# TARGETING COMMUNITY-LED TOTAL SANITATION (CLTS) TO FAVORABLE CONTEXTS:

## FACTORS CONTRIBUTING TO THE SUCCESS OF CLTS IN LIBERIA

## Study Findings

- CLTS is not uniformly successful. In Liberia, of 2,011 villages from two programs coordinated by Global Communities (the Improved Water, Sanitation and Hygiene Program and the Partnership for Advancing Community-Based Services Program), only 57% had achieved open defecation free (ODF) status.
- Implementers should focus CLTS programs in areas where local contexts are best suited for the approach. Favorable areas can be determined by leveraging the information they collect on program villages as well as publicly-available data on local contexts.
- We identified six factors that influence CLTS performance in Liberia. Villages were more likely to achieve ODF status if they had fewer households, lower access to improved water sources, lower water scarcity, higher forest coverage in the immediate vicinity, higher diarrhea prevalence at baseline, or were further from major roadways.
- Villages with approximately 15 households or less, 25% diarrhea prevalence at baseline or more, 65% forest coverage or more, a water scarcity ratio of 1.4 or less, and between approximately 10 to 16 kilometers from major roadways were more likely to achieve ODF than villages not meeting these criteria.

### Study Overview

The USAID Water, Sanitation and Hygiene Partnerships and Learning for Sustainability (WASHPaLS) project examined CLTS datasets in four countries to quantify the extent to which environmental, demographic, accessibility, and socioeconomic factors affect ODF achievement. In Liberia, we examined 2015-2018 performance data from the Improved Water, Sanitation and Hygiene Program and the Partnership for Advancing Community-Based Services Program, both coordinated by Global Communities. The resulting dataset (2,011 villages) included villages from 151 clans (the smallest division of local government) out of 815 nationally (Figure 1).

### Approach

We assessed CLTS performance based on whether a village had received ODF certification ("ODF achievement") according to Global Communities' database.

We examined the influence of 13 contextual factors listed in Table 1 and identified those that were closely associated with ODF achievement. We expressed model results as Odds Ratios (ORs) where values greater than 1 indicated a positive association between contextual factors and ODF achievement. P-values up to 0.1 can offer insight on general trends, but we deemed p-values greater than 0.05 statistically insignificant. To aid implementers in identifying areas favorable for CLTS, we determined two "split points" delineating three regimes of CLTS favorability (most favorable, somewhat favorable, and least favorable) for each key contextual factor. The first split point identified was the value that maximized the homogeneity of ODF achievement on one side and non-achievement on the other side. The algorithm then used the same methodology to find the second-best split. We note that these "split points" should not be interpreted as strict thresholds; villages with values just above and below splits are expected to respond similarly. Implementers can use this information to identify areas most favorable for CLTS and adapt their program accordingly. Detailed methods and limitations are described in a journal publication.[1]

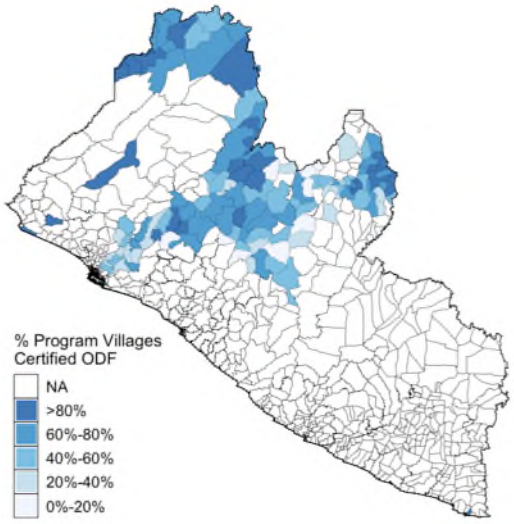


***Figure 1. Percent ODF achievement among program villages per clan.*** *Overall, 57% of study villages were certified ODF.*

