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**40<sup>th</sup> WEDC International Conference, Loughborough, UK, 2017****LOCAL ACTION WITH INTERNATIONAL COOPERATION TO IMPROVE AND SUSTAIN WATER, SANITATION AND HYGIENE SERVICES****After the pit is full: understanding latrine emptying in Fort Dauphin, Madagascar***K. Kirsch, & R. Hammersley-Mather (USA)***PAPER 2594**

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*Faecal sludge management (FSM) remains a challenge for developing countries, particularly in urban areas. This study investigated the barriers to pit latrine emptying in the urban commune of Fort Dauphin, Madagascar through household surveys, focus groups, and key informant interviews. On average, three households were sharing each of the latrines in the study and 20.4% of observed latrines were full. This research established that while no cultural barriers to latrine emptying appear to exist, other challenges include space, finding an emptier, and cost. The rapidity of shared latrine filling, lack of hygienic emptying services, and the absence of faecal sludge disposal or management sites will hinder public health in Fort Dauphin. Affordable access to hygienic emptying and FSM are the forthcoming challenges for sanitation projects in high-density urban communes.*

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**Introduction**

With just 12% of the population using an improved sanitation facility, Madagascar is the 4<sup>th</sup> least-developed nation in the world for sanitation indicators (WHO/UNICEF, 2015). The highest levels of open defecation are in the south of the country (UNICEF, 2015), including in the Anosy Region of southeast Madagascar, where 83.2% of the population live in poverty (Oxford Poverty and Human Development Initiative, 2013). More than half of the 85,000 people living in the regional urban centre of Fort Dauphin (Urban Commune of Fort Dauphin, 2015) do not have access to any form of sanitation. Of those with access, 33% do not have access to improved sanitation (WaterAid, 2013).

To address these challenges, British NGO SEED Madagascar partnered with a local organisation, ONG Azafady, to implement Project Malio, a three-year Community-Led Total Sanitation (CLTS) initiative seeking to reduce open defecation and improve sanitation and hygiene, funded by the UK Big Lottery Fund and the Overseas Aid and Development Commission. Developed in Bangladesh in 2000 by Kamal Kar, CLTS draws upon participatory exercises to ‘trigger’ awareness of harmful hygiene and sanitation behaviours (Kar and Chambers, 2008). Malio adopts an adapted CLTS approach, using triggering to mobilise communities while subsidising latrine construction for vulnerable households. Beginning in May 2014, Malio has worked with households, schools and other local stakeholders to provide sanitation and hygiene education for the community, and construction support for latrines at schools and 800 households. With Malio coming to a close at the end of April 2017, SEED is completing endline monitoring and evaluation in order to highlight successes, gaps and future priorities. Of particular concern is the lack of pit emptying options and associated barriers of faecal sludge management (FSM) in Fort Dauphin, and the impact this has on the sustainability of both latrines and the behaviour change required to use them on a long-term basis.

The World Health Organization (WHO; Howard, G. *et al.*, 2002) affirms that the safe disposal of human faeces is one of the principal ways to break the faecal-oral disease transmission cycle. While pit latrines remain the primary form of sanitation among the urban poor in sub-Saharan Africa (Nakagiri, 2016), there is limited research into comprehensive FSM services for developing urban areas. Bridging this gap in understanding will be essential if the Sustainable Development Goal targets for Goal 6 (water and sanitation access) are to be achieved (United Nations, 2015). Indeed, hygienic pit emptying remains critical to ensuring

the sustainability of sanitation programs. There are considerable obstacles to safely emptying pit latrines in highly dense urban areas. These include limited space for latrine facilities, safety in transporting faecal sludge, and difficulties in ensuring pit emptying equipment can access all plots (Thye *et al.*, 2011). With the imminent end of Project Malio, households already challenged by rapidly filling pits have requested assistance with latrine emptying. This precipitated research to further understand the existing logistical, cultural, and financial FSM challenges in the commune, with the study examining the barriers to pit emptying in Fort Dauphin in order to support improvements to FSM in the commune. The outcomes of this research will inform current monitoring and educational programs, and future sanitation projects.

