the WASH Task Force for Lofa County. The Paramount Chief of Quandu Gbone represented the perspective of several local traditional leaders. Results of the qualitative findings were analyzed to identify common responses across groups and also used to triangulate or explain findings from other sources, including the household survey.

Whenever findings did not correspond, additional information was sought through additional interviews or sources of information.

**Demographic Characteristics of the Population**

A total of 551 households from 43 communities participated in the household survey. Of the total households, 239 (43%) resided in communities where IWASH implemented CLTS activities. Altogether, 18 of the 43 communities selected for the survey were beneficiaries of IWASH CLTS project while 25 were not. Of the CLTS population, 19% (104 survey households in ten communities) were verified by the GoL specific criteria as ODF. Slightly more households (53%) were in Kolahun health district compared to Voinjama health district. Ten different clans were represented in the survey with a third of the households were from Tahamba clan. Lorma and Gbandi tribes were among the majority of survey respondents, with Mandingo and Kissi also represented. Respondents included 273 females and 278 males with a mean age of 40 years (median 38, SD 14.78). Most respondents (80%) were married (10% widowed, 7% single, 3% separated / divorced). Christians constituted 63% of the respondents and Muslims 32%. Average household size was 9 members (median 8, SD 4.98). Half of the respondents had no formal education and a total of 67% had not completed the lowest level of formal education. The main source of income was farming (86%).

To match communities and to account for income disparities, the study used a method similar to that used in the 2013 LDHS based on type of floor and roof for the main house as proxies for income status. “Higher” income groups in communities in the study coincide with the middle quintile of the LDHS, “middle” income the second lowest quintile and “lower” with the lowest income quintile. Figures 2 and 3 illustrate how this determination was made and that the majority of households (75%) were in the middle income group, or corresponding with the next lowest quintile in the 2013 LDHS.

\textsuperscript{12} Detailed information on the regression model can be found in the Household Survey Report

\textsuperscript{13} Available upon request

\textsuperscript{14} A list of references can be reviewed upon request
Limitations of the Study

Data collection in the study was conducted at the household level, then grouped and analyzed at the community level. This study does not provide insights on specific factors associated with person to person transmission or individual behavior within households. Additional epidemiologic research will be needed to understand why some members in households contracted Ebola while others did not, and also why some households within the community became infected and others did not. Rather, the study examines the relationship between instance of EVD in the community (regardless of percentage of households affected) and community-level factors (such as behaviors or characteristics) thought to correlate with instance of EVD.

Several limitations associated with the research method must be considered when reviewing findings and conclusions. In this type of study, limitations of the research method impact what the study can and cannot reveal regarding what effect CLTS interventions (that lead to ODF) might have had on the spread of EVD through households and communities. The findings must also be considered in light of the fact that the study is retrospective of a development program that was not originally designed to accommodate or serve as a research study. With some exceptions, a direct observation for most components examined in the study were not possible, and self-reporting was the only source of information. Certain types of bias are inherent in any study that relies on self-reporting:15

1) **Selection bias** is a potential limitation, due to several factors. CLTS communities, whether or not they became ODF, were not completely comparable with all other communities in the two districts because: a) The methodology deliberately calls for selecting small communities, b) CLTS communities already demonstrate initiative and motivation, as the CLTS process requires community initiation of the triggering process and declaration of intent by submitting a letter of interest and agreeing to organize initial triggering events. Therefore, CLTS communities are motivated by other underlying factors, and c) Large communities that were due to start CLTS were not started due to the epidemic, meaning all CLTS communities were small.

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15 Much of the DHS relies on self-reporting
2) *Recall Bias* has to do with individuals’ ability to accurately recall and report events in the past. In this particular study, individuals with a disease could be more concerned about remembering potential causes of an infection, such as hygiene behaviors, and consequently might have overestimated the association between failure to implement certain behaviors and actually contracting Ebola. To control for this potential bias, the sample included communities that had received ODF verification prior to February 2014 to demonstrate that specific behaviors were in place prior to the epidemic and mass media and social campaigns.

3) *Halo bias* is the tendency among respondents to under-report socially undesirable answers (or over-report desirable answers) and alter their responses to approximate what they perceive the social norm to be (or what they perceive the “interviewer wants to hear”). The study used a variety of sources and methods to collect information and triangulated responses between methods and/or objectively observable information (such as presence of hand washing stations and latrines). ODF verification checklists provided objective documentation that some behaviors were practiced in ODF communities prior to the outbreak.

In addition, data quality presents potential limitations, as all official EVD data was collected after the outbreak had already started and CHT officials acknowledge that data for early presumed cases was probably not completely accurate.

Further, the study was conducted shortly after the epidemic ended in Lofa County and during a response effort when massive external inputs for hygiene promotion were flooding into Lofa County. This could have influenced communities to under-report on some issues (such as availability of soap or buckets) with the hope it would attract donor support to their communities. Challenges with the quality of available health data, especially early EVD data have been well-documented. During community selection for the study, the team found that a few communities had been misclassified.

A final limiting factor is that Ebola is a new disease to the study area and to all of Liberia, as EVD prevalence at the debut of IWASH was zero. Previous Ebola health research was largely undertaken at health facilities in remote locations in other countries and focused on clinical care; very little is known about community and household factors. The Ebola ODF study was retrospective and not a case-control experimental study (with clearly defined outcomes to compare between intervention and non-intervention communities). The global health community still faces a significant learning curve regarding the interruption of disease transmission at the community level, and correlations identified in the study may be useful in orienting future efforts and “where to look” for useful interventions. A statement from WHO in early 2015 points out that much needs to be learned from the success stories like the Lofa County experience as precise causal factors driving the successful decline of Ebola there are not clear. Operational research such as this evaluation starts with identifying correlations between different factors to identify which ones should be selected for comparison studies.