| Table 1. Contextual factors examined in this study with data source and resolution. | | | |
|---|---|---|---|
| VARIABLE | PROXY | SOURCE | RESOLUTION |
| Distance to major waterbodies | Distance to inland waterways (lakes, rivers) | Satellite imagery[2] | Village |
| Village size | # of households | Global Communities | Village |
| Access to improved water | % of population with access to improved water | Statistical interpolation from DHS survey[3] | 5km x 5km |
| Water scarcity | Water use divided by water availability | Hydrological model[4] | 60km x 60km |
| Shrubland coverage | % coverage of shrubland per unit area | Satellite imagery[5] | 300m x 300m |
| Population density | # people per square kilometer<br>Average population per square kilometer in the clan | Satellite imagery + census[6] | 100m x 100m<br>Clan |
| Waterborne disease burden | Cholera predicted incidence<br>Diarrhea prevalence at baseline | Statistical interpolation of incidence data[7]<br>Global Communities | 20km x 20km<br>Village |
| Forest coverage | % coverage of forest per unit area | Satellite imagery[8] | 30m x 30m |
| Remoteness of village | Time to cities<br>Distance to main roads | Satellite imagery[9]<br>Crowd-sourced GPS tracks[10] | 1km x 1km<br>Village |
| Literacy | % literacy among women | Statistical interpolation from DHS survey[3] | 5km x 5km |

## Findings

We identified six contextual determinants of ODF achievement in Liberia (Figure 2). Villages were more likely to achieve ODF status if they had fewer households, were further from major roadways, had lower access to improved water sources, higher diarrhea prevalence at baseline, higher forest coverage in the immediate vicinity, or lower water scarcity.

**Higher CLTS success in villages with a smaller population:** Smaller villages were more likely to achieve ODF status (Figure 2). A number of reasons may explain this trend. Villages with fewer households are easier for implementers to engage with during triggering events and follow-up.[11] These villages may experience higher social cohesion and stronger local leadership.[12,13] Stronger relationships between households may also facilitate information transfers about latrine design and available construction materials. Finally, fewer households translates to fewer latrines to be constructed to reach ODF certification benchmarks.

While a smaller village size was generally more favorable, we found that villages with fewer than approximately 60 households were most favorable, achieving ODF status in 60% of cases (in villages >61 households) (Figure 3).

**CLTS was more successful in areas with lower access to improved water**. We found a correlation between ODF achievement and low access to improved drinking water sources (Figure 2). Implementers noted that NGOs and donors sometimes prioritize ODF villages for water projects.[11] In such cases, villages with no improved water source may be more motivated to build latrines, translating into higher ODF achievement.

**CLTS was more successful in areas with lower water scarcity (Figure 2).** Areas with a water scarcity ratio close to or below 1.4 experienced the highest probability of ODF achievement (65%), and villages between 1.4 and 1.7 achieved ODF status in approximately 59% of cases (Figure 3). Villages in water stressed areas may be less focused on sanitation due to competing priorities. Water scarcity may also be an indication of a lack of other resources such as agricultural or financial resources.

