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

FACTORS CONTRIBUTING TO THE SUCCESS OF CLTS IN ZAMBIA

Study Findings

- CLTS is not uniformly successful. Of 9,017 villages from the Zambia Sanitation and Hygiene Program (ZSHP), only 35% had achieved open defecation free (ODF) status (i.e., had at least one report of 100% basic sanitation coverage), and among those only 30% had sustained ODF status (i.e., retained 90% basic sanitation coverage after ODF achievement).
- 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 *ODF achievement* in Zambia. Villages were more likely to achieve ODF status if they had fewer households, were further from cities and from major waterbodies, were in areas with higher water scarcity, lower overall access to improved water, or higher cholera risk.
- We identified six factors that influence *ODF sustainability* in Zambia. Villages were more likely to sustain ODF status if they were in wards with higher population density, were closer to cities, closer to major roadways, had lower shrubland coverage, lower access to improved water sources, or higher water scarcity.

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 and sustainability. In Zambia, we examined CLTS performance data from the national WASH Management Information System (WASH MIS), which tracks the progress of Zambia's Sanitation and Hygiene Program (ZSHP). The cleaned WASH MIS dataset (9,017 villages) covered the period 2013-2018 and included villages from 434 wards (the smallest division of local government) out of 1,287 nationally (Figure 1).

Approach

We assessed CLTS performance based on whether a village had achieved ODF status ("ODF achievement"). We assumed that a village had achieved ODF status if its latrine coverage reported in the WASH MIS ever exceeded 100%, consistent with national guidelines.[1] For ODF villages, we also assessed whether they had sustained 90% latrine coverage or more over the data record ("ODF sustainability").

We examined the influence of 13 contextual factors listed in Table 1 and identified those that were closely associated with to ODF achievement and sustainability. We expressed model results as Odds Ratios (ORs), where values greater than 1 indicated a positive association between contextual factors and ODF achievement or sustainability. 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.

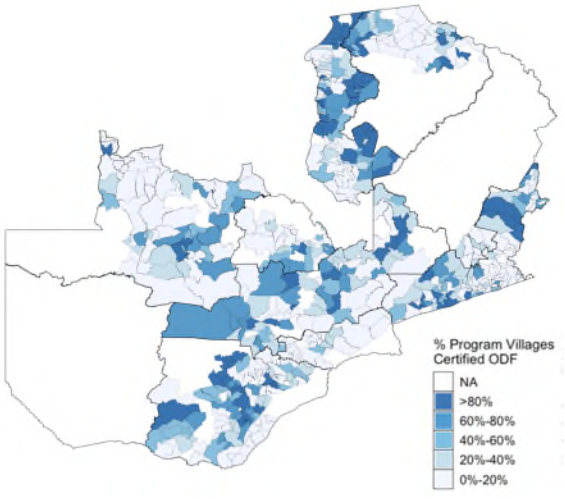

Figure 1. Percent ODF achievement among program villages per ward. *35% of study villages had achieved 100% latrine coverage (ODF).*

CLTS performance metrics

ODF achievement: has the village ever achieved 100% toilet coverage? (binary)

ODF sustainability: has the village remained above 90% toilet coverage following ODF achievement? (binary)

National ODF Guidelines: No sign of OD, and every house has a latrine with a superstructure, a smooth/cleanable floor, a lid, and a handwashing device with soap/ash.

Table 1. Contextual factors examined in this study with data source and resolution.

VARIABLE	PROXY	SOURCE	RES.
Village size	# of households	ZHP WASH MIS	Village
Access to improved water	% of population with access to improved water	Statistical interpolation from DHS survey[2]	5km x 5km
Population density	# people per square kilometer Average population per square kilometer in the ward	Satellite imagery + census[3]	100m x 100m
Shrubland coverage	% of coverage of shrubland per unit area	Satellite imagery[4]	300m x 300m
Remoteness of village	Time to cities	Satellite imagery[5]	1km x 1km
	Distance to main roads	Crowd-sourced GPS tracks[6]	Village
Forest coverage	% of cover of forest per unit area	Satellite imagery[7]	30m x 30m
Literacy	% literacy among men % literacy among women	Statistical interpolation from DHS survey[2]	5km x 5km
Distance to major waterbodies	Distance to major inland waterways (lakes, rivers)	Satellite imagery[8]	Village
Waterborne disease burden	Cholera predicted incidence	Statistical interpolation of incidence data[9]	20km x 20km
Water scarcity	Water use divided by water availability	Hydrological model[10]	60km x 60km

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 point. We note that these "split points" should not be interpreted as strict thresholds; communities 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.[11]

Findings

We identified six statistically significant contextual determinants of ODF achievement and six of ODF sustainability in Zambia (Figure 2). Villages were more likely to achieve ODF status if they had fewer households, had lower access to improved water sources, were further from cities and major waterbodies, had higher cholera risk or higher water scarcity. Villages were more likely to sustain ODF status if they had lower access to improved water, were located in wards with higher population density, had lower shrubland coverage in the immediate vicinity, were closer to major roadways and cities, and had higher 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.[12] These villages may experience higher social cohesion and stronger local leadership.[13,14] Stronger relationships between households may also facilitate information transfers about latrine designs and available construction