**Operational research is needed to understand why some areas have stopped or dramatically reduced transmission while others, including some in the same vicinity and with similar population profiles, remain hotspots of intense transmission. Did the striking and robust declines in Lofa County, Liberia, and Kailahun and Kenema districts in Sierra Leone occur because devastated populations learned first-hand which behaviors carried a high risk and changed them? Or can the declines be attributed to simultaneous and seamless implementation of the full package of control measures, as happened in Lofa country? Answers to these questions will help refine control strategies.”**

— World Health Organization

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**Correlation and Causation**

Most scientific evidence is based upon a correlation of variables that are observed as occurring together. Scientists are careful to point out that *correlation does not necessarily mean causation*. At the same time, as Holland point out, “much important scientific evidence would be discarded if correlations were discarded. Correlational evidence from several

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16 KII with Global Communities Liberia staff and Lofa County CHT, February 2015
different angles may be the strongest causal evidence available and has been used as a source of scientific evidence in medicine, psychology, and sociology.” Correlations must first be confirmed as real, and “then every possible causative relationship must be systematically explored. In the end correlation can be used as powerful evidence for a cause-and-effect relationship between a treatment and benefit, a risk factor and a disease, or a social or economic factor and various outcomes. But it is also tempting to come to premature conclusions based upon the preliminary appearance of a correlation.” Any potential correlations identified by comparing matched communities in the study may provide the basis for those types of studies, but would need to be followed up by observational or experimental studies to confirm that the relationships were real.

Validity

To ensure validity, results of the survey were triangulated during data analysis with qualitative findings from the KII and FGDs and other available data (such as the LDHS, IWASH, the HC3 KAP study and CHT monitoring data). Any differences were followed up and reconciled with additional data analysis, interviews at the community and CHT level and visits to specific communities. Some CLTS community survey respondents reported that a household members were infected, but when this information was triangulated, enumerators determined that these household members resided in Monrovia and not in Lofa County. Only one community that started CLTS but did not reach ODF certification reported EVD cases, and no communities that reached ODF certification were affected by EVD. Follow-up investigation regarding the affected community discovered it had experienced internal conflict that was unrelated to WASH activities. This led to breakdown of the social cohesion necessary for CLTS and other community-based interventions to be successful. (See Recommendations section.)

Findings by Research Question

**Question 1: How did communities respond to Ebola, particularly focusing on practices related to hygiene, sanitation, disease prevention, exposure to infected people, and treatment and burials of the dead, etc.?**

At the time of the survey, Ebola prevention knowledge and behaviors were relatively high in Lofa County and there were no statistical differences in responses from both EVD and non-EVD communities regarding level of knowledge or adoption of preventative hygiene practices. A likely factor in this similarity is that intensive Ebola prevention promotion had already been in place for several months as part of the larger emergency Ebola response effort supported by both GoL entities, NGOs, and donors. Core activities during that period included the distribution of hygiene kits and instructions about avoiding personal contact, identifying and referring infected people and notifying the CHT of deaths.

All Ebola-specific interventions took place in the study area after IWASH CLTS activities had already ended. During key informant interviews, CHT and DHT officials reported that initial responses to radio messaging varied widely between communities, and that in non-CLTS communities, heavy resistance persisted in some areas, specifically towards attempts made by the CHT to reach the sick as part of the overall response effort. In Kolahun District, the District Hospital ambulance was attacked and heavily damaged. In addition, health facilities were not equipped for timely or effective response to the Ebola outbreak; most had no electricity or water and lack of roads made it difficult to reach many EVD communities. The CHT reported that communities already engaged with the IWASH project were more receptive and tended to comply with radio and government messaging to mainstream the identification of EVD symptoms, hygiene and sanitation messages, and to encourage avoidance of personal contact and traditional burial practices. Eventually all communities in the study responded to health messaging about improved hygiene and sanitation due to Ebola response.

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18 Novella, S. “Evidence in Medicine: Correlation and Causation” *Science and Medicine.* Science-Based Medicine, November 2009
19 Johns Hopkins Center for Communication Programs, *Community Perspectives About Ebola in Bong, Lofa and Montserrado Counties in Liberia: Results of a Qualitative Study,* January 2015
20 Comparative data on these behaviors can be found in the Household Survey Report, available upon request
and adjusted behaviors accordingly. At the time of the study, standard hygiene and sanitation practices, including safe burial, had evolved according to guidelines across all different categories of communities involved in the research efforts.

Survey data and community FGDs found that both CLTS/ODF and EVD communities reported making significant changes in their water, sanitation and hygiene behaviors, specifically hand washing with soap and/or chlorine. However, differences emerged when participants were asked when some hand washing behaviors were first adopted. FGD respondents in ODF communities confirmed the survey findings by responding that they were already practicing preventive hygiene behaviors before EVD emerged in Lofa County and believe that these behaviors played a key role in resisting infection in their community. Focus groups conducted in verified ODF communities asserted a belief that they were able to practice preventive behaviors before the Ebola epidemic because it was part of the training they received in the IWASH/CLTS program. Researchers triangulated this feedback by observing hand washing dispensers for chlorine water and the enforcement of hand washing before entering a community, business or attending a gathering even within the community.

Because CLTS training (which IWASH would have provided) promotes specific hand washing behaviors, including construction of hand washing stations using local materials and using soap, the study can assert that these are factors to consider in the overall consideration of reduced Ebola risk.

**Question 2: Where did communities get information and guidance on Ebola prevention? What was their willingness to follow it?**

All communities in the survey, regardless of CLTS or EVD status, identified radio broadcasting as their first source of EVD information, followed by interactions with health workers, family and friends and NGOs (see Figure 4). No statistically significant variation was observed when comparing community Ebola transmissions and where or how community members first learned about Ebola and how to prevent it. Focus group feedback in communities where Ebola was present suggested that family and friends, including those living overseas not only provided them Ebola with information but also sent money to purchase medicine. Feedback from communities where EVD was contracted indicated an initial level of distrust of all information disseminated through radio and by the government.

Community access to radios was varied, and information on household access to radios, specifically in Voinjama and Kolahun health districts prior to the epidemic, was limited or unreliable although radio distribution was a key component of Ebola response programming. At the time of the survey, households in CLTS communities had more access to radios for information than those living in EVD communities.
Focus groups across different community categories described very different responses to Ebola messaging and information in the early phase of Ebola response. FGDs in CLTS/ODF communities specifically mentioned increased hand washing as one of the most important Ebola response measures adapted by community members as a result of information campaigns. Respondents also indicated that Natural Leaders had credibility and were trusted sources of information due to the relationships built during the ODF verification process. Natural leaders may have helped to reinforce information provided by other sources.

