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**LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND
SUSTAIN WATER, SANITATION AND HYGIENE SERVICES**

**Evaluation of pour-flush latrines and
pit management in Honduras**

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In order to meet the Sustainable Development Goals criteria for sustainable sanitation, sanitation solutions must safely separate humans from waste and include safe disposal in situ or treatment off-site of excreta. In 2016, Water Mission conducted a cross-sectional evaluation assessing the function, use, and pit management of 15,644 pour-flush latrines installed in Colón, Honduras between 2007 and 2015. Continued function of 85% of latrines and continued use of 82% demonstrated viability of the latrines, at least up until the point of pit fill. Of the 15% of pits that had filled at the time of survey, nearly 77% of households had not taken any action to enable ongoing pit functionality, likely attributable to a lack of planning. Increased education and programming on pit management and the training of a local mason are now integrated into the employed approach in efforts to improve the longer-term viability of this sanitation solution.

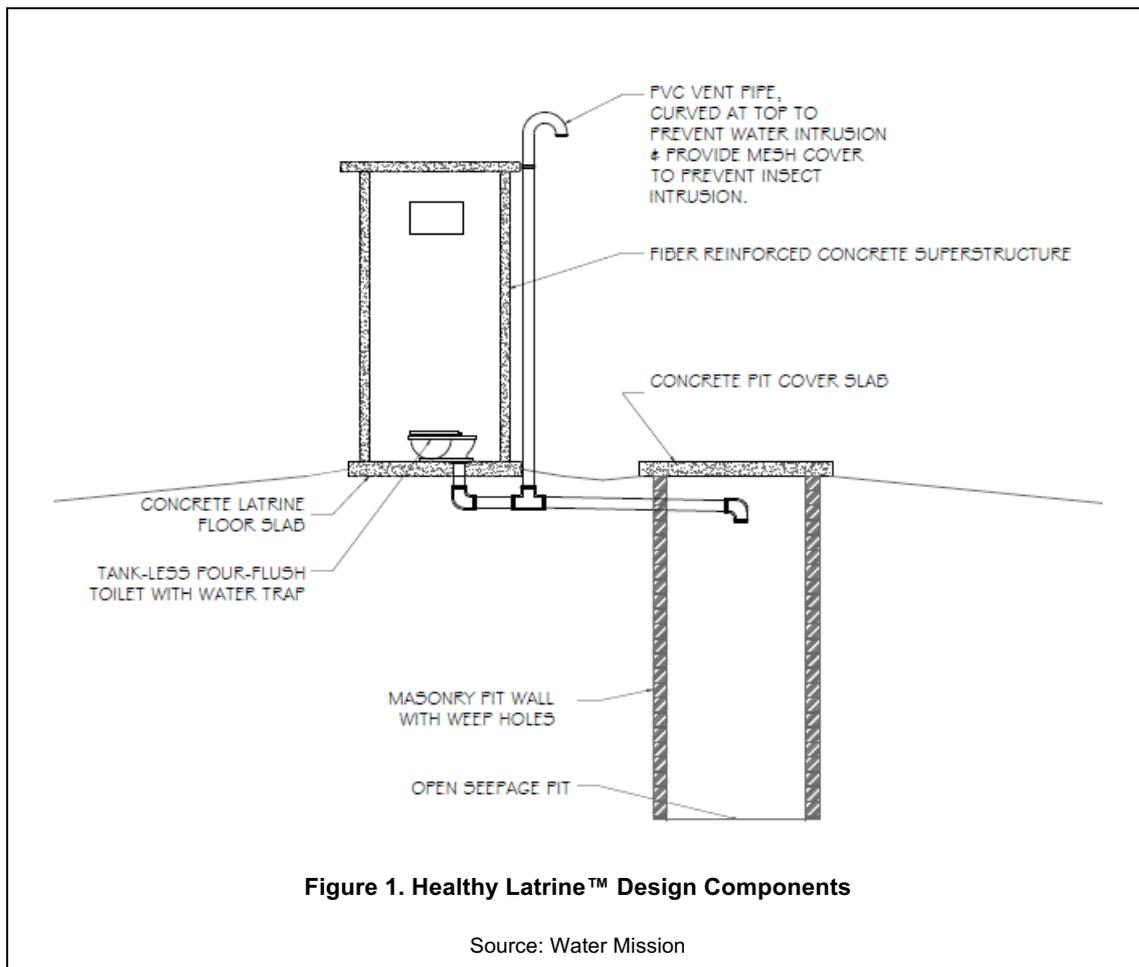
Introduction

Under the Sustainable Development Goals (SDGs) the target is for all people worldwide to achieve sustainable access to not only basic sanitation (sanitation solutions that safely separates humans from waste) but to ‘safely managed’ sanitation, that is basic sanitation where excreta is safely disposed in situ or treated off-site. (WHO/UNICEF 2015, WHO/UNICEF 2006, WHO 2015). In 2013, it was estimated that 1.77 billion people relied on pit latrines for sanitation (Graham 2013). To meet the new standards for the targeted ‘safely managed’ criteria, pits need not only to safely contain faecal sludge during the time of use, an issue on its own for many pits (Graham 2013), but also need to be properly managed once filled. In cases where it is not economically or physically preferential for a latrine with a filled pit to be sealed and replaced by an entirely new latrine and pit scheme, filled pits need to either be safely emptied or sealed while the pipe is re-routed to a new pit. Implementation of both methods must not reintroduce the waste into the environment or to human contact.

The Healthy Latrine™, designed by Water Mission during a large water and sanitation program in the Colón department of Honduras, relies on the use and recovery of pits to provide access to ‘safely managed’ sanitation. The Healthy Latrine™ is a pour-flush latrine with a superstructure constructed of fiber-reinforced concrete. The pour-flush design carries the human waste away from the user to a single, vented, offset soak pit that protects the environment from contamination. The water or ‘sanitary seal’ created by the siphon in the pour-flush toilet acts as a barrier between the pit contents and the user.