## Methods

This study was conducted in the urban commune of Fort Dauphin in the Anosy Region of southeast Madagascar. There are 11 *fokontany* (neighbourhoods) in Fort Dauphin, and this research examined barriers to latrine emptying in 10 of them (the 11<sup>th</sup> was excluded due to distance). This study was comprised of household surveys, focus groups, and key informant interviews.

### Household survey

One hamlet (sub-*fokontany*) was randomly selected from each of the 10 *fokontany*. Community health volunteers developed lists of households with latrines in each of the selected hamlets. Households were defined as per Malagasy custom; the grouping of people who cook meals together. Both Project Malio latrines and non-Malio latrines were included in the community list and subsequent survey. In each hamlet 20 households with latrines were selected using a computer generated random number. If a hamlet had fewer than 20 households with a latrine, every household with a latrine was interviewed. The survey consisted of a questionnaire administered to the head of household or, when the head was not available, another adult member of the household. Surveys were pre-tested and orally conducted in the Antanosy dialect of the Malagasy language. A total of 147 household surveys were administered. The interviewer marked the appropriate response from a set of pre-coded answers; responses that varied from these were recorded. Observations were made of existing facilities at surveyed households to assess latrine type, cleanliness, and infrastructure condition. Survey data was entered manually using Microsoft Excel 2016. Descriptive statistics, correlation, and chi-square tests for association were used for analysis. Two-tailed tests with  $p < 0.05$  were considered statistically significant.

### Focus groups

Four focus group discussions were held to further the understanding of FSM barriers. They comprised two male and two female groups from two randomly selected *fokontany*. Each focus group was made up of 8-12 participants. Full audio recordings were translated and notes were coded and thematically analysed.

### Key informant interviews

Interviews were conducted with all 10 *Chef de Fokontany* (the elected leader of a *fokontany*) in the study area to gain a broader understanding of the FSM situation in the community. Additional key informant interviews were conducted with three latrine emptiers.

## Results

### Demographics

There were 147 survey respondents; 32.7% were male and 67.3% female with ages ranging from 18 to 92 years (average 42.5 years). Most respondents (61.2%) were married and the average household size was 5.6 persons. Demographic data showed that 72.8% of respondents had a middle school or lower educational level, and the primary employment status was as a street vendor. Income level of survey participants varied, with 69.4% of respondents stating a monthly income below \$124 (in February 2017 1 USD = 3176.50 Malagasy Ariary). Challenges determining monthly income for respondents without a fixed salary and cultural constraints surrounding discussions about money may have impacted these reported values.

Of the 18 community groups in Madagascar, 12 groups were represented amongst the survey respondents. The majority of participants in Fort Dauphin identified themselves as Antanosy (44.9%), Antandroy (29.3%), and Antesaka (13.6%). Lutheran and Catholicism were the primary religious affiliations at 74.1%, with the other 25.8% of participants identifying as Sect (new local churches) or not religious.

### Sanitation facilities

Various types of latrines were observed during the study; 30.6% were Ventilated Improved Pit (VIP) latrines, 10.2% latrines with a SanPlat pit cover, and 59.2% pit latrines with other platform materials (as seen in Table 1). The average latrine depth was 1.95 metres, and the majority of latrines were classified as being at least functional (in acceptable condition and safe to use, 60.5%) and of adequate cleanliness (70.7%).

While all latrine infrastructure met the Joint Monitoring Programme (JMP) classification for improved sanitation, the JMP classifies sanitation facilities of an otherwise acceptable type shared between two or more households to be unimproved shared latrines (WHO/UNICEF, 2015). Per this definition, 67.3% of the latrines in the survey are shared by more than one household and are therefore classified as unimproved. The number of households sharing a latrine ranged from one to 21, and the number of users ranged from one to 56 people. On average, three households were sharing each of the latrines in the study.

