Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Ajilé Owens Date

Perceptions of Latrine Safety and Mental Well-Being in urban Kampala, Uganda

By

Ajilé Owens
Master of Public Health

Global Epidemiology

_____

Dr. Thomas Clasen, JD, PhD

Committee Chair

_____

Dr. Bethany Caruso, MPH, PhD

Committee Member

Perceptions of Latrine Safety and Mental Well-Being in urban Kampala, Uganda

By

Ajilé Owens
B.A. Sociology, B.A. Global Health
Duke University
2019

Thesis Committee Chair:
Thomas Clasen
J.D. 1981, Georgetown University Law Center
MSc 2002, London School of Hygiene and Tropical Medicine
PhD 2006, University of London

An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Epidemiology
2021

Abstract

Perceptions of Latrine Safety and Mental Well-Being in urban Kampala, Uganda

By Ajilé Owens

Background: In Uganda, 60% of Kampala residents live in a slum, growing by 10% each year. Because of the growing population, shared sanitation facilities are increasingly common. Latrine users report these facilities as overused, dirty, and lacking adequate doors or proper lighting. The resulting loss of dignity, shame, and fear of harm associated with these latrines are stressors that influence how women navigate their sanitation options. Understanding which latrine attributes make women feel safe can highlight the characteristics that best improve women's sanitation experiences. This paper aims to understand the relationship between latrine attributes, safety, and anxiety among women in urban Kampala.

Methods: An Emory University team developed a cross-sectional survey to measure sanitation-related empowerment. Between December 2019 and February 2020, enumerators interviewed 1,024 women in Kampala. Latrine attributes included privacy, lockability, lighting, latrine sharing, and distance from the home. For outcomes, we assessed perceived lack of safety when using a latrine at night, and anxiety, using a two-question subscale of the PHQ-4. Multiple linear regressions determined the association between latrine attributes, perceived lack of safety, and anxiety.

Results: Sanitation locations were mostly private in location (71%), well-lit both on the way to and inside the latrine (60%), and capable of locking (83%). Approximately half (52%) of women reported never feeling unsafe using their latrine at night and 33% of participants scored above the clinical anxiety threshold. Women who reported frequent perceived lack of safety had higher anxiety scores ($p<0.01$). A latrine's private location and ability to lock were associated with more frequent perceived lack of safety. Private latrine locations were also associated with higher anxiety scores among women who did not perceive a lack of safety ($p<0.01$). Alternatively, women that used latrines with sufficient lighting reported more perceived safety and lower anxiety scores.

Conclusion: Latrine attributes play a significant role in how safe women feel using their latrines at night; however, these relationships are highly nuanced. Stakeholders can use this evidence to reassess latrine quality in urban Kampala and prioritize improving the attributes, like lighting inside latrines, that confer women the greatest feelings of safety.

Perceptions of Latrine Safety and Mental Well-Being in urban Kampala, Uganda

By

Ajilé Owens
B.A. Sociology, B.A. Global Health
Duke University
2019

Thesis Committee Chair:
Thomas Clasen
J.D. 1981, Georgetown University Law Center
MSc 2002, London School of Hygiene and Tropical Medicine
PhD 2006, University of London

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Global Epidemiology
2021

Acknowledgments

I would foremost like to thank Dr. Bethany Caruso for being an unbelievably understanding, patient, and kind mentor throughout the entirety of my Rollins experience. This thesis and I are all the better because of your brilliant insight.

I am also grateful to Dr. Thomas Clasen who gave me the freedom to produce a thesis truly reflective of my research interests. Thank you for believing in my ability to create something that would make us both proud.

I must also thank Madeleine Patrick, Amelia Conrad, Shauna McManus, and Dr. Sheela Sinharoy. The four of you were instrumental in my understanding of scale development, urban sanitation, and women's empowerment, all of which proved invaluable for this paper. Thank you also for the constructive advice as I worked through the narrative for my thesis.

Many thanks to Emory University, the Bill and Melinda Gates Foundation, Athena Infonomics, and the team of enumerators in Kampala that made this work financially and logistically possible. An even bigger thank you to the 1,024 women of Kampala who participated in this research; it goes without saying that this would have been impossible without their contributions.

Everyone above made finishing this degree requirement possible; however, finishing the degree itself would have been unimaginable without God, my parents, my sisters Sanaa and Sasha, my partner Marcus, my friends Laken and Apoorva, my therapist, and my ADAP Farah. The encouragement and support from each of you pushed me across the finish line and for that, I am eternally grateful.

Table of Contents

1. Introduction

1.1 Water, Sanitation and Hygiene (WASH) in Uganda

As of 2017, 26% of the global population, more than 2 billion people, still lack access to improved sanitation services (UNICEF and WHO, 2019). While this marked improvement from the 41% that lacked service access in 2000, worldwide improvements to sanitation access have not occurred universally. From 2000 to 2017, the number without access to improved sanitation services fell by 416 million people in Central/South Asia but rose by 212 million in sub-Saharan Africa (UNICEF and WHO, 2019). The paradoxical drop in sanitation coverage is well-demonstrated, specifically in the country of Uganda.

From 2017 to 2018, Uganda's basic sanitation coverage fell from 80% to 79% (Ministry of Water and Environment, 2018). Uganda is currently one of the few countries where sanitation accessibility is equally low in urban and rural areas. Less than one-fifth of the rural population has access to non-shared, improved sanitation services compared to one-fourth of the urban population (Uganda Bureau of Statistics and ICF, 2018). In Kampala, Uganda's capital city, it is estimated that 60% of the population resides in a slum, with a continued growth rate of almost 10% per year (Tumwebaze, Orach, Niwagaba, Luthi, & Mosler, 2013). Partially due to this rapid growth, the overcrowded areas of Kampala lack sufficient water and sanitation infrastructure. Households frequently share improved sanitation facilities; a 2012 study estimates that as many as 68% of those living in 50 of Kampala's slums shared their sanitation facilities with nearby families (Tumwebaze, Orach, Niwagaba, Luthi, & Mosler, 2013).

Shared sanitation facilities are considered an interim solution on the "ladder" to private sanitation and flushing toilets; however, even as a solution, they are associated with increased health risk (Kwiringira, Atekyereza, Niwagaba, & Günther, 2014; Heijnen, et al., 2014). In

addition to increased contact with contaminated fecal matter inside the latrine, several studies found that regardless of improvement, shared sanitation facilities led users to return to open defecation (Heijnen, et al., 2014; Kwiringira, Atekyereza, Niwagaba, & Günther, 2014). Shared latrines are often poorly cleaned and rarely emptied, so when toilets become filthy, users shift back to openly defecating to avoid these locations (Kwiringira, Atekyereza, Niwagaba, & Günther, 2014). However, some shared sanitation facilities, especially those that are community managed, provide slum residents with safe, clean alternatives to open defecation (Evans et al., 2017; Tidwell et al., 2021). Unfortunately, it is increasingly difficult to differentiate which shared sanitation facilities are beneficial or harmful to slum dwellers.

Though arguably justified in the classification of shared facilities as "unimproved" due to their potential health risks, this definition has proved problematic for slum residents. Instead of leading to the strengthening of sanitation infrastructure and introducing private flushing latrines, shared facilities may contribute to the urban decline in sanitation utilization because of how they are defined. There is evidence that the JMP's classification of shared sanitation facilities as "unimproved" may discourage NGOs and government partners from investing in sanitation infrastructure in slum communities (Evans, et al., 2017). Because many sanitation facilities found in these areas are shared, improving the existing facilities would not count toward providing "safe" sanitation for the site; this can encourage donors to focus on more well-off communities where partners will acknowledge sanitation progress (Evans, et al., 2017; Tidwell, et al., 2021). The incentive to deprioritize sanitation improvements in slum areas will likely worsen as we approach 2030 – the target end time for Sustainable Development Goal 6.2, which calls explicitly for the use by all of improved sanitation facilities not shared with other households.