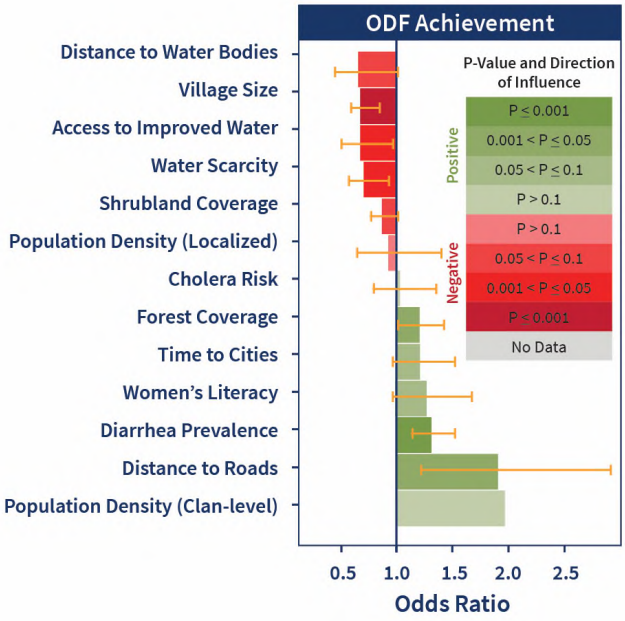


***Figure 2. Outputs of logistic regression models in terms of odds ratios (OR).*** *Each bar represents the output of a specific multivariate model, derived for the explanatory variable of interest (rows). Results are displayed as Odds Ratios (length of the bar), p-values (shade, darker=more significant, lighter=less significant), and direction of impact (color, green=positive, red=negative), and 95% confidence intervals (in gold). Confidence intervals for clan-level population density exceeded the plot boundaries and were removed for clarity (Liberia: 0.61-5.34).*

**Higher diarrhea prevalence at baseline was strongly correlated with ODF achievement (Figure 2)**. Practitioners have previously proposed that villages with a higher disease burden are easier to motivate about sanitation improvements. In fact, prevalence of waterborne disease, and diarrhea in particular, was listed as a favorable characteristic for CLTS

implementation in the CLTS Handbook.[14] Villages with 25% diarrhea prevalence or more at baseline achieved ODF in 73% of cases. The least favorable regime was limited to villages with rather low diarrhea prevalence (<1.4%, Figure 3).

**Villages in more forested settings had higher ODF achievement.** While it has been reported that natural cover such as forest, shrubland or waterbodies can provide shelter for OD, in Liberia we found higher ODF achievement in villages with higher forest coverage (Figure 2). Villages with more than approximately 51% forest coverage in the immediate vicinity achieved ODF in over 58% of cases, with those with over 65% forest coverage showing the most success (Figure 3). Community members, and women in particular, may perceive the forest as dangerous.[15] With respect to environmental conditions, we also found that proximity to major waterbodies and lower shrubland coverage were weakly correlated with ODF achievement (Figure 2).

**CLTS was more successful in remote settings.** Villages further from main roadways and major cities experienced higher ODF achievement (Figure 2). This is potentially because remote villages have stronger social cohesion, higher socioeconomic homogeneity, and have been exposed to fewer subsidy-driven sanitation programs in the past.[12,14,16] Our implementing partners have also observed that urbanized villages are more difficult to trigger because households have less time to attend mobilization events and also have less space for building latrines.[11,17] The association was not completely linear, with villages between 10 and 16 kilometers from major roadways being most likely to achieve ODF (Figure 3).

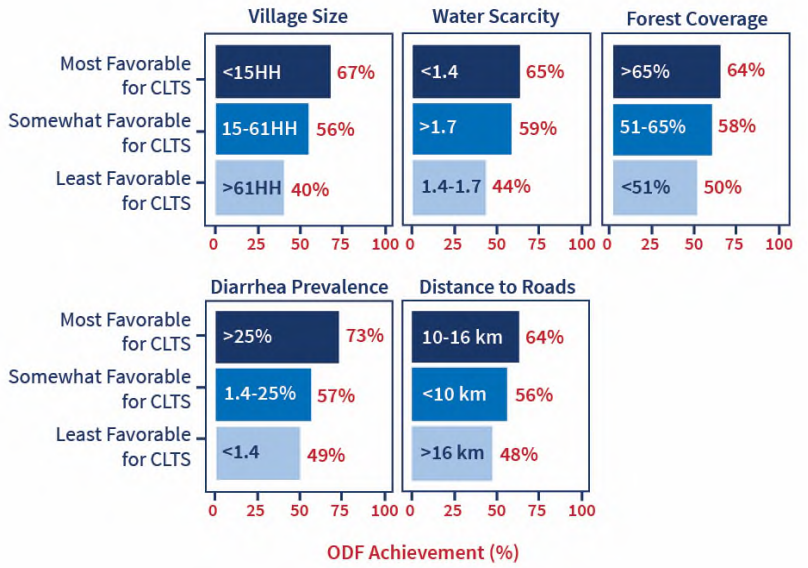


***Figure 3. Favorability regimes for ODF achievement.*** *While the split points are the values of the contextual factor corresponding to the largest possible differences in ODF achievement across regimes, they should be interpreted as guidelines rather than strict thresholds.*