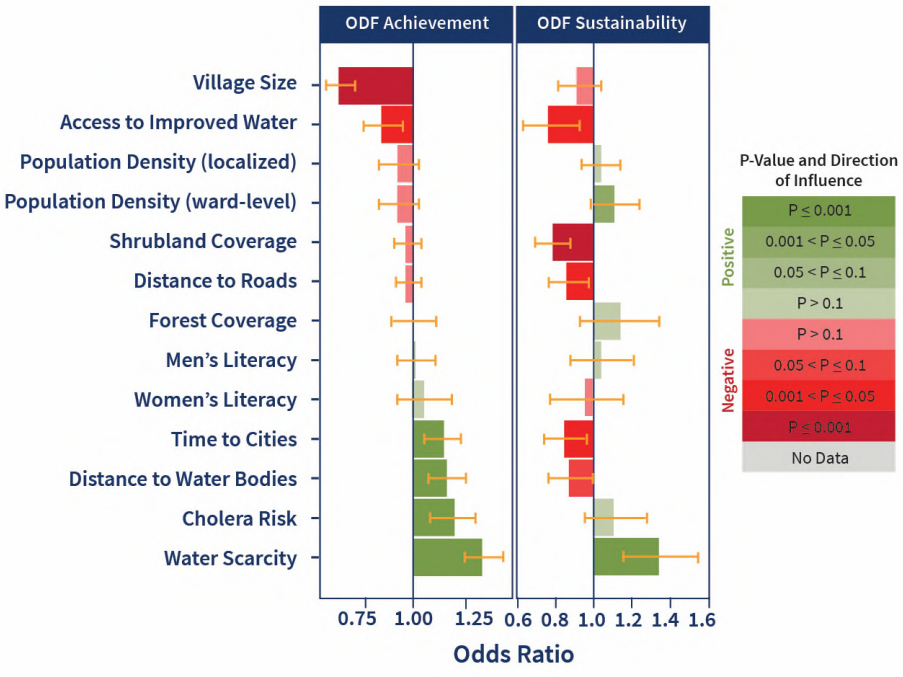

Figure 2. Outputs of logistic regression models in terms of odds ratios (OR). *Each bar represents the output of a specific multivariate model, derived for the explanatory variable of interest (rows) and outcome variable (columns). Results are displayed as Odds Ratios (length of the bar), p-values (shade, darker=more significant, lighter=less significant), and direction of impact (color, green=positive, red=negative), and 95% confidence intervals (in gold).*

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 32 households were most favorable. In contrast, villages with more than approximately 75 households were least favorable, achieving ODF status in 19% of cases, lower than the program-wide average of 35% (Figure 3).

Village size was not associated with ODF sustainability, indicating that the above benefits of small villages may not translate to sustained behavior change.

Both ODF achievement and sustainability were more likely in water stressed villages with lower access to drinking water (Figure 2). We found a correlation between ODF achievement and low access to improved drinking water sources (Figure 2). Implementers noted that some NGOs prioritize villages with high latrine coverage for water projects.[12] In such cases, villages with no improved water source may be more motivated to build latrines and keep them functional, translating into higher ODF achievement and higher ODF sustainability. While lower access to improved water was generally more favorable, the villages from 25% to 95% had the highest probability of ODF achievement (Figure 3).

Similarly, CLTS was more successful in villages with higher water scarcity and located further from major waterbodies (Figure 2). Villages in water stressed areas typically have fewer resources overall and may be more responsive to development programs, and in particular to water supply incentives as described above.[11] Villages located further than 27 kilometers from a major waterbody achieved ODF status in 38% of cases compared to only 27% in those closer than 12 kilometers (Figure 3).

ODF achievement was more likely far from cities, but ODF sustainability was higher in more accessible areas (Figure 2). Villages further than 34 minutes from a city experienced 38% ODF achievement (with even higher achievement further than 92 minutes), while villages closer to cities only achieved ODF in 23% of cases (Figure 3). This finding is consistent with prior studies, which have reported that remote areas can be more receptive to the CLTS approach, particularly if they have received fewer WASH programs in the past.[14]

In contrast, ODF *sustainability* was higher in accessible areas characterized by a short distance to roads, short travel time to cities, and high population density (Figure 2). Such areas have easier access to market centers and construction materials, allowing for quicker recovery when a latrine is damaged during the rainy season. Less remote areas also tend to be wealthier,[15] favoring the construction of durable latrines. Finally, these areas are easier for implementers to reach for follow-up.[12]

Higher cholera risk was strongly associated with ODF achievement (Figure 2). Researchers and implementers have proposed that villages with a higher disease burden are easier to motivate about sanitation improvements. In fact, prevalence of waterborne disease, was listed as a favorable characteristic for CLTS implementation in the CLTS