1.2 WASH and Mental Well-being

The mere presence of shared sanitation facilities in slum environments does not equate to their utilization, mainly when the latrines are poorly maintained. In addition to cleanliness, the social aspects of using the facility, such as the lack of dignity, privacy, or safety the facility provides, can also hinder latrine utilization. Several studies have shown a link between inadequate sanitation and poor mental well-being, as evidenced by a loss of dignity, shame, and fear, particularly for women and girls (Sclar, et al., 2018; Kulkarni, O'Reilly, & Bhat, 2017; Corburn & Hildebrand, 2015; Caruso, et al., 2018).

In Uganda's slums, shared latrine users often report that there are not enough toilets for the users because of the growing population. As a result, latrines are often overused, quickly becoming dirty. Tumwebaze et al. (2012) found that 21% of individuals living in Kampala's slums using a shared sanitation facility reported their location as either "dirty but useable" or "very dirty", compared to 3% of individuals with a private latrine. Since over 75% of slum-dwellers use a shared sanitation location, most individuals do not have the option to use a private toilet. Without alternative latrine options, using smelling, filthy toilets can often be a source of embarrassment for women, if not outright "demorali[zing]" and "undignifying" (Massey, 2011).

The limited privacy that sanitation facilities offer women (Sahoo, et al., 2015; Sclar, et al., 2018). Women report feeling vulnerable and ashamed to be seen by men and boys while entering or leaving sanitation facilities, an inevitability for shared facilities (Caruso, et al., 2017b; Sahoo, et al., 2015). In Kampala, women are expected to keep the act of defecation "secret and private," stating that men would shame them if they saw women on the way to the latrine (Cross & Coombes, 2014). Additionally, even if men do not see women on the way to sanitation facilities, the physical structure of toilets can inhibit sufficient privacy. Many women

report that their shared facilities lack an adequately locking door, leaving women feeling exposed when using the facility (Caruso, et al., 2017b; Sahoo, et al., 2015). In efforts to obtain more privacy, women may change the sanitation facility they use or the time they use it; however, it is not uncommon for these behavior changes to increase privacy while simultaneously putting women at increased risk of harm (Sahoo, et al., 2015).

Women frequently report fear of harm and anxiety when using latrines located further from their homes, that do not lock, or lack proper lighting, especially at night (Corburn & Hildebrand, 2015; Massey, 2011). Even in instances where women have not been personally assaulted, the threat of violence can be enough to cause stress (Massey, 2011). Corburn and Hildebrand (2015) found that to avoid using toilets at night out of fear of rape, women in Kenya would stop drinking fluids, suffer chronic constipation, or use buckets in their homes as toilets. Kulkarni, O'Reilly, & Bhat (2017) similarly found that women in India withheld food and water or suppressed defecation when they could not access safe and private latrines. These practices should be considered salient health concerns in Uganda since many women do not perceive their facilities as safe. For example, only 74% of women and girls using a sanitation facility in Uganda during menstruation report their facility as safe (UNICEF and WHO, 2019).

A loss of dignity, shame, and fear of harm are all stressors that influence how women navigate their sanitation location options or lack thereof. Several studies have examined latrine attributes and mental well-being; however, few have investigated the specific interaction between latrine qualities, perceived safety, and anxiety. This work will foremost contribute to the growing body of literature on the influence of inadequate sanitation conditions on mental health outcomes by determining whether specific latrine attributes influence women's feelings of safety and anxiety. Understanding which latrine attributes make women feel the safest may also

facilitate prioritizing the qualities that best improve women's sanitation experiences. Finally, women's perceived safety when accessing latrines may prove a significant source of sanitation-related stress; understanding which populations of women feel the most vulnerable may allow for targeted sanitation programming in urban Uganda.

1.3 Research Objectives

This paper aims to identify how latrine conditions impact women's perceived safety and anxiety. In this paper, we explore the following research questions:

- Do women feel unsafe when accessing their latrines at night in Kampala, Uganda?
- Who feels unsafe when accessing their latrines at night in Kampala, Uganda?
- What latrine-related attributes influence whether women feel unsafe when accessing their latrines at night?
- Does feeling unsafe when accessing latrines at night impact reported anxiety, accounting for demographic and latrine-related factors?

Based on the literature regarding perceptions of safety, shared sanitation locations, and overall mental well-being, we hypothesize that:

1. *Perceived lack of safety* will be associated with increased anxiety. Women who report never feeling unsafe when using the latrine at night will report less anxiety than women who report ever feeling unsafe.
2. *Age* will be associated with increased lack of safety, with older women feeling less safe than younger women.

3. *Marital status* will be associated with increased lack of safety, as married women will feel safer than unmarried, separated, or widowed women.
4. *Locking* and *privacy* will be associated with increased lack of safety. Women with locking locations with privacy will feel safer than those with non-locking toilets lacking privacy.
5. *Sharing a sanitation location* will be associated with increased lack of safety. Women with private sanitation locations will feel safer than women with shared sanitation locations.

2. Methods

2.1 Study Setting

Kampala, Uganda's capital city, is located in the country's southern region, just north of Lake Victoria (Encylopedia Britannica, 2014). Within 8,451 km^2, Kampala's population was over 6.7 million people; however, this figure is rapidly increasing as Kampala is among the fastest-growing cities in Africa (City Mayor, 2019). Kampala Capital City Authority (KCCA) governs Kampala, divided into five divisions headed by a different mayor. Each division includes 15-20 parishes and 600-900 villages. In this study, we interviewed individuals residing in 22 parishes, including both slum and non-slum neighborhoods, throughout the five divisions of Kampala City.

As the capital, Kampala is ethnically diverse, and most citizens speak both Luganda and English. In Kampala, the female literacy rate is 92%, and 28% of women 15-49 have secondary education or higher (Uganda Bureau of Statistics and ICF, 2018). Though 60% of Kampala's residents reside in informal settlements, they are comparatively better off than much of the country (Tumwebaze, Orach, Niwagaba, Luthi, & Mosler, 2013). Almost all (95.7%) of the residents in Kampala fall in the highest wealth quintile for the nation (Tumwebaze, Orach, Niwagaba, Luthi, & Mosler, 2013; Uganda Bureau of Statistics and ICF, 2018).

Throughout Kampala's different divisions, the primary water source in slum areas is individual or community water taps. Some communities also utilize wells, springs, and boreholes, especially the most impoverished slum areas, due to the fees attached to tap water collection (Ask Your Government Uganda). Unlike access to water, sanitation conditions vary widely between the different divisions. In the Kawempe division, of the 1,675 functioning toilet facilities in slum areas, 1,533 (91.5%) are shared, compared to 10 of 325 (3.1%) in the Makindye division (Ask Your Government Uganda). Likewise, 30% of Kawempe and Makindye residents reported open

defecation within their slums, which is considerably higher than the 19% reported in the Central division (Ask Your Government Uganda).