**Achieving a higher probability of ODF achievement by considering multiple factors:** Using five significant contextual factors (village size, forest coverage, water scarcity, distance to roads, and diarrhea prevalence at baseline)[i], we identified two types of villages with at least 70% probability of ODF achievement: 1) villages with a water scarcity ratio under 1.7 and fewer than 11 households; 2) villages with a water scarcity ratio of 1.1-1.7, fewer than 11 households, and more than 54% forest coverage. Villages meeting either of these criteria achieved ODF in over 70% of cases, which is substantially more than the overall program (57%). Targeting villages with a higher probability of success could help improve the cost-effectiveness of CLTS programs.

Data limitations such as low-resolution variables (e.g., water scarcity, cholera risk) or unavailable datasets (e.g., poverty, men's literacy) may have affected our results.

## Implications

This study demonstrated that it is possible to gain insights on the contexts most favorable for the CLTS approach by leveraging publicly available, high-resolution datasets on accessibility and socioeconomic factors. While extensive literature has documented how the quality of CLTS implementation can improve outcomes,[12,18] our results indicate that implementers should equally focus on targeting geographic areas most suitable for the approach. CLTS programs in Liberia perform better in smaller villages, those with lower access to improved water sources, higher diarrhea prevalence at baseline, lower water scarcity, higher forest coverage in the immediate vicinity, and/or located further from major roadways. CLTS implementers would thus benefit from recognizing these influences and incorporating them into their planning.

[i] Access to improved water was removed from this analysis due to failed Wilcoxon test (Wilcoxon p-value >0.05).

The determinants of CLTS performance in Liberia differed from other countries. For example, in Cambodia, ODF achievement was higher in areas with high accessibility.[1] These divergences suggest that cultural preferences and co-existing sanitation interventions can affect the "performance envelope" of CLTS. In locations like rural Liberia where rudimentary pit latrines made with wood and mud are still widely accepted, remote areas with low economic status are actually are more receptive to CLTS due to stronger social cohesion and fewer prior experiences with sanitation subsidies. In contrast, in locations like Cambodia, intensive sanitation marketing interventions have popularized pour-flush toilets made with durable construction materials such as concrete and ceramic.[19] In these areas, rural sanitation programs, including CLTS, are more successful in accessible areas with higher economic status.[1] Implementers should examine the data at their disposal (through their own data collection or public datasets) to understand the determinants of CLTS performance in their specific program areas and identify favorable and unfavorable areas for this approach.

We do not suggest that implementers should avoid difficult areas altogether. In fact, the gradual shift to area-wide programming will require that Liberian implementers address all villages within a given jurisdiction. Implementers can leverage information on favorability to strategically prioritize timing of implementation and evaluate if CLTS should be combined with, or replaced by, other approaches. These types of data-informed decisions could help improve the cost-effectiveness of CLTS interventions.

Finally, we encourage implementers to continue to collect M&E data post-ODF to further investigate the drivers of ODF sustainability.

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## About USAID/WASHPaLS

The USAID Water, Sanitation and Hygiene Partnerships and Learning for Sustainability Project (USAID/WASHPaLS) is a five-year task order funded by the Bureau for Global Health that identifies and shares best practices for achieving sustainability, scale, and impact of evidence-based environmental health and WASH interventions. Through extensive desk reviews, key informant interviews, and field-based implementation research, USAID/WASHPaLS works with implementing partners to broaden the evidence base on the use and effectiveness of sanitation interventions, including Village-Led Total Sanitation (CLTS), market-based sanitation (MBS), and hygienic environments for infants and young children. For further information about this and other aspects of the project, as well as to access our knowledge products, please visit **globalwaters.org/washpals**.