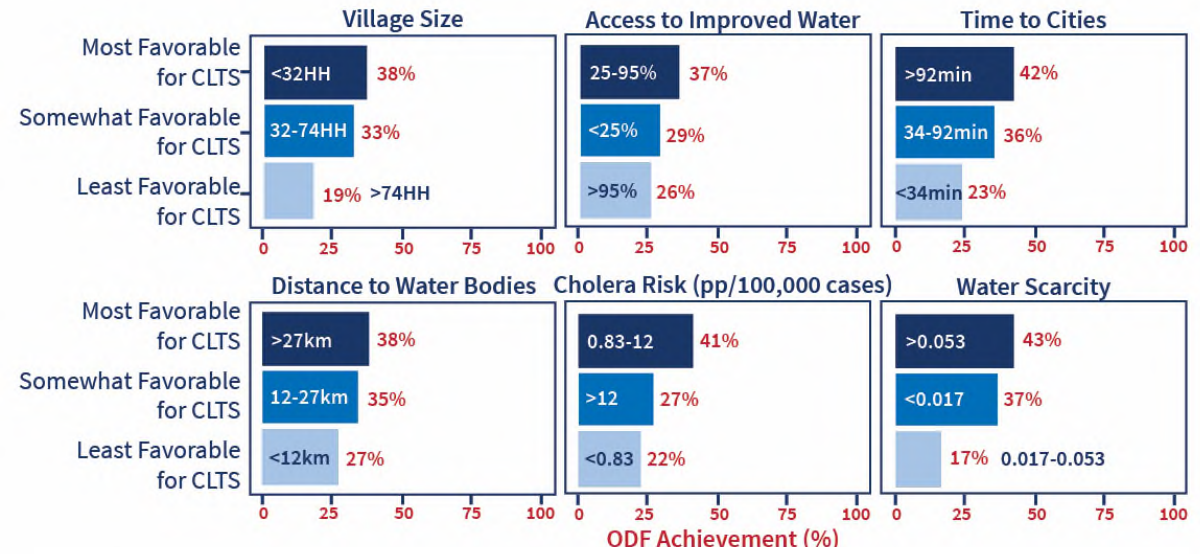

Figure 3. Favorability regimes for ODF achievement. *While the split points are the values of the contextual factor corresponding to the largest possible differences in ODF achievement across regimes, they should be interpreted as guidelines rather than strict thresholds.*

Handbook.[16] We found the most favorable regime for CLTS was the mid-range values between 0.83 to 12 cases per 100,000 people, with an average of 41% ODF achievement (Figure 3).

Achieving a higher probability of ODF achievement by considering multiple factors: Using the six significant contextual factors, we identified a type of village with at least 50% probability of ODF achievement: villages with less than 46 households, located 34-92 minutes from cities and more than 12 kilometers from waterbodies, and in areas with 77% access to improved water or more achieved ODF in 57% of cases, which is substantially more than the overall program (32%). Targeting villages with a higher probability of success could help improve the cost-effectiveness of CLTS programs.

Data limitations may have affected our results. Specifically, we excluded 13,000 villages from this analysis because we did not have their GPS coordinates and could not identify their contextual characteristics (a process that required matching a village location with publicly-available spatial datasets).

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,[13,17] our results indicate that implementers should equally focus on targeting geographic areas most suitable for the approach. In terms of ODF achievement, CLTS programs in Zambia perform better in smaller villages, further from cities, further from major waterbodies, with lower access to improved water sources, higher water scarcity, and/or higher cholera risk. CLTS implementers would thus benefit from recognizing these influences and incorporating them into their planning.

The determinants of ODF achievement in Zambia differed from other countries. For example, in Cambodia, ODF achievement was higher in areas of high accessibility and literacy. Further, cholera risk, water scarcity and distance to waterbodies were not correlated with ODF achievement in Cambodia, Ghana, or Liberia.[11] This divergence suggests that cultural preferences and co-existing sanitation interventions can affect the "performance envelope" of CLTS. In rural Zambia, 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, where intensive sanitation marketing interventions have popularized pour-flush toilets made with durable construction materials such as concrete and ceramic, rural sanitation programs, including CLTS, are more successful in accessible areas with higher economic status. 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.

The determinants of ODF sustainability differed from the determinants of ODF achievement: while remote villages were more likely to achieve ODF, denser areas with easier access to markets were more favorable for ODF sustainability. It is therefore important for implementers to recognize that most areas where CLTS is initially successful will require continued support (e.g., follow-up visits, access to durable construction materials) if they are to sustain ODF status in the long term.

We do not suggest that implementers should avoid difficult areas altogether. In fact, the gradual shift to area-wide programming will require that Zambian 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 more systematically collect GPS coordinates of program villages, and continue to collect M&E data post-ODF to further investigate the drivers of ODF sustainability.

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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**.