2.2 Study Design

This paper leverages data collected as part of a more extensive 4-Phase mixed-methods study designed to develop measures of women's empowerment in urban sanitation. For Phase 1, an Emory University research team conducted an extensive literature review to inform the generation of new survey items and adapt existing items appropriately. In *Phase 2*, 41 women in Kampala, Uganda and Tiruchirappalli, India participated in cognitive interviews to provide feedback on the survey items for content validation. The research team then sent the survey tool to field experts, who provided additional feedback. During *Phase 3*, enumerators administered the survey tool to ~1,000 women in Tiruchirappalli and ~1,000 women in Kampala. Following survey administration in February 2020, the items were analyzed using exploratory and confirmatory factor analysis, item response theory analysis, and validity/reliability assessments. The final phase (*Phase 4*) will include further refinement of the scale and deployment to 6 additional cities in 3 other countries. This paper uses data collected during *Phase 3* in Kampala, Uganda. (See Appendix 1 for complete timeline).

2.2.1 Target Sample Size

The target sample size calculated was 1000 participants – ten subjects for each primary variable in the survey. Statisticians recommend this number to allow for appropriate factor analysis of the survey tool (Pett, Lackey, & Sullivan, 2003). We administered the survey tool to 1,024 women in Kampala, Uganda.

2.2.2 Eligibility

Women were eligible to participate in this study if they were (1) 18 years or older, (2) spoke in Luganda or English and (3) were mentally competent, without any hearing or speech impediments that would have prohibited adequate comprehension of the survey.

2.2.3 Sampling

We utilized a stratified, multi-stage sample design and sampled two units: communities and women within these communities. In partnership with KCCA, the team purposefully selected zones in each of Kampala's five divisions to provide socioeconomic diversity. We chose one parish in each division included in Citywide Inclusive Sanitation (CWIS) programming and one parish that was not part of CWIS programming, resulting in 10 total parishes. In four of the five divisions, there was a slum parish surveyed with the tool. Within the parishes of Kampala, enumerators identified homes and apartment complexes. They knocked on every third door, identifying if an adult woman lived in the house, met the eligibility criteria, and would be willing to participate. Enumerators skipped all eligible participants if they had already interviewed someone in the household.

2.3 Data Collection

15 enumerators trained by Emory University and hired and managed by Athena Infonomics led the data collection. Athena Infonomics identified and hired enumerators from the local community in partnership with the research team at Emory. All enumerators were female, held a university degree, and were fluent in both Luganda and English. Before data collection, members of the Emory University research team traveled to Kampala to train the local team about ethical

data collection, data management, and pilot the data collection tools. Surveys were conducted in Luganda and recorded using ODK on electronic tablets from December 2019 to February 2020. Data from the interview was entered on tablets and uploaded to field coordinators. At regular intervals, field coordinators working with Athena Infonomics conducted quality checks on the data. Afterward, coordinators uploaded the data to the Emory team, who then cleaned the raw data for analysis.

2.4 Measures

2.4.1 Outcomes

There are two primary outcomes of interest – perceived lack of safety and anxiety. Safety is "the condition of being safe from undergoing or causing hurt, injury or loss" (Merriam-Webster, 2021). However, this study's use of safety measures women's perceived safety. Using the study's questionnaire, perceived safety was measured using the following question: "In the past 30 days, I have felt unsafe in the place where I typically go for sanitation at night." Respondents provided a numeric response ranging from Never (1) to Always (4). The higher the score, the more frequent the participant experiences feeling unsafe when accessing a latrine at night.

To assess anxiety symptoms, we used the Generalized Anxiety Disorder Scale-2, part of the Patient Health Questionnaire-4 (PHQ-4) (Kroenke et al., 2009). Anxiety is one of the most common mental health disorders and is characterized by excessive worry during everyday routine life events that does not subside for an extended period (NIMH, 2018). A significant risk factor for anxiety disorder is exposure to a stressful and hostile environment; however, treatment is rarely as simple as removing the negative stimuli and often requires psychotherapy, medication, or a combination of both (NIMH, 2018). If untreated, anxiety can impair physical, social, and

occupational health due to reduced concentration, fatigue, shortness of breath, upset stomach, and declining sleep quality (American Psychiatric Association, 2013).

The PHQ-4 (Löwe, et al., 2010; Kocalevent, Finch, Jimenez-Leal, Sautier, & Hinz, 2014; Ahmadi, Arani, Bakhtiari, & Emamy, 2020) (Materu, et al., 2020) (Gottert, et al., 2019)consists of four statements and asks respondents how often they have experienced each feeling in the last two weeks using a Likert scale ranging from Not at all (0) to Nearly every day (3). The first two questions of the PHQ-4 form the Generalized Anxiety Disorder Scale-2, or the anxiety subscale, while the second two questions comprise the Patient Health Questionnaire-2 or the depression subscale. For the anxiety subscale, the two questions are:

1. Over the last two weeks, how often have you been feeling nervous, anxious, or on edge?
2. Over the last two weeks, how often have you been not being able to stop or control worrying?

For each subscale, the score is the sum of the two items. Scores range from 0 to 6, and a score of 3 or greater on the subscale indicates the potential presence of anxiety disorder for screening purposes. Though this tool cannot diagnose an anxiety disorder, it helps categorize the potential for psychological distress.

Researchers have validated the PHQ-4 in several countries; however, most of these studies have used the tool among cohorts that share a similar clinical disease (Löwe et al., 2010; Kocalevent, Finch, Jimenez-Leal, Sautier, & Hinz, 2014; Ahmadi, Arani, Bakhtiari, & Emamy, 2020). Specifically, in central-East Africa, the PHQ-4 has been validated to screen for anxiety and depression among adolescent girls and young women in Tanzania (Materu et al., 2020). The PHQ-4 was also used in Uganda to measure resilience among those living with HIV (Gottert et al., 2019), but researchers have never validated the tool specifically for the general public in Uganda.

2.4.2 Exposures

The primary exposures are the latrine attributes, which include latrine privacy, lockability, latrine sharing, distance from the home, and lighting. All reported characteristics correspond to the sanitation location that women report using at night, which may differ from the facility used during the day.

Latrine privacy was measured using two survey questions, the first regarding the structure and the second regarding the location: 1) Is it possible for someone to see you while you are using this sanitation location? And 2) Is this sanitation location located in a private place? Latrine privacy was coded as '0' if the latrine was neither private in structure nor location. A code of '1' meant the toilet was private in design, while '2' indicated the latrine was private in location, and '3' referred to both.

Lockability was determined by whether the respondent reported that the latrine could lock from the inside (yes/no).

Latrine sharing was measured using the following question: "How many households in total use this sanitation location, including your own household?" Sanitation locations used by one household are considered privately owned latrines.

Distance to the latrine corresponded to the reported number of minutes required to walk to the sanitation location from the household.

Lighting was measured using two questions, the first regarding the latrine itself and the second regarding the path to the toilet: 1) Does this sanitation location have sufficient lighting on the inside? And 2) Is there sufficient lighting on the way to this sanitation location? Lighting was coded as '0' if there was not sufficient lighting inside or on the way to the latrine. A code of '1'

referred to a toilet with sufficient inside lighting, while '2' indicated sufficient lighting on the way. A code of '3' signified sufficient lighting both inside and on the way to the latrine.

2.4.3 Covariates

Demographic covariates include age, marital status, and economic status. We calculated economic status using a sum score for wealth-based asset items. A higher score is associated with more ownership of asset items and an assumed higher (Montgomery, Gragnolati, Burke, & Paredes, 2000).