Between 2007 and 2015, Water Mission installed 15,664 Healthy Latrines™ in 464 villages throughout all 10 municipalities within the department of Colón, Honduras, historically one of the poorest departments in the country.

As part of a larger study evaluating the success and long-term viability of this program’s approach, Water Mission surveyed over 1,000 beneficiary households to assess the degree to which the Healthy Latrines™ were still functioning and in use as well as the rates and patterns of pit fill and management.



Methods

A cross-sectional study was carried out between March 15 and July 6, 2016 in the northern department of Colón, Honduras. All 464 villages within Colón that had received Healthy Latrines™ from Water Mission between 2007 and 2015 were eligible for inclusion. Sixty-five randomly selected villages were visited for the study. Within each of the 65 villages, enumerators visited every other Healthy Latrine™ to survey a random sample of approximately 50% of the Healthy Latrines™ in the village. Inverse probability weighting was applied in analysis to adjust all villages to a representation of 42% of Healthy Latrines™ from each village.

Surveys included a 20 minute interview with household members of 18 years or older, followed by a latrine observation. Eleven aspects from the physical design of the latrine were assessed during observation and latrine use was determined using three interview questions verified, to the extent possible, by six observations. Observations included presence of human faeces on plot, items blocking access to the toilet bowl, and non-flushing toilets. Latrines were sorted into function and use classifications based on the responses and observations. Pit management practices and patterns were assessed using interview questions.

Statistical analysis was performed using StataIC 14 software. All regressions run were ordinal logistic regressions and multicollinearity tests were performed using the `-collin-` command.

Box 1. Definitions of function and use classifications

Function

- **Full:** Flushes and all installed parts present and functioning as intended
- **Basic:** Flushes but not all installed parts present and/or functioning as intended
- **Non:** Does not flush

Use

- **Full:** Self-reported full time use by all household members and no contradictory observations
- **Partial:** Does not meet any determinants of 'non-use' and does not meet *all* criteria of 'full-use'
- **Non:** Self-reported "never" or "rarely" using latrine *or* no toilet bowl *or* latrine does not flush