Focus group participants and key informants in Ebola-affected communities confirmed CHT assertions regarding strong local resistance to Ebola guidelines and preventative measures in the first stage of Ebola response. EVD communities confirmed that denial or "ignorance" of Ebola as a “real” disease made them resist early information about prevention and resulted in many fatalities. CHT representatives indicated that communities where Ebola was present were reluctant to change traditional practices, adopt recommended measures and to comply with new requirements, although compliance is now mainstreamed across all communities in the post epidemic context. Survey data support this assertion and demonstrate that the majority of all respondents, regardless of community EVD status agreed that “Ebola is preventable,” and were able to identify several symptoms of Ebola as well as note appropriate response measures to suspected symptoms or infections.

“Before the outbreak some of us (had heard of) Ebola from Congo. When the outbreak came (here), we didn’t believe it was real (Ebola). After it became serious, our brothers in the diaspora sent us money to buy medicines. This was the time we began to really believe it and started to listen to the Ministry of Health awareness messages on the radio and also to advice from our family and friends. By that time we had many cases and we were willing to follow the advice from these messages. We started hand washing practices. But many people had already died from the Ebola virus.”

– Men’s FGD, EVD Community, Bakadu, Quandu Gboni, Voinjama District
Communities generally cited radio information and follow-up information provided by NGOs (specifically Global Communities) as important sources of information for Ebola; however, focus group responses from ODF communities that had no EVD cases varied when compared to responses from focus groups in communities with EVD cases. Both cited health workers as the most trusted source of information (see Figure 5), but non-CLTS communities explained that radio is now the primary information source and expressed an increased willingness to adhere to broadcast information and instructions compared to the onset of the Ebola outbreak.

Figure 5. Most Trusted Sources of EVD Information by Community EVD Status

It is possible that the most important difference between communities was greater receptiveness of ODF communities to messages about Ebola prevention and care-seeking developed through CLTS through interactions with the community. However, further validation of this assertion should be investigated in future research efforts.

“We heard the Ebola news over radio. The Ministry of Health gave us educational messages through the radio. Also Global Communities used to carry awareness and sensitization into our community. From (that) point we believe (sic) that this sickness is real (exists) and we continue to use preventive measures…The community accepted the information willingly and followed all advice.”

– FGD focus groups (men and women) in ODF communities Upper Walker, Dehdehsi in Voinjama
Question 3: If there was variation in both the providers of public health messages and the support and information provided did some seem more effective than others?

According to the World Health Organization, “Community resistance must be tackled by all outbreak responders with the greatest urgency. During 2014, (we) learned that community leaders, including religious leaders as well as tribal chiefs, can play an especially persuasive role in reducing high-risk behaviors.” Global Communities embraced these approaches successfully early in the IWASH program and expanded them in their Ebola response. According to community FGDs, differences between providers of public health messages and support to the community level were greatest at the beginning of the epidemic.

By the time of the study, both ODF and EVD communities ranked health workers, radio and NGOs in the same order as most trusted sources. To answer this question retrospectively, the survey asked about “first source of information about EVD” followed by “most trusted source” of information. Communities with EVD changed the sources of information they responded to over the course of the epidemic. By the time of the study, over four months after the last case of Ebola in Lofa County, both CLTS/ODF and EVD communities listed (in this order) “health workers”, “radio” and “NGO’s as the most trusted sources of information, so no specific variation between providers was detected.

Government was not mentioned specifically in the survey as a source, but health workers, radio and all major NGOs working in Lofa County implement their programs jointly with the GoL. FGDs identified the GoL as important in providing help to them during the epidemic. This was mentioned most frequently in EVD communities.

Overall, 37% had first heard about Ebola from a source they trusted; health workers (43%) were the most trusted source of information. But coverage of trusted sources varied. Lofa County has a dearth of health human resources, and shortages increased with the health worker deaths from Ebola. Many health workers do not come from the area, do not speak local languages and were not the initial source of information for many survey respondents. In addition, the 2013 LDHS found only 48% of men and 20% of women overall listened to the radio at least once a week in Lofa County (this data included both urban and rural areas of the county). Household survey data found that 45% of households said they had access to a radio in their community; of those, over 82% said they received them in 2014 as part of the Ebola emergency response effort.

Fifty-six percent of households in CLTS communities had received WASH training from a Natural Leader. By definition, training from a Natural Leader is linked only to IWASH CLTS. Most respondents who had received training from Natural Leaders indicated that trainings covered both overall hygiene and (later) Ebola topics, including hand washing with soap at critical times, constructing hand washing stations, covering water containers, and using clothes lines and dish racks.

Messages communicated through different channels were most frequently in Liberian English (52%) but many survey respondents said that they (77%) would have preferred the messages in a different language. Most households (63%) reported having a WASH NGO in the community before Ebola outbreak, but not specifically IWASH. The presence of NGOs implementing WASH activities was reported more often in CLTS/ODF communities (73% vs 56%).

Focus group discussions with Global Communities and key informant interviews with CHT managers helped to explain the different findings between ODF and EVD communities. EVD communities indicated that they did not trust or believe initial reports of Ebola or guidelines that were transmitted through various sources and preferred the advice of relatives, including diaspora, who also sent them money to buy medicines from local pharmacies. Respondents refuted the possibility of taking preventive measures, such as changing their usual hygiene practices (including traditional burial practices where relatives bathe, dress, braid the hair and lie next to the deceased, sometimes for several days).

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21 What needs to happen in 2015, WHO, January 2015
22 2013 Liberia Demographic and Health Survey (LDHS), 2014
23 More information about sources of information and which sources were trusted can be found in the Household Survey Report, available upon request.
Focus group discussions with verified ODF communities suggested a level of awareness and practice of protective hygiene practices before the Ebola outbreak, and expressed confidence that these behaviors explain the lack of infections and transmissions in their communities. Some respondents from verified ODF FGDs indicated that individual households increased their efforts once Ebola was confirmed as a threat and that they were also accustomed to Natural Leaders, whom they already trusted, to bring them information. Respondents credited Global Communities and the IWASH program for building capacity through CLTS that allowed them to prevent the spread of Ebola to their communities.