2.5 Data Analysis

Multiple linear regressions determined the relationship between latrine attributes, perceived safety, and anxiety when using latrines at night. We chose linear regressions for its simplicity in interpretation and to provide specific model results between respondents who reported ‘never’ and ‘ever’ lacking safety. The 'Lack of Safety' model examines the overall relationship between demographic characteristics, latrine attributes, and frequency of perceived lack of safety.

Linear models were also used for the relationships between demographic characteristics, latrine attributes, perceived lack of safety and score on the anxiety subscale. We generated three different linear models to determine whether latrine attributes impacted women’s anxiety differently based on whether they experienced a lack of safety. Model 1 incorporated all participants. Model 2 included only those who reported no perceived lack of safety, while Model 3 comprised those who perceived any lack of safety using a latrine at night. All analyses, including descriptive statistics and linear modeling, were conducted in R (version 4.0.2).

2.6 Ethics

The Institutional Review Board at Emory University (Atlanta, GA, USA; IRB00110271) and the Makerere University School of Health Sciences Institutional Review Board (Kampala, Uganda; 2019-038) provided ethical approval of this study. Participants provided written informed consent before participation.

3. Results

3.1 Sample Size and Demographics

The total number of administered surveys was 1,024. The final analytic sample included 849 individuals; we excluded 175 surveys from analysis due to: missing outcome (N = 158), missing exposures (N = 4), or missing covariates (N = 13). The average age of all participants was 31.8 years old. The average size of the participants' household was 4.4 people, and 45.2% were married. Women in this sample were generally well-educated; 94.1% had attended school, and 56.0% obtained secondary education. Of the 16 assets, women owned an average of 7.1 items, primarily electricity (89.6%), a bed (88.8%), and a phone (84.8%). Almost one-fourth (24.2%) of the women also owned land.

Women's experiences with a lack of safety when using the latrine at night were varied. Most women (N = 442, 52.1%) stated that they 'Never' felt unsafe, followed by 26.4% (N = 224) reporting feeling unsafe 'Sometimes', 11.5% (N = 98) reporting 'Often' and 10% (N = 85) stating they 'Always' felt unsafe using a latrine at night. For anxiety, the mean score was 1.79 (out of 6), though 32.8% of women scored above a 3, the threshold for anxiety screening.

Women regularly shared latrines with others outside the household; only 13.3% of participants privately owned their toilets. Though most respondents shared their toilets with non-household members, the latrines were typically nearby, either in the dwelling (6.9%) or in the participant's yard (77.9%). Women shared latrines with an average of 11.25 households. The sanitation location used by participants were mainly private in location (71.0%), with a few private in structure (7.18%) or both (11.3%). Very few (10.5%) participants had a facility that was not private in some way. Many (83.4%, N = 709) respondents reported the ability to lock their latrine from the inside.

The mean travel time to a latrine was 2.67 minutes. Finally, 3.7% of women reported that their toilets had sufficient lighting inside, while 19.3% said adequate lighting on the way to the facility. Most respondents reported having lighting both in the latrine and on the way (59.8%); lacking lighting both inside and on the path was not standard (17.2%, N = 146). See Table 1 for a further breakdown of the outcome, exposure, and covariates by the perception of safety.

Table 1. Descriptive statistics by the perception of lack of safety when using the latrine at night

		All		'Never' feels unsafe		'Sometimes' feels unsafe		'Often' feels unsafe		'Always' feels unsafe	
Number of Participants		849		442	52.1%	224	26.4%	98	11.5%	85	10.0%
Education	None	50	5.9%	23	5.2%	16	7.1%	5	5.1%	6	7.1%
	Less than primary	149	17.6%	80	18.1%	29	13%	22	22.5%	18	21.2%
	Primary	174	20.5%	84	19%	51	22.8%	19	19.4%	20	23.5%
	Secondary	384	45.2%	207	46.8%	104	46.4%	43	43.9%	30	35.3%
	Higher	92	10.8%	48	10.9%	24	10.7%	9	9.2%	11	12.9%
Household size, Range: (1-24)		4.4		4.6		4.1		4.0		4.7	
Owns Land		206	24.3%	126	28.5%	45	20.1%	21	21.4%	14	16.5%
Age	18-24	234	27.6%	113	25.7%	65	29.1%	35	35.4%	21	24.4%
	25-34	333	39.2%	174	39.1%	94	41.9%	33	33.3%	32	38.4%
	35-44	177	20.9%	90	20.5%	42	18.5%	22	22.2%	23	26.7%
	45+	105	12.4%	65	14.7%	23	10.6%	8	9.1%	9	10.5%
Marital Status	Single	155	18.3%	83	18.8%	37	16.5%	23	23.5%	12	14.1%
	Married	384	45.2%	196	44.3%	112	50%	44	44.9%	32	37.7%
	Separated	176	20.7%	96	21.7%	43	19.2%	17	17.4%	20	23.5%
	Divorced	93	11%	44	10%	23	10.3%	10	10.2%	16	18.8%
	Widowed	41	4.8%	23	5.2%	9	4.0%	4	4.1%	5	5.9%
Wealth items		7.1		7.5		6.5		6.7		6.7	
Anxiety Score, Range: (0-6)		1.8		1.4		2.1		2.3		2.4	
Sufficient Privacy	No privacy	89	10.5%	36	8.1%	35	15.6%	9	9.2%	9	10.6%
	Private location	61	7.2%	13	2.9%	19	8.5%	12	12.2%	17	20%
	Private structure	603	71.0%	339	76.7%	151	67.4%	64	65.3%	49	57.7%
	Private location and structure	96	11.3%	54	12.2%	19	8.5%	13	13.3%	10	22.8%
Latrine can lock		709	83.5%	391	88.5%	178	79.5%	80	81.6%	60	70.6%
Latrine is shared		728	85.8%	355	80.3%	203	90.6%	91	92.9%	79	92.9%
Latrine users (households), Range: (1-100)		11.3		9.7		9.7		11.7		21.7	
Distance to latrine (minutes), Range: (0-30)		2.6		2.4		2.8		2.5		3.5	
Sufficient Lighting	No lighting	146	17.2%	51	11.5%	50	22.3%	27	27.6%	18	21.2%
	Lighting inside	31	3.7%	11	2.5%	9	4.0%	5	5.1%	6	7.1%
	Lighting on the way	164	19.3%	89	20.1%	42	18.8%	17	17.4%	16	18.8%
	Lighting inside and on the way	508	59.8%	291	65.8%	123	54.9%	49	50%	45	52.9%

3.2 Perceived Lack of Safety

Table 2 summarizes the linear regression for demographic and latrine characteristics on perceptions of safety. A private latrine location, a latrine's locking ability, and lighting both inside and on the way to the toilet are significant contributors to whether women feel unsafe using their sanitation location at night. Women with non-privately structured latrines in private areas were more likely to report frequent feelings of a lack of safety than women with non-privately structured, non-privately located toilets ($p<0.01$). Latrines that locked from the inside were associated with frequent perceptions of a lack of safety. Finally, women with well-lit facilities inside and on the way to the latrine were less likely to report frequent feelings of perceived lack of safety at night than women whose latrines lacked sufficient lighting altogether ($p<0.05$). No demographic variable was associated with a perceived lack of safety.