<b>Variables</b>	<b>Total 147 (%)</b>		
<b>Type of latrine</b>		<b>Depth (metres)</b>	
VIP	45 (30.6)	<0.9	0 (0)
Latrine w/ a SanPlat cover	15 (10.2)	1.0-1.9	66 (44.9)
Pit latrine w/ other platform	87 (59.2)	2.0-2.9	66 (44.9)
<b>Latrine cleanliness</b>		3.0-3.9	14 (9.5)
Clean	53 (36.0)	≥4.0	1 (0.7)
Adequate	51 (34.7)	<b>Latrine maintenance</b>	
Dirty	43 (29.3)	Good condition	52 (35.4)
<b>Faecal sludge level</b>		Functional	37 (25.2)
Full	30 (20.4)	Poor condition	58 (39.5)
Not Full	117 (79.6)		

### Pit emptying

The average age of surveyed latrines was 2.9 years. When asked about emptying options, 98% of respondents indicated they would not be willing to empty their own latrine. However, nearly half of survey participants (49%) had emptied their latrine previously, an average of six times. All survey respondents indicated their pits were manually emptied into holes surrounding the latrine and covered. In focus groups and key informant interviews it was confirmed that no mechanical emptying mechanisms currently exist in Fort Dauphin. For those who had emptied their latrine previously, paid emptiers were used in 93% of cases.

Analysis of emptying for the median depth of 2-metres found a statistically significant ( $p = 0.001$ ) association between number of users and frequency of emptying. Encouragingly, 92.6% of households with shared latrines stated they had a plan or agreement about how the latrine would be emptied when it was full.

### Barriers to latrine emptying

One-fifth of latrines were full (20.4%). Reasons given for not emptying the latrine were highly stratified amongst a variety of causes including not having time, wanting to use a new pit, not knowing an emptier, and not having enough money. When asked how much it costs to empty a latrine, respondents' answers varied from about \$3.15 to \$9.44 (with an outlier of \$31.48), averaging at \$5.39. The average emptying cost for study participants who had emptied their latrines was comparable at about \$5.10. Respondents were polled about their willingness to pay approximately \$4.66 to empty their latrine; 90.9% of Malio latrine owners and 68% of non-Malio latrine owners indicated they were willing to pay this ( $p$ -value = 0.003).

Through focus groups and key informant interviews, it was confirmed that the existing latrine emptier structure is informal. Most respondents could not identify the name or phone number of an emptier and said they found emptiers in passing. 40.8% of respondents did not know anyone they could pay to empty their latrine. Emptiers do not have a formalised pricing structure. No emptiers interviewed could correctly identify the safety hazards of emptying, nor did they own any personal protective equipment.

In Fort Dauphin and throughout Madagascar, a complex set of customs guide daily practices through *fomba* (traditions) and *fady* (taboos). Even the discussion of excrement can be viewed as poor *fomba*, so survey respondents were asked about their notions of *fady* as it related to latrine emptying. Most respondents (87.8%) indicated latrine emptying is not *fady*, with no statistical significance between community group identification (Antanosy, Antandroy or Antesaka) and classifying latrine emptying as *fady* ( $p$ -value = 0.49).

Through the household surveys, focus groups, and key informant interviews it was confirmed that emptiers do not transport faecal sludge to any other location, nor is there a formal faecal sludge disposal or treatment site in Fort Dauphin.

## Discussion

While sanitation programs have increasingly focused on behaviour change in addition to infrastructure, planning for filled latrine pits is insufficient, despite its crucial link in the sustainability of sanitation practices. A literature review of pit latrines in sub-Saharan Africa found that due to the high population density in most urban areas, digging new replacement pits and the use of alternate pits are not practical options, and that pit latrine filling is currently a problem across the region (Nakagiri *et al.*, 2016). Kwiringira (2014) argues that common challenges leading to facility abandonment include keeping latrine facilities clean, pits filling quickly, emptying costs, and difficulties with emptying. Ultimately, latrine abandonment results in families stepping down a rung on the sanitation ladder.