KIs and FGDs confirmed that NGOs, including Global Communities were judged “effective” by both communities and CHT counterparts. This should be interpreted in the context of very heavy NGO activity that was still ongoing at the time of the study. These NGO activities include “handouts” of hygiene supplies, hygiene promotion, and sometimes money to EVD affected households and communities. CHT representatives went further and described Global Communities as a “very effective” partner because they were already heavily integrated with the GoL at the county level in WASH activities well before the outbreak. This facilitated collaboration in managing the response. CHT representatives cited only a few examples of small local NGOs that were “not effective” because they did not coordinate their activities with the county authorities and sometimes alarmed the already distraught population with inappropriate Ebola messages.

**Question 4: What was the role of the Liberian government, donors, NGOs and other service providers in Ebola education, prevention and response? What key approaches were used?**

The Government of Liberia (GoL) initiated several measures to address Ebola, including border closures, school closures, facilitating access to functioning health centers, and issuing restrictions for public gatherings and high-risk behaviors such as “bush meat consumption.” In addition, GoL institutions channeled critical health and Ebola-specific information through public media, supported training and capacity building as feasible, and provided emergency health supplies, as well as security services to response agencies, when and where available. GoL informants credited donors with providing financial support to NGOs and the GoL to implement its EVD response plan.

Since late 2014, UNICEF-supported NGOs (including Global Communities) have been very active in providing direct support to communities for Ebola education and response through hygiene promotion and distribution of materials (buckets, chlorine, etc.). By late 2014, several additional international NGOs, including Plan International and Samaritan’s Purse were involved in these activities. Radio messages regarding case detection, care-seeking and prevention were broadcast in Liberian English and indigenous languages by local radio stations in Lofa County; however, access to radios at the overall community level was low, and lower in non-CLTS communities where EVD was present. As noted, to increase access to critical broadcast information, Global Communities and other response agencies engaged in radio distribution. In the later stages of Ebola response, a mobile phone hotline was established and communities were encouraged to report cases so they could be linked to health facilities.

As time progressed and information campaigns intensified, communities were saturated with information through mass media, government, tribal officials, religious leaders and health workers. Fortunately, most of the information sources conveyed consistent messaging. Health workers (CHT and DHT) and radio messages were supplemented by community-level information and mobilization campaigns, led by NGOs.

Already embedded with GoL WASH programming at the County and District level, IWASH was well positioned to collaborate closely through Community Health Teams and provided support to CLTS focal persons working at the National, County and District levels. As a result of constant collaboration in the years leading up to the Ebola outbreak, trust and good working relationships had already been established between the government and the Global Communities. Community-based Natural Leaders already active in IWASH supported hygiene promotion through the Natural Leaders Network (NLN) established in the IWASH CLTS program, and also continued to trigger new communities for CLTS without significant external support.

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24 This approach has been cited by WHO as a “lesson learned” in successful approaches to the epidemic.
According to the CHT, this facilitated quick planning and action, particularly because Global Communities implemented IWASH through technically sound staff from a local office in Lofa County, in close proximity to the county CHT office. CHT representatives reported that Global Communities’ technical capacity and ability to quickly mobilize resources and get to the field were important and enabled them to reach communities with essential materials, training and supervision. Additionally, while the IWASH program created conditions for healthy practices and apparent risk reduction prior to the Ebola outbreak, supplemental services and activities introduced by other Global Communities programming, including safe burial teams and intensive hygiene promotion (with hygiene kits) may have added value during the emergency phase. Analyzing the impact and contribution of this USAID/OFDA-funded programming on Ebola transmission and case fatalities in Lofa County is outside the scope of this research but may present an opportunity for further investigation.

**Question 5: How did Global Communities refocus the IWASH project to address Ebola? What were the strengths and weaknesses of this approach?**

**Emergency Distribution**

IWASH collaborated with members of the Lofa CHT and supplied three front-line health centers on the border with neighboring Guinea that had no basic preventive materials and provided soap, chlorine, WaterGuard®, latex gloves, jerry cans, and nose masks. IWASH staff worked with gCHVs (Liberian Community Health Workers) and Natural Leaders to provide community education and sensitization about the importance of basic hygiene and safe behaviors needed to stop disease transmission. Ebola-specific information about safe burial practices, avoiding shaking hands and not consuming bush meat were added to hygiene messages. Messages also encouraged people to contact local health workers as soon as anyone in the community became sick. GoL and IWASH also aired integrated radio spots that went out into the wider community on market days.

CHT and Lofa County WASH partners reported that IWASH provided a solid foundation and framework that supported EVD activities, as many activities were already jointly implemented when the first case of EVD entered Lofa County from Guinea. Global Communities appropriately refocused IWASH activities and supplied soap and chlorine supplies for hand washing in the border areas. Global Communities organized community-wide meetings including Community Health Teams, government officials, Natural Leaders and traditional leaders to elaborate action plans for preventing the spread of Ebola in their communities.

**Relationships and Partnerships**

Well-established relationships and joint implementation of WASH activities at the county, district and community levels, developed over a significant period of time through IWASH prior to the Ebola outbreak, provided the foundation for collaborative planning. WHO has confirmed that these foundations at the district (similar to counties in Liberia) and sub-district (similar to health districts in Liberia) levels are important to an effective epidemic response. “Outbreak responders learned the importance of tailoring response strategies to match distinct needs at district and sub-district levels. An understanding of transmission dynamics at the local level usually reveals which control measures are working effectively and which ones need improvement.”

IWASH staff and program infrastructure was already deeply integrated with their GoL partners for IWASH at these levels of government. Global Communities also helped to establish the National-level WASH task force, convening key stakeholders (and local representatives of key ministries), so they were already well-positioned before the epidemic. The importance of developing these relationships are an important lesson for any national or regional CLTS/WASH program.