Table 2. Perceptions of lack of safety by demographic and latrine characteristics

Variables	**ß**	**95% CI**
Age **(**Ref: 18-24)		
25-34	-0.08	(-0.25, 0.08)
35-44	0.03	(-0.16, 0.23)
45+	-0.21	(-0.46, 0.05)
Marital Status (Ref: Married)		
Single	-0.02	(-0.21, 0.16)
Separated	0.02	(-0.16, 0.20)
Divorced	0.19	(-0.04, 0.41)
Widowed	0.15	(-0.19, 0.50)
Wealth items	-0.02	(-0.04, 0.00)
Privacy (Ref: No Privacy)		
Private location	0.56**	(0.24, 0.88)
Private structure	-0.08	(-0.30, 0.14)
Private location and structure	-0.06	(-0.35, 0.22)
Latrine can lock from inside	0.20*	(0.01, 0.39)
Sharing (Number of HH Shared)	-0.00	(-0.00, 0.00)
Distance (Time to Travel)	-0.00	(-0.01, 0.00)
Lighting (Ref: No Lighting)		
Lighting inside	0.17	(-0.21, 0.55)
Lighting on the way	-0.22	(-0.44, 0.01)
Lighting inside and on the way	-0.22*	(-0.41, -0.03)
Adjusted R^2		0.06

Significance codes: 0.01 '**' 0.05 '*'

3.3 Mental Well-being

Table 3 summarizes the results from Models 1, 2, and 3. Model 1 examines the association between perceived lack of safety and score on the PHQ-4 anxiety subscale among all women. Model 2 looks at this association among women who never perceived lack of safety and Model 3 among women who sometimes, often, or always perceived being unsafe when using the latrine at night.

Results from Model 1 suggest that perceived safety impacts anxiety; women with higher occurrences of perceived lack of safety were significantly more likely to have higher anxiety scores. For latrine characteristics, distance and lighting were associated with anxiety. Compared to women with latrines without sufficient lighting, women with lighting on the way to the latrine and women with both were less likely to have high anxiety scores. Each additional minute of travel time to the latrine corresponded to a 0.01 increase in anxiety score. Wealth was also a significant predictor of anxiety score; with every 1 item increase in asset-based wealth ownership, there was a 0.06 decrease in score on the anxiety subscale of the PHQ-4.

In Model 2, privacy in location, number of households using the latrine, and lighting inside and on the way to a latrine were associated with anxiety scores among women who did not perceive a lack of safety. Both a latrine being in a private place ($p<0.01$) and being shared with more households ($p<0.05$) were associated with increased frequency of anxiety. Having a latrine that had lighting both inside and on the way to the latrine was associated with less anxiety.

For Model 3, distance, lighting, and wealth were statistically significant for women who perceived a lack of safety. Increasing travel time to the latrine was associated with an increase in the frequency of anxiety ($p<0.01$). Having lighting on the path to the toilet and having lighting both on the path and inside the latrine were associated with a reduction in anxiety score. Finally,

women with more asset-based wealth items were less likely to have frequent anxiety among those who perceived lack of safety at night ($p<0.01$).

Table 3. Anxiety score by perceived lack of safety, demographic, and latrine characteristics

	Model 1: All (N = 849)		**Model 2: Never perceives lack of safety (N = 442)**		**Model 3: Perceives lack of safety (N = 407)**	
Variables	**ß**	**95% CI**	**ß**	**95% CI**	**ß**	**95% CI**
Perceived Lack of Safety	0.28**	(0.16, 0.40)	--	--	0.18	(-0.03, 0.39)
Age (Ref: 18-24)						
25-34	0.11	(-0.17, 0.40)	0.09	(-0.31, 0.49)	0.12	(-0.28, 0.52)
35-44	0.36*	(0.03, 0.70)	0.57*	(0.09, 1.05)	0.21	(-0.27, 0.69)
45+	0.23	(-0.21, 0.66)	0.10	(-0.46, 0.66)	0.48	(-0.22, 1.18)
Marital Status (Ref: Married)						
Single	-0.03	(-0.42, 0.35)	0.22	(-0.33, 0.78)	-0.34	(-0.90, 0.22)
Separated	-0.09	(-0.39, 0.22)	0.21	(-0.21, 0.62)	-0.37	(-0.82, 0.08)
Divorced	-0.04	(-0.36, 0.28)	0.14	(-0.30, 0.57)	-0.25	(-0.72, 0.22)
Widowed	-0.09	(-0.68, 0.50)	-0.36	(-1.14, 0.41)	0.05	(-0.85, 0.96)
Wealth items	-0.06**	(-0.10, -0.02)	-0.04	(-0.09, 0.02)	-0.08*	(-0.14, -0.02)
Sufficient Privacy (Ref: No privacy)		(-0.07, 1.04)				
Private location	0.49		1.61**	(0.52, 2.70)	0.20	(-0.47, 0.87)
Private structure	-0.06	(-0.44, 0.32)	0.36	(-0.22, 0.94)	-0.26	(-0.77, 0.25)
Private location and structure	0.11	(-0.38, 0.60)	0.47	(-0.24, 1.18)	-0.03	(-0.72, 0.67)
Latrine can be locked	0.00	(-0.32, 0.32)	0.01	(-0.51, 0.53)	-0.15	(-0.57, 0.26)
Sharing (Number of HH Shared)	0.00	(0.00, 0.01)	0.01*	(0.00, 0.01)	0.00	(-0.01, 0.01)
Distance (Time to Travel)	0.01**	(0.00, 0.01)	0.00	(-0.01, 0.01)	0.01**	(0.00, 0.02)
Sufficient Lighting (Ref: No lighting)		(-0.79, 0.50)				
Lighting inside latrine	-0.15		-0.31	(-1.39, 0.77)	-0.10	(-0.91, 0.71)
Lighting on the way	-0.87**	(-1.26, -0.49)	-0.55	(-1.13, 0.04)	-0.98**	(-1.50, -0.45)
Lighting inside and on the way	-1.11**	(-1.44, -0.79)	-0.67**	(-1.18, -0.16)	-1.34**	(-1.77, -0.91)
R^2	0.13		0.04		0.14	

Significance codes: p<0.01 '**' p<0.05 '*'

4. Discussion

We investigated potential associations between demographic characteristics, latrine attributes, perceptions of lack of safety, and anxiety, using the PHQ-4 among women in Kampala, Uganda. This work aimed to understand women's feelings of safety using their latrines at night. We found that perceiving a lack of safety was common for women in this setting; 49% of women report feeling unsafe at least sometimes when using their latrines at night. However, there were no demographic predictors associated with this perceived lack of safety. This finding did not support the hypotheses that younger and married women would feel safer than older women and women of other marital statuses. Instead, feeling a lack of safety was associated with latrine attributes, especially a latrine's privacy, locking ability, and lighting. We found the opposite of the predicted relationship between privacy, locking, and feelings of safety. Women with privately located and locking latrines were more likely to report frequent feelings of lack of safety. Finally, the data did not support the hypothesis that sharing a sanitation location with many households will be associated with greater perceptions of lack of safety.

The second aim was to investigate the relationship between perceived lack of safety using a latrine at night and anxiety among women in Kampala, Uganda. We hypothesized that a more frequent perceived lack of safety would be associated with a greater frequency of anxiety, which the overall model supported. Several factors influenced this relationship, including distance and lighting. For women who did perceive safety, privacy was also associated with an increased frequency of reported anxiety. However, there were also non-sanitation-related factors associated with frequent anxiety. In the overall model and among women who did not report feeling a lack of safety, anxiety scores were higher among 35–44-year-olds. However, this age group was not likely to report feeling unsafe using a latrine at night.