The Malio FSM research has ramifications for the project's community outreach programs. Even though Malio targets the most vulnerable population, more Malio latrine owners indicated a willingness to pay for latrine emptying than non-Malio latrine owners. This disparity in willingness to pay for emptying between Malio latrine owners and owners in the wider community indicates a gap in sensitisation, which may be the result of the project's extensive sanitation and hygiene educational program. Future initiatives should look to provide Malio's tailored workshops and individualised support to all latrine owners throughout Fort Dauphin. However when targeting latrine maintenance, Malio exerted significant efforts both through informational materials and an educational campaign on how latrine owners could empty their own latrines. The unequivocal consensus of survey participants indicated that paying local emptiers was the primary choice for households needing to empty latrines. Latrine owners also expressed difficulty finding emptiers, therefore latrine maintenance spending would be better allocated to connecting local emptiers to latrine owners. Additionally, UNICEF (2015) found that standard approaches to triggering in southern Madagascar are not effective in creating a new sanitation social norm in communities with strong traditions surrounding defecation practices. While appropriate care needs to be taken to observe good *fomba* in community discussions on sanitation, the lack of a *fady* designation determined in the study for latrine emptying should make seemingly forbidden discussions easier.

This research also begs further examination into the efficacy of subsidies. Should development programs subsidise latrines when emptying costs will not be subsidised? The small but meaningful contribution of ~\$1.55 per household towards latrine infrastructure was designed to ensure facility accessibility for the most vulnerable population. Despite owners of Malio latrines indicating a willingness to pay for emptying, at a median emptying cost of ~\$4.66, will households be able to afford long-term latrine maintenance? Kar and Bongartz (2006) argue that subsidies can slow or inhibit the spread of sanitation. Additional monitoring will be needed after Malio concludes in order to determine the long-term sustainability of this approach.

In key informant interviews, emptiers identified emptying space as a problem. As the majority of latrines in the study are shared, and shared latrines fill more frequently, the impact of emptying and faecal sludge decomposition needs to be considered. Faecal sludge is stored in underground pits around the latrine, and needs to be periodically removed to make additional emptying space. However, this still leaves the question of whether sludge will safely decompose at a pace comparable to the emptying rate of shared latrines; some latrines were emptied multiple times a year. The WHO (Howard *et al.*, 2002) advises that households wait at least two years for faecal sludge to safely decompose before handling and thus the rapid filling rates in some surveyed households and the resulting faecal sludge disposal hold stark public health ramifications.

Is it appropriate to build latrines in high-density urban contexts without FSM services? This research confirmed that no FSM services exist in Fort Dauphin beyond manual emptying, and latrine emptiers are equipped with neither safe emptying equipment or knowledge of workplace health issues. A study in Dar Es Salaam found similarly unhygienic emptying conditions resulted in reduced emptying, and established a willingness to pay for mechanical hygienic emptying services by over 50% of property owners (Jenkins *et al.*, 2015). Nakagiri *et al.* (2016) maintain that pit latrines no longer serve as a stand-alone solution to FSM in urban areas, recommending a systems approach to ensure sanitation sustainability. Additional research is needed in Fort Dauphin to examine the feasibility of additional emptying technologies and faecal sludge disposal and treatment facilities.

## Conclusion

While hygiene education and sanitation infrastructure are frequently the foundation of latrine programs, further emphasis is needed on planning for what happens after the pit fills up. This study showed that while cultural beliefs surrounding latrines do not seem to present barriers to emptying in Fort Dauphin, the lack of hygienic emptying services, rapidity of shared latrine filling, and the absence of a faecal sludge treatment site to transport waste to inhibits broader public health. Additional monitoring is needed to examine the sustainability of latrine emptying in Fort Dauphin as owners, particularly of subsidised Malio latrines, face continued emptying costs over time. Affordable access to hygienic emptying and FSM services is the forthcoming challenge for sanitation programs in Fort Dauphin and other high-density urban communes.

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