While working with multiple ministries at several levels certainly provided a strong foundation that facilitated the response, it was a time consuming process and Global Communities provided financial support to the government for many routine tasks, such as meetings, staff and travel that will need to be assumed by GoL in the future. Joint planning and ability to collaborate with other partners through support to Task Forces and regular meetings of partners is also a valuable feature.


USAID IWASH Project: Community-Led Total Sanitation
June 2015
of the IWASH approach. As the country returns to development programs after being declared “Ebola Free”, the long term sustainability, including financing, for WASH and CLTS to be incorporated into national development plans with limiting the operational role of international NGOs will need to be addressed.

Other factors beyond the role of the project (poor roads, weak health treatment infrastructure, and some cultural factors) presented multiple challenges. Working with multiple government ministries and private partners (such as other NGOs) through task forces and working groups developed trust between partners and allows for synergies of each partner’s strengths. As already mentioned, these relationships take time and developing them for the first time in the midst of a crisis can be exceeding difficult, especially with the influx of new players that are responding only to the emergency needs with no intention to play any role in the long term development of the sector. Supporting the GoL to remain “in control” of the sector is an important role Global Communities has continued to play in spite of the crisis.

Community and Local Empowerment

At the community level, foundations for community mobilization and collective action based on the communities’ own perceived needs are “triggered” through CLTS approach. A core component of this process includes capitalizing on existing community assets (such as Natural Leaders) and enabling communities to identify the resources that they need within their own communities (such as materials to build latrines). The result of community strengthening is an empowerment effect, decreasing a sense of dependency on outside entities. Establishing and supporting networks of effective community mobilizing agents (such as NLN), supported with appropriate and consistent monitoring and supervision, and continuing to engage these human capital resources in ongoing programs can support rapid mobilization for possible emergency activities while facilitating future development activities.

Question 6: Is there evidence that the existence of IWASH improved the health status of and/or ability of communities to protect themselves from the spread of the Ebola virus? If so, what differences can be documented?

Differences in EVD Prevalence in Sample Community Categories

Quantitative analysis of the household survey results found that out of 551 households sampled, 272 (49%) were in communities where at least a case of EVD was confirmed. Of the 272 households that were in Ebola affected communities, 36 (13%) were located in one community that had benefited from the CLTS project but dropped out and did not reach ODF. The remaining 236 households (87%) were in communities that had not participated in the CLTS project (see Figure 6).
Overall, households in CLTS communities were **17 times** less likely to have any cases of Ebola than households in non-CLTS communities.\(^2^6\)

Correlation is a measure of association between two variables and measured by with a calculation represented by “R”. Values for correlation are usually between -1 and +1, with a value of 0 implying that there is no correlation at all. The closer the R falls to 1 and away from zero, the higher the correlation and vice versa. The study found an **R of negative 0.6** indicating a **strong inverse correlation** between Ebola and CLTS. The correlation strongly infers that CLTS had an effect on community resistance to Ebola, but cannot directly confirm a causal relationship.

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\(^2^6\) The odds ratio for incidence of EVD in households in CLTS vs. non-CLTS communities was 0.06. The table below shows the breakdown of the sample according to CLTS and EVD status.

<table>
<thead>
<tr>
<th>EVD</th>
<th>CLTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>CLTS</td>
<td>203</td>
</tr>
<tr>
<td>Non-CLTS</td>
<td>76</td>
</tr>
<tr>
<td>Totals</td>
<td>279</td>
</tr>
</tbody>
</table>

The odds ratio is calculated by dividing the odds of EVD incidence in households in CLTS communities (0.18), by the odds of EVD incidence in households in non-CLTS communities (3.12) to reach a ratio of 0.06. In other words, households in CLTS communities were 17 times (1/0.06) less likely to have incidence of Ebola than households in non-CLTS communities. The odds ratio was calculated with a 95% confidence interval, and was statistically significant with a p-value of <.001.
Although the study was intended to measure differences only between verified ODF and EVD-infected communities, data indicate that communities that had participated in CLTS but not achieved verified ODF status also had much lower chance of contracting Ebola. Only one out of 18 ODF and non-ODF CLTS communities contracted Ebola, though limited IWASH program data was available for CLTS communities that were not validated as ODF. This is due to the fact that communities failing to take significant action toward reaching ODF were no longer monitored after a certain point by program staff. However some protective effect was likely provided by inherent characteristics of communities that participated in CLTS, or by the impact of CLTS triggering activities on community motivation to achieve verified ODF status. Further exploration of causal factors merits additional attention in light of the significance of an apparent correlation between CLTS and reduced Ebola risk.

Findings from the household survey (see Figure 7) confirmed that there were no cases of EVD in any of the 104 households in ODF communities. Survey results also indicated lower levels of Ebola infection in communities that were actively engaged in CLTS but did not achieve full ODF status. Out of eight non-ODF CLTS communities, only 36 households (27%) of one community were affected by Ebola. All of those EVD-affected households were located in one community that had benefited from the CLTS project did not reach ODF status. Qualitative investigation of the one community that was triggered for CLTS but did not reach ODF status found there had been internal conflict that had destroyed the community cohesion that may have enabled them to successfully achieve ODF status. In comparison, 236 households (76%) across 23 of the 25 surveyed communities that did not participate in CLTS programs reported confirmed Ebola cases.

Survey data, FGDs and KII evidence all support the hypothesis that the adoption of hygiene behaviors promoted by CLTS is correlated to reduced risk of Ebola in verified ODF communities; however, more research through well-designed controlled studies are recommended in order to determine any causal relationship ODF status and human disease transmission patterns. While ethical considerations may preclude the conduct of such studies during a rapidly-spreading deadly disease like Ebola, efforts to understand whether ODF status in a community can predict vulnerability to other communicable diseases may be possible, and could serve as a model for future testing of ODF status as a protective factor against infectious diseases that result from personal contact and poor hygiene.