This study provides evidence that latrine attributes play a significant role in how safe women feel using their latrines, especially at night. First, we found that privacy was important for women's safety; however, we discovered that toilets with private locations were associated with less perceived safety. In contrast, Sahoo et al. (2015) found that the women did not feel safe if men saw them on the way to the latrine. Likewise, Kulkarni, O'Reilly, & Bhat (2017) noted that women using public and community toilets took issue with their latrine and deemed them unsafe due to their location. These findings suggest there is nuance in how women's latrine location influences their perceived safety. In specific contexts, being seen by men on the way to a latrine might make women feel unsafe. At the same time, if latrines are too private, women may feel they are at increased risk of being attacked. Toilets on busy roads might make women feel that more people could witness a hypothetical attack, conferring a degree of safety. Furthermore, in this study, the latrine location referred to the facility used at night. There may be a different perception of safety and privacy when using a latrine in the daytime.

We also found that a latrine's ability to lock was associated with a less perceived safety, which contradicts the findings of several other papers. Hennegan (2018) asserts that the ability to lock doors confers a sense of privacy and dignity for women. Likewise, women consider facilities that do not have locks "unsafe" or "not private" (Corburn & Hildebrand, 2015; Sclar et al., 2018). However, there is a possibility that latrines that have locks do so because safety has been or is an ongoing issue in the area. Women may still perceive limited safety in these areas if the locks alone did not change their perceptions. Future iterations of this work could include perceived neighborhood safety to determine whether latrines that lock are more common in neighborhoods with low perceived safety, supporting this theory.

Finally, we found latrine lighting to influence women's perceived safety when using the latrine at night. The presence of lighting both inside and on the way to the latrine was associated with more perceived safety. This finding is similar to existing literature, which found that women felt vulnerable at night when using toilets that did not have proper lighting (Corburn & Hildebrand, 2015; Sclar et al., 2018). Corburn & Hildebrand (2015) discovered that women deemed using the toilet at night "too risky" due to a lack of lighting and would instead prefer to use buckets for urination. Women with no lights inside their latrines said they would defecate outside due to fear and that if they had a light in their yard, they would be less fearful when using the toilet at night, even if the latrine was not in their yard (Caruso et al. 2018). The fact that women still regard lighting as necessary, even when latrines are not nearby, provides further credence to the critical role that lighting on the path to a latrine plays in providing a perception of safety.

Although we found strong evidence for the connections between latrine attributes and perceived lack of safety, no such association existed for any demographic characteristic. This result not only contradicted several hypotheses but also contradicted existing literature. Several studies have found strong relationships between life stage and the intensity of women's sanitation-related concerns, nighttime concerns, and fear of harm (Caruso et al. 2017a; Caruso et al. 2017b). Hulland et al. (2015) illustrated differences in sanitation-related stressors and found significant differences in perceived lack of safety by location and life stage. In Hulland et al. (2015), the most significant lack of safety occurred among women in urban environments and newly married or pregnant women. Though two components of life stage (age and marital status) were not significantly associated with a perceived lack of safety, more nuanced demographic characteristics (e.g., pregnancy) could have influenced perceived safety when using the latrine.

However, much of the existing literature examines the relationship between demographic characteristics and sanitation-related concerns in India. Perceived safety may vary by life stage in Odisha and not Kampala if the association between demographics and sanitation concerns is context-specific.

Lastly, we found some evidence that a perceived lack of safety contributes to the frequency of self-reported anxiety. In our study, the overall model determined that a higher frequency of lack of safety when using the latrine at night was associated with higher anxiety scores. This result aligns with Caruso et al. (2018), which found a correlation between nighttime concerns and anxiety scores. Also, Sclar et al. (2018) stated that when individuals perceive a threat to privacy or safety when using the latrine, they can experience anxiety from the anticipation of violence. Like Sclar et al. (2018), this paper also found an association between latrine privacy and safety and between safety and anxiety. However, when the model included perceived safety, latrine privacy was no longer significant. In our context, latrine characteristics like distance and lighting were more impactful on women's anxiety from perceived threats to safety when using the latrine at night.

4.1 Strengths and Limitations

A key strength of this paper is its ability to provide critical insight into the sanitation experiences of numerous women throughout Kampala. This study of women's sanitation experiences utilized a data set from more than 1,000 randomly sampled adult women in urban Kampala, Uganda. Within this population, we shed light on the frequency with which women felt unsafe using their latrines and the qualities related to this lack of safety. We also identified a considerable proportion of women above the clinically relevant threshold for anxiety,

highlighting a need for additional mental health research and services in urban Kampala. Additionally, our results successfully linked sanitation qualities, safety, and mental well-being, confirming the need for continued work in this space. Researchers must further explore these relationships in additional areas of Uganda, East Africa, and other parts of the world.

The survey questions used referred to the sanitation location that women used at night for defecation. There might have been different responses for the latrine used during the day. However, we felt confident in using nighttime defecation location because most women (~75%) reported that they used the same facility for nighttime urination. The women who used a different location primarily used buckets located within their home. Hence, the latrine for defecation provided information on the facility most relevant for safety and anxiety at night. However, subsequent iterations of this research could also examine nighttime urination and menstrual management to understand how varying sanitation needs shape how safe women feel accessing a particular sanitation location at night.

Throughout this study, we discovered that specific latrine attributes might have different perceptions between contexts. Previous studies found that privacy was important for women's safety and dignity; however, our research found that a latrine located in a private location was associated with less perceived safety. Existing literature often defines privacy singularly, combining privacy in structure and location. Instead, our study examined both privacy in location and whether the latrine structure provided privacy during use (i.e., doors). An additional strength of this paper is its ability to provide nuance to discussions surrounding latrine privacy and safety because of the distinction between privacy in location and structure.

The authors recognize that we could have conducted the ‘perceived lack of safety’ model using an ordinal logistic regression. However, this study used linear regressions for both

outcomes primarily for the simplicity in interpretation. Subsequent iterations of this study might consider the use of a logistic regression for the ordinal outcome variable 'safety' as appropriate.

We found associations between perceived lack of safety and several latrine attributes, yet no relationship existed between safety and age or marital status. Several previous studies found connections between fear or nighttime concerns and life stage. This study could have seen these associations if we had used life stage instead of discrete age and marital status categories. Additionally, one study found differences in safety based on pregnancy – a demographic characteristic not included in this survey tool. Future work should expand upon age and marital status, considering more detailed demographics to determine whether there is a difference in who experiences less safety using a latrine at night.

Our study illustrated multiple latrine stressors related to anxiety and provided insight into which latrine qualities might enable women in Kampala to feel the most at ease. However, the measure of anxiety has not been validated to measure anxiety in Uganda's general population, though it has been used in studies throughout central and East Africa. Nonetheless, since researchers have not validated the PHQ-4 specifically for women in Uganda, there could be better measures of anxiety for this population. We believe its use in our study was appropriate because the PHQ-4 has been validated among women in Tanzania and a clinically similar cohort in Uganda (Materu et al., 2020; Gottert et al., 2019).

The ownership of more wealth items corresponded to lower anxiety scores among women that ever perceived a lack of safety. The DHS Wealth Index suggests analyzing asset-based wealth items with principal components analysis (Uganda Bureau of Statistics and ICF, 2018). However, the authors wanted to refrain from introducing this analysis since the research questions did not focus primarily on the relationship between economic status and perceived lack

of safety or anxiety. Further, there is evidence supporting the ability of a summed asset score to serve as a proxy for wealth (Montgomery, Gragnolati, Burke, & Paredes, 2000). Like the PHQ-4, we believe the use of an asset sum score was appropriate in this context.