Results

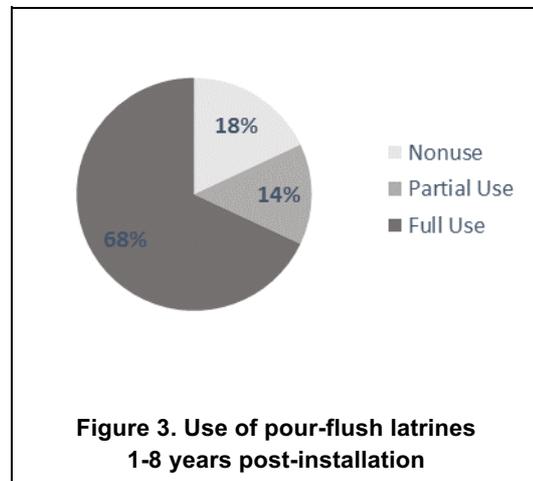
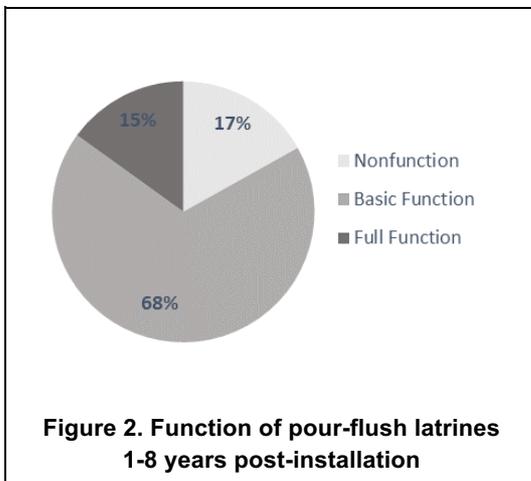
Survey

One thousand and thirteen usable household surveys were completed across 65 villages inside nine of the 10 municipalities.

Latrine function

Of the 1,013 surveys, 984 were included in function analysis. Eighty-five percent (832) of latrines were functioning at the time of visit (17% classified as "full function" and 68% as "basic function") and 15% (147) were non-functioning (Figure 2). Of the latrines that were classified as "basic function", 52% of them were not classified as "full function" do solely to an issue with the door or latch.

Ordinal logistic regression of these function levels regressed on household size, home ownership, original ownership of latrine, age of latrine, wealth quintile, and village showed no significance of any of the predictors.



Latrine use

The majority of latrines (82%) were still in use, 68 % classified as "full use" and 14% as "partial use" (Figure 3). Enumerators' rating of odour ($p=0.011$), households' satisfaction with odour ($p<0.001$), presence of a door ($p<0.001$), village ($p<0.001$), and overall satisfaction with the latrine ($p<0.001$) were significant predictors of level of use. Home ownership, household size, original ownership, wealth, age of latrine, and sharing of the latrine were not. For latrines in partial use, there were no demographic patterns as to which members of the households were not always using the latrine.

Pit fill and management

At the time of survey, 15% (147) of the surveyed pits were reported to have filled at least once. Larger households were more likely to have filled pits ($p=0.001$), as were pits in some villages ($p=0.018$). Home ownership, original ownership of latrine, wealth quintile, and age of latrine were not significant in pit filling.

Tests for multicollinearity showed VIFs ranging from 1.01 to 1.53, indicating little to no correlation between these predictors and thus reliability of the regression results.

No pit management action was taken for 77% (113) of the pits that had filled and when action was taken rerouting to a new pit was more common (20%, 30) than pit emptying (3%, 4) (Figure 4). No significant predictors of management method (wealth index, households' ranking of affordability, home ownership, original ownership of the latrine, village, age of latrine, and household size) were found. Tests for multicollinearity showed VIFs ranging from 1.02 to 1.51, again indicating little to no correlation between these predictors and thus reliability of the regression results.

Of the 113 households that chose to take no pit management action, 86% attributed not doing anything to cost (Figure 4). The mean reported cost of management was 2,212.12 Lempira (~94.85USD). Average reported cost of hired service was 300 Lempira (~12.7USD).