Positive Behaviors to Guard against EVD

At the time of the study, both EVD and non-EVD communities reported significant increases in the adoption of specific positive behaviors, and variance in common water and sanitation-related infectious disease rates between CLTS and non-CLTS communities was observed. Relevance of these factors to Ebola transmission has been inferred, but not confirmed, by global health researchers. The results of additional targeted research could provide a foundation for developing a set of common indicators that could be used by both the WASH and health sectors.

Public health programs relevant to WASH programs currently measure change using two approaches. One approach is to measure change in disease prevalence at two points in time before and after the intervention. Examples include diarrheal disease, respiratory diseases, intestinal parasites and some skin diseases. Prevalence data for these diseases before and after CLTS was started was not measured in the IWASH program, although the study team attempted to

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27 Lofa County CLTS focal persons
28 Measuring Health Impacts of WASH programs webinar with Johns Hopkins University School of Public Health and CORE group, January 2015
estimate trends during the IWASH project from CHT health statistics but was unsuccessful in obtaining relevant data. FGDs and KII respondents with CHT officials independently volunteered perceptions that diarrheal diseases had significantly decreased in CLTS communities, and that CLTS/ODF communities reported fewer households with intestinal parasites and skin diseases.

Another way public health researchers attempt to determine changes in health status involves measuring increased coverage of evidence-based behaviors known to have an impact on the specific water and hygiene-related diseases already mentioned. Indicators to measure these changes include hand washing with soap/ash/chlorine at critical times, point of use water treatment, latrine use, and safe disposal of feces (including children). Monitoring data to qualify for ODF status documents some changes in these behaviors at each community, but not at the household level. In the survey, however, there were differences in self-reports of these key behaviors with significantly higher percentages of ODF communities using latrines as compared to EVD communities. Other indicators, such as presence of hand washing stations and clean latrines were directly observed by the survey team in a larger percentage of CLTS communities than in non-CLTS communities.

Numerous studies linking increased coverage of hand washing with soap and/or POU water treatment and decreased diarrhea and respiratory illness (primarily in children) have been conducted; however, published studies directly linking water and hygiene behaviors to preventing Ebola transmission are less prominent. Observational studies and anecdotal reports have noted that improved hygiene practices, especially hand washing and safe disposal of body fluids (including from dead bodies) appear to reduce the incidence of new EVD cases, but more research on these practices as well as understanding the EVD epidemic curve is necessary to fully understand how hygiene reduces individual risk of contracting Ebola.

**Understanding Natural Leaders**

Statistical analysis of multiple factors in the household survey showed that “Training by a Natural Leader” (a proxy for CLTS) emerged as an important and unique difference between communities that contracted Ebola and those that did not. Details of the regression analysis can be reviewed in the survey report. By definition, “Training by a Natural Leader” was a factor in the household survey that was unique to IWASH CLTS. Findings are sufficient to support a statistically significant correlation between CLTS methodology employed by IWASH through Natural Leaders and whether a community became EVD, but the study does not identify which components of CLTS was the most important. Research regarding human health behavior changes indicates that training WASH topics, “messaging” or even “triggering” were probably not sufficient to transition a community from “awareness” to “taking action.” Factors such as trust, NL leadership skills, community’s collective capacity to respond to shocks (“resilience”), supportive supervision or other factors may also have contributed to the results, but additional research will be needed to identify which of these, or other factors might have been the most important.

The direct relationship with specific CLTS practices and prevention of community level infectious diseases has not yet been documented in the scientific literature. Empirically, EVD transmission rates and infections decreased as recommended WASH behaviors promoted by NL (such as hand washing and household hygiene improvement) increased and became mainstream in high risk areas. Community structures (NLs, engagement of community governance structure, enforcement mechanisms (such as fines) that were put in place to mobilize and maintain the behaviors required will all need to be assessed to determine the significance of each measure in Ebola outcomes for a given community. Strict adherence to national CLTS protocols without short-cuts or “give aways” that may have compromised intended results facilitated a review of outcomes and impacts associated with implementation of “the full CLTS package.”

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30 Epidemics of many infectious diseases have a tendency (but no guarantee) of ending over time with, or without intervention
31 Available upon request
Relationship between CLTS Natural Leaders and EVD

Fifty-six percent of households in CLTS communities had received training from a Natural Leader. The remaining households in those communities did not receive training directly from a Natural Leader, although they may have participated in CLTS activities in other ways. Most survey participants specified that NL training included overall hygiene topics covered during triggering, as well as Ebola-specific topics once the epidemic broke out. By definition, training from a Natural Leader is linked only to IWASH CLTS and therefore indicates an effect of CLTS. Statistically significant differences in incidence of EVD were found between communities that reported training by a NL and those that did not (Figure 8). Nearly all (91.5%) of the EVD-affected households had not received training from an NL. The 45.8% of households that remained Ebola-free despite not having NL training include households in ODF/CLTS communities that did not receive training directly from an NL. The 8.5% of EVD-affected respondents reporting NL training are assumed to represent the single non-ODF CLTS community of 36 households affected by EVD that had dropped out before reaching ODF. Although NL training is a proxy for CLTS, findings from the qualitative portion of the study suggest that this particular aspect of CLTS may have had a protective effect against Ebola in the communities.

The research does not assert that ODF status equates to the absence of Ebola or resistance to Ebola in the community. However, survey data do indicate that the process of achieving ODF status, which includes significant change in various hygiene behaviors and sanitation practices provide an enabling environment, and can be interpreted as building protective factors in the community. Given that communities also commit to taking specific and measurable actions to achieve verified ODF status, behavioral indicators are likely to be higher in CLTS/ODF communities than in communities where these actions are not taken. In this context, a more detailed analysis of individual CLTS components that result in successful ODF verification, and further examination of behavior indicators will support further understanding of any causality in the relationship between Ebola transmission rates and CLTS programming.

NLs have continued to be active in their communities and engaged in (non-IWASH) hygiene promotion activities as part of the continuing EVD response. Interestingly, verified ODF communities have developed enforcement mechanisms (such as fines) for any return to open defecation practices, indicating that behavior change was sustained for at least one year in ODF communities. ODF communities and NLs also reported a perceived reduction in diarrheal illness even prior to the EVD outbreak as a result of improved feces disposal. The study team was unable to verify this with CHT data. Survey enumerators, on the other hand, who were not involved in IWASH, and local authorities observed clear differences in cleanliness and observable feces between ODF communities and non-ODF communities.