5. Public Health Implications

Few studies have focused on the impacts of sanitation on mental well-being in women, especially regarding perceptions of safety. These findings provide insight into the perceptions of lack of safety when accessing latrines at night for women in Kampala and the factors that influence these perceptions. Moreover, this study was also able to illuminate a potential link between perceived lack of safety and anxiety, providing further evidence that sanitation stressors negatively impact women's mental well-being. This research is part of a more extensive study seeking to define and refine a measure of urban sanitation-related empowerment in sub-Saharan Africa and Southeast Asia. Safety is just one facet of this measure of empowerment, so understanding the interaction between women's latrine use and their perceived safety will provide stakeholders with necessary information on current issues with existing latrines.

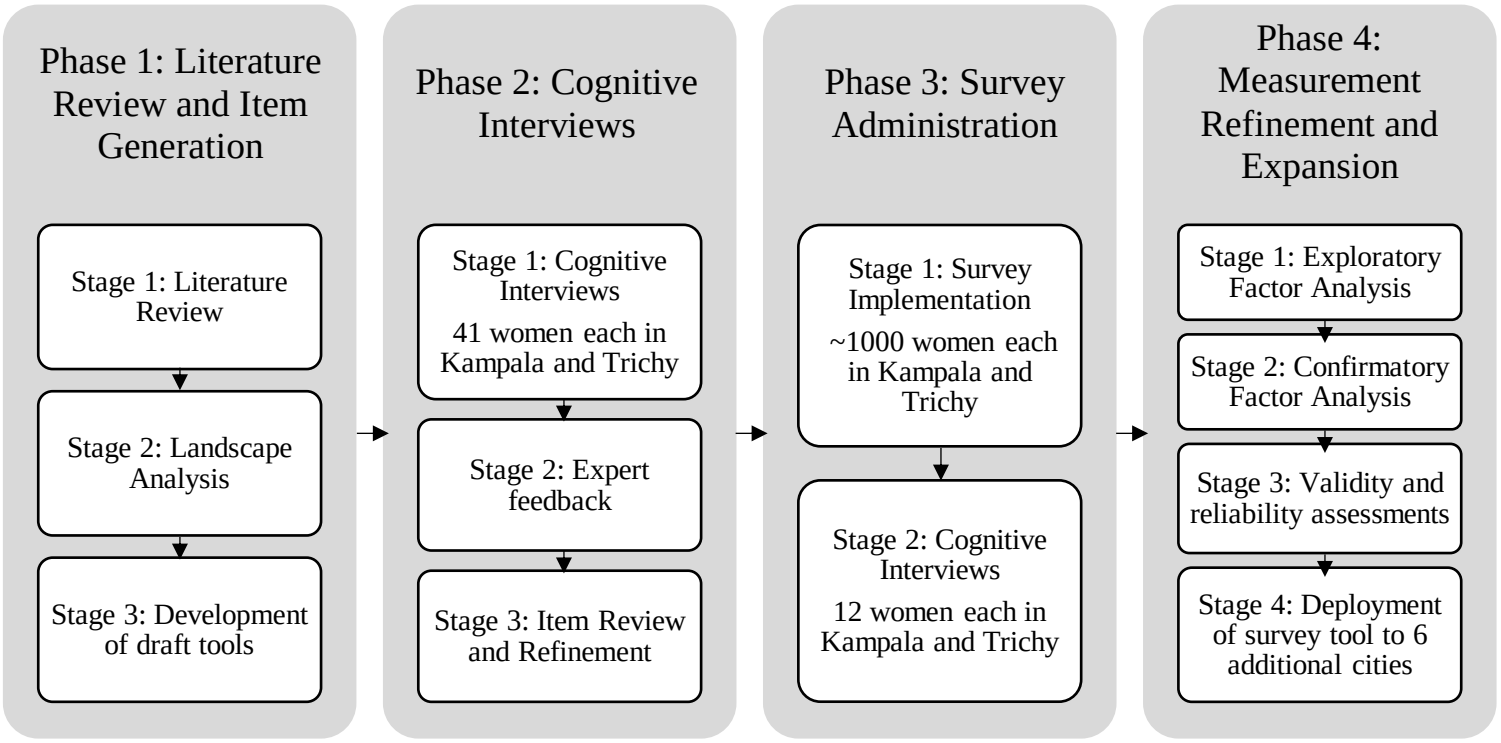
The results of this paper provide evidence of a need to reassess latrine quality in urban Kampala, especially as it relates to shared sanitation spaces. As it stands now, many women in this study reported feeling unsafe when using their latrines at night. This research suggested some of the factors that might be the most important for women to feel safe and thus the most important factors to prioritize. Namely, women often reported more perceived safety when they had access to latrines that were well-lit, both inside and on the way to the toilet. It is important to continue investigating how different latrine attributes influence perceived safety, and ultimately well-being.

One of the unintended implications of this study was the suggestion that shared sanitation locations can be viable sanitation options. WASH stakeholders often miss shared sanitation facilities in sanitation infrastructure initiatives because of their status as "unimproved" facilities. However, most of the women in this study reported using a shared sanitation facility. Even with the high rate of shared facilities, the rates of privacy, ability to lock, and sufficient lighting were relatively high. Much of the criticism of shared latrines is that it is almost impossible to separate the dangerous and unclean facilities from safe and helpful alternatives to open defecation in low-resource settings. Studies like this one can prove that even though shared latrines require attention and reform, they are not hopeless altogether.

There is also a need to devote further attention to sanitation-related mental health, particularly anxiety. We found that certain latrine qualities and overall lack of safety were associated with more frequent experiences of anxiety. Many of the women in this study reported scores on the PHQ-4 above the cut-off for clinically relevant anxiety screening. Though we have recommended a change in how stakeholders approach sanitation reform in urban Kampala, this is likely to be a lengthy endeavor. In the interim, it is essential that policymakers also make efforts to help women manage their anxiety when accessing their latrines at night. For example, communities could host meetings where women could discuss their feelings and potential coping strategies to help mitigate the emotional stress associated with their sanitation facilities. Likewise, communities could police themselves to help women feel safe. If communities were made more aware of the anxiety that women feel in these situations, more husbands, family members, and close friends might be willing to escort women to and from their latrine or provide watch over latrines in general. These changes could increase perceptions of safety in the absence of added lights and doors to a latrine.

Appendix

Appendix 1. Timeline of Study Phases



Bibliography

Ahmadi, S., Arani, A., Bakhtiari, M., & Emamy, M. (2020). Psychometric properties of Persian version of patient health questionnaires-4 (PHQ-4) in coronary heart disease patients. *Iranian Journal of Psychiatry and Behavioral Sciences, 13*(4).

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5).* Washington, DC: American Psychiatric Association.

Ask Your Government Uganda. (n.d.). *Slum Settlement Profile: Kampala Central.* Kampala, Uganda: Ask Your Government Uganda.

Ask Your Government Uganda. (n.d.). *Slum Settlement Profile: Kawampe.* Kampala, Uganda: Ask Your Government Uganda.

Ask Your Government Uganda. (n.d.). *Slum Settlement Profile: Makindye.* Kampala, Uganda: Ask Your Government Uganda.

Ask Your Government Uganda. (n.d.). *Slum Settlement Profile: Nakawa.* Kampala, Uganda: Ask Your Government Uganda.

Ask Your Government Uganda. (n.d.). *Slum Settlement Profile: Rubaga.* Kampala, Uganda: Ask Your Government Uganda.