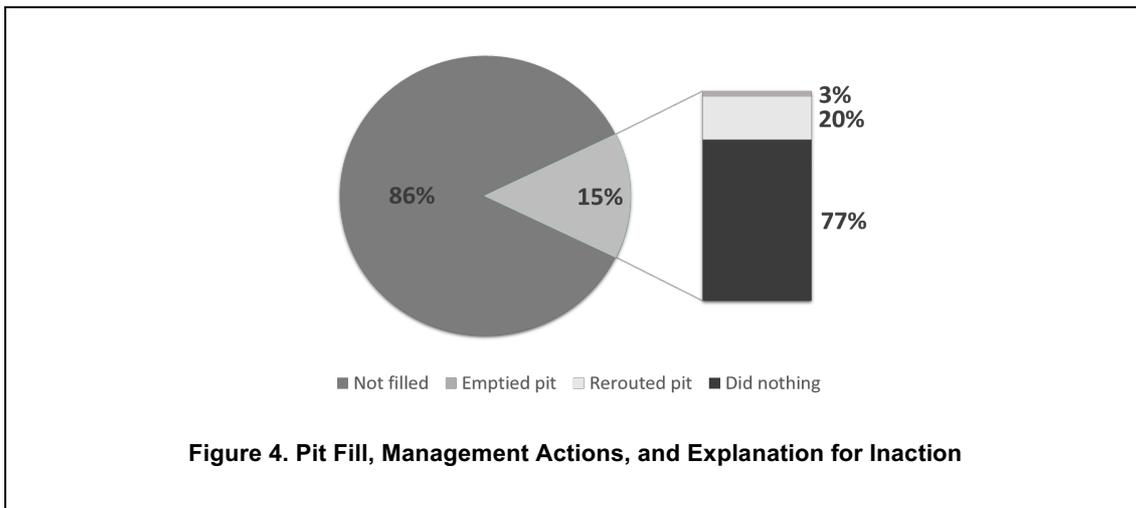


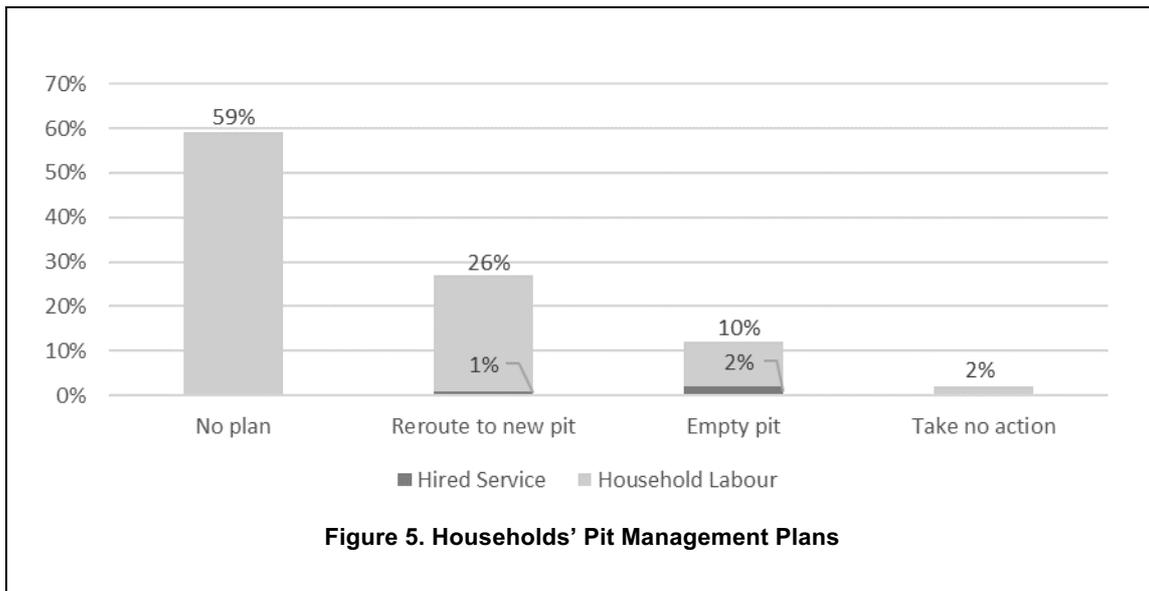
Figure 4. Pit Fill, Management Actions, and Explanation for Inaction

Pits were most commonly managed exclusively by household members (88%, 30), specifically by male household members only (82%, 28). Some households received help from either friends or neighbours (12%) and 6% hired a service.

Both households that hired a service rated pit management as “easy” to do. For those households that did not hire a service, 66% (32) rated management as difficult or very difficult, 16% (7) said it was easy or very easy and 19% (6) were neutral. Reported difficulty and cost had a weak positive correlation. Difficulty interpretation increased as cost did ($r = .3895$).