Conclusions from the Study Findings

The study confirmed that there were no EVD cases in ODF communities. CLTS communities, even those that dropped out before reaching ODF, were 17 times less likely to have EVD cases than communities that had not participated in CLTS. These findings support a strong and significant correlation between successful implementation of CLTS (through ODF verification) and significantly reduced risk of EVD (0% in the study sample). Training by a NL (by definition an intervention of CLTS) was also significantly correlated with decreased risk of EVD. This supports findings from qualitative methods that positive behaviors in hand washing, latrine use, POU treatment of water, and safe disposal of feces that started prior to the EVD outbreak were significantly higher in CLTS/ODF communities than in non-CLTS communities and may have provided protection against EVD transmission on those communities.
Because verified ODF status requires that specific behaviors and physical infrastructure are maintained in the community, the presence and continuation required behaviors and stewardship of WASH infrastructure are further evidence that ODF communities took action to address hygiene and sanitation prior to the Ebola Outbreak. The study cannot identify which specific behaviors or processes might have been more important than others; further analysis is required to fully understand the importance and contribution of each measure to ensuring community health and reducing Ebola risk.

While this study establishes an existing correlation between adoption of CLTS behaviors and verified ODF status prior to the EVD outbreak and resistance to EVD, the evidence does not conclusively isolate CLTS as the only protective factor. The full impact of CLTS on Ebola rates is inconclusive and requires additional research, as well as a more in-depth comparative analysis between non-CLTS communities who did not contract Ebola and ODF communities. In addition, further examination of the role of trust and social capital in communities with low or no Ebola caseloads will provide valuable insight regarding where future programming efforts should invest time resources and energy in order to provide the greatest level of protection against future health epidemics. Expansion into larger communities in the IWASH project area, especially in semi-urban areas that was planned but curtailed due to the epidemic, still needs to be implemented and tested. Application of CLTS methodologies that encourage ODF and sustainable maintenance of healthy hygiene practices in peri-urban and urban areas should constitute a priority.

Lessons Learned

IWASH activities, at both national and community levels, strengthened local organizational structures and capacity through strong collaborative partnerships and joint implementation of WASH programs with the GoL. Global Communities was therefore well-positioned to support community-based prevention and response measures when the Ebola outbreak occurred. This collaboration was extremely important to enabling programmatic agility and responsiveness to address all aspects of the Ebola emergency response. Well-established relationships and joint implementation of WASH activities with partners, including the GoL at the county, district and community levels, developed over several years, but prior to the epidemic, provided the foundation for collaborative planning and implementation.

Global Communities’ support to IWASH communities was decidedly a factor in the success of Ebola response in Lofa County. CLTS strengthened community capacity to draw upon their own resources and increased community “resilience,” enabling communities to absorb the shock of the EVD outbreak. Structures developed by CLTS at the community-level were not EVD-specific but were intended to provide sustainable mechanisms to maintain community health and will likely remain in place as a foundation for additional community-based development activities.

Global Communities made major contributions to the GoL to adapt CLTS to the Liberian environment. With additional support for implementation, quality could be maintained, communities could know what was expected of them and monitor their progress towards ODF. The study team felt that IWASH’s success in achieving such a high number of ODF communities in their two health districts, when NGOs implementing ODF in other Lofa health districts had not completed any, was largely due to following the specific protocols: quality assurance, monitoring and the verification processes that were adopted at the national level with Global Communities’ encouragement. GoL was engaged at every step including when providing supportive supervision, a critical element in community-based programs working with volunteers. Partners and NL in Lofa County remain very enthusiastic about CLTS because results have taken hold in the long term, as CLTS is now included in the national pre-service

“We see the results and the people living in the districts can see it too. You can tell the community is cleaner and more sanitary as soon as you enter...People are building and using latrines in places where they never succeeded before.”
– Community Members, Lofa County

32 KII with Lofa County and Global Communities
education curricula for health workers, including EHTs, and will promote sustainability through large numbers of Liberian WASH professionals trained to implement CLTS throughout Liberia.

IWASH maintained good CLTS monitoring records in a computer database that was easily sortable and accessible, providing timely answers to questions posed by the study team. Available data was very valuable in providing evidence to the team about activities and processes that had taken place in the past. However, the research team notes that electronic records, data flow and database processes need to be updated to be useful in future programs.

**Recommendations**

*If linkages between IWASH and EVD resistance/prevention can be documented, what recommendations can be provided for future programming linking WASH to prevention of infectious diseases, including EVD? Are there recommendations for future development programs that might need to quickly refocus programming to respond to public health crises, such as Ebola?*

1. Additional detailed epidemiological studies should be undertaken to understand more about the patterns of Ebola transmission within the population as well as households and communities that contracted EVD. The presence and behavior of "positive deviants" (those who were not infected when other similar households or individuals in similar circumstances were infected) could be studied to determine what protective factors supported resistance to Ebola despite high risk and proximity. Global Communities should consider additional research regarding the only CLTS community that did not attain ODF status (and any others that were not included in the study sample) and identify any factors, conditions, characteristics, or exposure that increased vulnerability to Ebola. Global Communities should also make the data set from the household survey and CLTS monitoring records available for any ongoing or future WASH and Global Health epidemiology and Social and Behavior Change (SBCC) studies.

2. Global Communities should continue to share their experience of the CLTS/ODF experience in the WASH task forces and other development fora and also contribute to ongoing analysis in the health sector regarding protective factors observed in communities and households.

3. If specific health outcomes from CLTS are to be proven in the future, then well-designed Operations Research should be included in the design of future WASH or CLTS programs. If these studies are to include health outcomes, then a population-based Knowledge, Practice and Coverage (KPC) survey (or similar measure) should be conducted at baseline and at the end of the program and analyzed as part of the program results.