Caruso, B., Clasen, T., Hadley, T., Yount, K., Haardörfer, R., Rout, M., & Cooper, H. (2017a). Understanding and defining sanitation insecurity: women's gendered experiences of urination, defecation and menstruation in rural Odisha, India. *BMJ Global Health, 2*, e000414.

Caruso, B., Clasen, T., Yount, K., Cooper, H., Hadley, C., & Haardörfer, R. (2017b). Assessing Women's Negative Sanitation Experiences and Concerns: The Development of a Novel Sanitation Insecurity Measure. *International Journal of Environmental Research and Public Health, 14*(755).

Caruso, B., Cooper, H., Haardörfer, R., Yount, K., Routray, P., Torondel, B., & Clasen, T. (2018). The association between women's sanitation experiences and mental health: A cross-sectional study in Rural, Odisha India. *SSM-population health, 5*, 257-66.

City Mayor. (2019). *The world's fastest growing cities and urban areas from 2006 to 2020*. Retrieved from City Mayor Statistics: http://www.citymayors.com/statistics/urban_growth1.html

City Mayor. (2019). *The world's fastest growing cities and urban areas from 2006 to 2020*. Retrieved from City Mayor Statistics: http://www.citymayors.com/statistics/urban_growth1.html

Corburn, J., & Hildebrand, C. (2015). Slum Sanitation and the Social Determinants of Women's Health in Nairobi, Kenya. *Journal of Environmental and Public Health, 2015*.

Cross, P., & Coombes, Y. (2014). Sanitation and Hygiene in Africa: Where do We Stand? *AfricaSan Conference, Kigali, Rwanda.* London: IWA Publishing.

Encyclopedia Britannica. (2014). *Kampala*. Retrieved from Britannica: https://www.britannica.com/place/Kampala

Encylopedia Britannica. (2014). *Kampala*. Retrieved from Britannica: https://www.britannica.com/place/Kampala

Evans, B., Hueso, A., Johnston, R., Norman, G., Pérez, E., Slaymaker, T., & Trémolet, S. (2017). Limited services? The role of shared sanitation in the 2030 Agenda for Sustainable Development. *Journal of Water, Sanitation and Hygiene for Development, 07*(3), 349-351.

Gottert, A., Friedland, B., Geibel, S., Nyblade, L., Baral, S., Kentutsi, S., . . . Pulerwitz, J. (2019). The People Living with HIV (PLHIV) Resilience Scale: Development and Validation in Three Countries in the Context of the PLHIV Stigma Index. *AIDS and Behavior, 23*, 172-182.

Heijnen, M., Cumming, O., Peletz, R., Chan, G. K.-S., Brown, J., & Clasen, T. (2014). Shared Sanitation versus Individual Household Latrines: A Systematic Review of Health Outcomes. *PLoS One, 9*(14), e93300.

Hennegan, J., Zimmerman, L., Shannon, A., Exum, N., OlaOlorun, F., Omoluabi, E., & Schwab, K. (2018). The Relationship between Household Sanitation and Women's Experience of Menstrual Hygiene: Findings from a Cross-Sectional Survey in Kaduna State, Nigeria. *International Journal of Environmental Research and Public Health, 15*(905).

Hulland, K., Chase, R., Caruso, B., Rojalin, S., Biswal, B., Sahoo, K., . . . Dreibelbis, R. (2015). Sanitation, Stress, and Life Stage: A Systematic Data Collection Study among Women in Odisha, India. *PLoS ONE, 10*(11), e0141883.

Kocalevent, R.-D., Finch, C., Jimenez-Leal, W., Sautier, L., & Hinz, A. (2014). Standardization of the Colombian version of the PHQ-4 in the general population. *BMC Psychiatry, 14*.

Kroenke, K., Spitzer, R., Williams, J., & Lowē, B. (n.d.). An ultra-brief screening scale for anxiety and depression: the PHQ-4. *Psychosomatics, 50*(6), 613-21.

Kulkarni, S., O'Reilly, K., & Bhat, S. (2017). No relief: lived experiences of inadequate sanitation access of poor urban women in India. *Gender & Development, 25*(2), 167-183.

Kwiringira, J., Atekyereza, P., Niwagaba, C., & Günther, I. (2014). Descending the sanitation ladder in urban Uganda: evidence from Kampala Slums. *BMC Public Health, 14*.

Löwe, B., Wahl, I., Rose, M., Spitzer, C., Glaesmer, H., Wingenfeld, K., . . . Brähler, E. (2010). A 4-item measure of depression and anxiety: validation and standardization of the Patient Health Questionnaire-4 (PHQ-4) in the general population. *Journal of Affective Disorders*, 86-95.

Massey, K. (2011). *Exploration of the impact of the lack of sanitation on women in the slums of Kampala, Uganda.* London, UK: Department for International Development.

Materu, J., Kuringe, E., Nyato, D., Galishi, A., Mwanamsangu, A., Katebalila, M., . . . Wambura, M. (2020). The psychometric properties of PHQ-4 anxiety and depression screening scale among out of school adolescent girls and young women in Tanzania: a cross-sectional study. *BMC Psychiatry, 20*(1), 321.

Merriam-Webster. (2021). *safety*. Retrieved April 3, 2021, from Merriam-Webster.com: https://www.merriam-webster.com/dictionary/safety

Ministry of Water and Environment. (2018). *Water and environment sector performance report: 2018 Kampala.* Uganda: Ministry of Water and Environment.

Montgomery, M., Gragnolati, M., Burke, K., & Paredes, E. (2000). Measuring Living Standards with Proxy Variables. *Demography, 37*(2), 155-174.

NIMH. (2018). *Anxiety Disorders*. Retrieved from National Institute of Mental Health: https://www.nimh.nih.gov/health/topics/anxiety-disorders/index.shtml

Pett, M., Lackey, N., & Sullivan, J. (2003). Designing and Testing the Instrument. In *Making Sense of Factor Analysis* (pp. 29-49). SAGE Publications, Inc.

Sahoo, K., Hulland, K., Caruso, B., Swain, R., Freeman, M., Panigrahi, P., & Dreibelbis, R. (2015). Sanitation-related psychosocial stress: A grounded theory study of women across the life-course in Odisha, India. *Social Science & Medicine, 133*, 80-89.

Sclar, G., Penakalapati, G., Caruso, B., Rehfuess, E., Garn, J., Alexander, K., . . . Clasen, T. (2018). Exploring the relationship between sanitation and mental and social well-being: A systematic review and qualitative synthesis. *Social Science & Medicine, 217*, 121-134.

Tidwell, J., Chipungu, J., Ross, I., Antwi-Agyei, P., Alam, M., Tumwebaze, I., . . . Simiyu, S. (2021). Where Shared Sanitation is the Only Immediate Option: A Research Agenda for Shared Sanitation in Densely Populated Low-Income Urban Settings. *Am. J. Trop. Med. Hyg., 104*(2), 429-432.

Tumwebaze, I., Orach, C., Niwagaba, C., Luthi, C., & Mosler, H.-J. (2013). Sanitation facilities in Kampala slums, Uganda: users' satisfaction and determinant factors. *International Journal of Environmental Health Research, 23*(3), 191-204.

Uganda Bureau of Statistics and ICF. (2018). *Uganda Demographic and Health Survey 2016.* Kampala, Uganda and Rockville, Maryland, USA: UBOS and ICF: Uganda Bureau of Statistics.

UNICEF and WHO. (2019). *Progress on household drinking water, sanitation and hygiene 2000-2017: Special focus on Inequalities.* New York.