Of the 4 households that reported emptying their pits, 2 reported that the faecal sludge was dumped on the property, 1 reported it was dumped off of the property, and 1 reported that they did not know the fate of the sludge.

The majority (59%) of households that have not yet had their pit fill reported having no plan for managing the faecal sludge when it does fill. Rerouting to a new pit was a more common plan (27%) than emptying the pit (12%). Of this combined 39% (343) that plan to reroute or empty their pit, 36% plan to handle it themselves (10% to empty, 26% to reroute) and 3% plan to pay a service to manage it (2% to empty, 1% to reroute) (Figure 5).



Some households (2%, 13) reported actively planning to take no action once their pits fill, most (77%) citing cost as a reason. Eight of 13 (62%) reported cost as the sole reason for planning inaction. Other reasons given for planned inaction were not knowing how and no services locally available.

Discussion

The Healthy Latrines™ were a viable solution to the sanitation needs of these households up until the point of the first pit fill.

Function and use

Latrine function and use rates were high, though a lack of literature on these measures for other approaches prevents comparison of these rates (Davis 2016).

There is also reason to believe that current Water Mission sanitation projects may see higher rates than these in the future. Recent evidence has found that while subsidy driven interventions can be effective interventions, approaches that combine subsidies with an education component are most effective (Garns 2016). While this project included community involvement and household contribution, it lacked the comprehensive approach, which involves demand generation, capacity building, market-based elements, and structured support that Water Mission has since developed. Households in this project received a one-off operation and maintenance training at the time of commissioning whereas households now receive several months of education and training prior to installation as well as several years of follow up and support. Additionally, this study revealed that doors and latches were the weakest mechanical area of the latrines and that the presence of doors significantly influenced use. Water Mission is now revisiting the door design to make the doors more durable, which will lead to higher function and possibly use.

Pit management

Low pit fill rates of 15% were not surprising as the mean age of these pits was 1.5 years less than the designed lifespan of 7 years. Pit management rates were also low and the majority of households attributed inaction to cost. When pit management action had been taken, in all but 4 cases it was to re-route the pipe to a new pit rather than to empty the pit. Re-routing was also more than 2.5 times more popular of a plan for future pit fill than emptying was. These latrines were designed and sited to be re-route once filled rather than emptied so these results were consistent with expectations. Based on material costs, re-routing to a new pit should not be cost prohibitive for these households. The cost estimate to re-route to a new pit, if done by the household as almost all of the labor that was done was, is 30USD, reaching up to 50USD if all tools such as shovels, etc. are needed to be purchased. The average reported cost by households who had taken action was roughly 2-3 times this amount, which may be accurate or may be due to poor or biased recall. The more difficult a household recalled the process being, the higher the reported price was. While the 30-50USD cost estimate is a high expense for a household in this area, it accounts for about 1% of the average income of

these households over the lifespan of the pit. When also considering that nearly 60% of households who had not yet filled their pits had no pit management plans for when their pits do fill, the lack of management seems more likely due to issues planning for the cost than simply to the cost.

As mentioned above, households in this project received minimal education and no formal follow up or support. Since the program in Colón, Water Mission Honduras began making changes to this approach in attempt to better prepare households for pit management. Under the revised approach, before hardware installations begin, households receive several months of sanitation sensitization including training on how to properly care for a pour-flush latrine and what to expect when its pit fills. During implementation, households are required to contribute all of the materials for constructing the first pit as well as a small cash contribution to pay for training of a local mason in pit construction and latrine maintenance. The trained mason is then available to households for hire to construct new pits and tending to other latrine maintenance. After implementation, households receive several years of sustained follow up and support. New programming at Water Mission will include supervised construction and payment of a second pit during this time. This gives households a second pit to use when the first pits fills extending the minimum use timeline of the latrine, and more importantly is provides households with the knowledge of what is required to manage a pit and the skills needed to take action.

Conclusion

High rates of continued function and use showed the Healthy Latrine™ to be a viable option for access to safely managed sanitation, at least up until the first fill of the pit. Pit management rates were very low and hindered longer-term viability for most latrines with filled pits. Increased pit management education and planning are now being employed in attempt to increase pit management and improve sustainability of the Healthy Latrine™.

Acknowledgements

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