4. Only 32% and 28% of all the communities in Kolahun and Voinjama districts respectively were covered by the IWASH CLTS project. The Ebola experience has increased demand for increased sanitation, especially latrines, in Lofa County. Global Communities should build upon public momentum created during ODF verification ceremonies and successful demonstrations of EVD resistance that have increased awareness regarding the necessity of healthy and hygienic practices in creating an enabling environment for community prevention and mitigation against health epidemics. Global Communities should document CLTS implementation methodology for public review, including: selection criteria for the Natural Leaders, developing Natural Leader Networks, training curriculum and methods used, data collection tools, reporting structures, any supervisory checklists, etc. so that partners that want to adopt or support the strategy can benefit from the Global Communities’ experience.

5. Expansion into larger communities, including those located in urban and semi-urban areas that was curtailed due to the epidemic, should be resumed and the adapted methods to implement CLTS in those types of communities should be tested and documented.

6. IWASH databases proved extremely valuable for documenting how IWASH monitored the entire CLTS implementation process through ODF verification. Some recommendations have been made to Global Communities regarding a need to update data capture methods, databases and use of newer GPS systems. Future programs
would also benefit from follow up stronger documentation of reasons or factors that explain why “drop-out” communities did not continue to ODF status. Global Communities should continue their collaboration with GoL in updating WASH indicators for monitoring and evaluation (GoL has already identified and planned to revise their indicators). In particular, ODF verification criteria included in checklists need to be weighted according to the importance of each of the criteria.

7. Additional opportunities for linking WASH to the health structure are evident. Although EHTs are supervising Community Health Volunteers and act as CLTS focal points at the district level, WASH activity connections with health programs at the community level could be strengthened, especially in relation to disease prevention. Linking NLNs with programs that can sustain their function in water and sanitation such as income generation (piloted in IWASH) or community savings and loan groups may support them to continue without external or direct government financial support. This has been started to some extent through the WASH entrepreneurs. Other forms of “motivation” such as training, recognition and engaging them in future activities (such as the current hygiene promotion) can help them continue to remain active.

8. If Global Communities wants to measure health impacts of future WASH programs, baseline surveys of relevant health-related performance indicators should be collected before and after interventions are implemented to support further analysis of the public health impacts of WASH programming. Assessing the disease-related impacts of WASH and CLTS will not be possible without health related monitoring and evaluation methods embedded in WASH programs. The international public health and development communities already recognize the need for better evidence-based indicators of success for CLTS and WASH overall. Global Communities’ WASH experts should contribute to these discussions. Data collected in the household survey and the IWASH monitoring database could be a rich source for research by schools of public health, health and WASH partners programs and for EHT and health students in Liberia. The WASH cluster that meets regularly in Monrovia may identify additional ways to use the databases and survey results to support research. Overall, data from the study survey can add additional depth of understanding about the socioeconomic, education and cultural influences on adoption of prevention behaviors for Ebola and the diseases which were prevalent in the area prior to the crisis.

Opportunities for Program Strengthening

**Disposal of Child Waste:** The household survey revealed that high percentages of households, even in ODF communities, did not always practice safe disposal of child fecal matter (not buried or disposed of in latrines). This is consistent with the findings in the 2013 LDHS. CLTS training should increase emphasis on safe disposal of child feces, include it in monitoring and add this to the ODF criteria checklist. Hand washing at some critical times is high in both ODF and non-ODF communities, but the survey indicated hand washing at other times need strengthening to improve overall health impacts.

**Deworming:** Routine deworming of children will be one way of supporting and sustaining the improved sanitation status from CLTS. The CHT, and not Global Communities, would be the best ones to do this through their community health or school health programs.

**Gender Balance in Program Activities:** Only 20% of NLs in the project were female. FGDs in ODF communities cited literacy requirements (needed to fill out reporting forms) as the barrier to female participation because their levels of education are significantly lower (in a population where 2/3 of the population has not completed primary school). Women expressed an eagerness to participate as NLs and male NLs suggested “pairing” may be a solution if women met all of the other NL characteristics. USAID-funded health programs are now required to report on gender considerations in their programs. Global Communities should document how gender is considered in their CLTS programs, and contribute to developing methods to make CLTS programs more inclusive of women volunteers.
Additional Issues Identified by the Team

The need for joint programming between the public health sectors (especially maternal, newborn and child health) and WASH experts have been acknowledged by both disciplines for decades, but the “way forward” toward successful collaboration and implementation (along with appropriate monitoring and evaluation indicators of progress toward objectively measurable impact) have yet to be mainstreamed at a global level; therefore, opportunities to demonstrate if/how CLTS has measurable health impacts (disease reduction, improved treatment, increased child growth, health expenditures, etc.) are limited, even when empirical data suggests otherwise.

Households must to have access to water, whether clean or not clean. During much of the year, access to water in many CLTS and non-CLTS communities decreases. This is not a shortcoming of CLTS per se, but indicates that there is still more to be done to address overall gaps in WASH needs in Lofa County. Many wells and hand pumps installed by donors during the emergency programs after the Liberian Civil War and the recovery period have ceased functioning due to many factors; one of these is lack of maintenance of wells and hand pumps in communities. Community water committees established for this purpose when they were installed during that time have largely become inactive. IWASH began to address this issue by training pump mechanics, but access to operations and maintenance goods and services is not universal. While not a deficit of CLTS, water supplies are poor in both ODF and non-ODF communities. This highlights a continuing need for partners to advocate for support for the GoL to address the global and structural constraints that prevent access to clean water.

Local enumerators hired for the IWASH survey reported to the study team that EVD communities have large numbers of individuals in need of sustained psychosocial support due to severe emotional distress and hardships associated with the deaths of their relatives. Identified needs include psycho-social support as well as additional attention to re-establishing livelihoods and family systems. Some women are widows with no means of support, and many children to support, including the children of co-wives who died. Women’s FGDs in EVD communities reported that they needed help to get their children into school. It is unclear the basis for this concern and Lofa County schools were in process of reopening at the time of the study. These concerns are unrelated to the IWASH project but their concerns were relayed to USAID.

Global Communities is not expected to develop a program to address the severe psychological trauma experienced in EVD communities; however, monitoring this trend in program areas and allowing for a referral system can benefit the larger population with mental health needs.