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IDENTIFYING FACTORS ASSOCIATED WITH WOMEN'S SANITATION  
PRACTICES IN INFORMAL SETTLEMENTS IN SUB-SAHARAN AFRICA:  
A CASE STUDY OF MATHARE VALLEY IN NAIROBI, KENYA

by

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N. Andrew Peterson

And approved by

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## **ABSTRACT OF THE DISSERTATION**

### **IDENTIFYING FACTORS ASSOCIATED WITH WOMEN’S SANITATION PRACTICES IN INFORMAL SETTLEMENTS IN SUB-SAHARAN AFRICA**

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Dissertation Director:

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**Background:** Approximately 2.4 billion people around the world lack access to basic sanitation. Sanitation access has proven to be a particularly persistent obstacle to meeting international, national, and local poverty alleviation and sustainability initiatives, especially in sub-Saharan Africa. Literature has shown that women living in informal settlements in these “developing” contexts are disproportionately burdened by lack of access to sanitation. These women, who are often socially and economically disadvantaged, are not only more likely to be excluded from accessing basic services, such as water and sanitation, but are likely to suffer a broader range of consequences from lacking access. While there have been a number of studies over the last decade recognizing women’s unique relationship to sanitation and the disproportionate disadvantages women face as a result of lacking access to sanitation, there have been very few studies focused exclusively on the multi-level factors associated with women’s ability to access and utilize sanitation in informal settlements in East Africa. The purpose of the dissertation was to explore these factors in a large informal settlement in Nairobi, Kenya using a multiphase, mixed methods approach.

**Methods:** The study design for the project was approved in May 2015. Data collection for the project was carried out independently in Mathare Valley informal settlement. Case studies of 55 women in Mathare were carried out between September 2015 and February 2016. Between April 2016 and June 2016, 550 household-level surveys were collected. The project concluded with a period of preliminary analysis and member checking carried out in Mathare between June and August 2016. The goals of this dissertation were to investigate: (1) women's sanitation utilization practices in Mathare; (2) the factors that women identify as influencing their utilization practices; (3) the role that women's fear of victimization/perceived sense of safety plays in women's utilization practices; (4) the role that the proximal social context plays in women's utilization practices; and (5) women's solutions to current sanitation challenges in informal settlements of Nairobi, Kenya.

**Key Findings:** The first aim of the dissertation was to document and empirically analyze the complexity of women's sanitation practices in informal settlements in Nairobi and to generalize about these sanitation practices without losing all the complexity. Findings from the study revealed that women's sanitation profiles are heterogeneous not just in terms of how they manage urine and feces, but also in terms of when. Qualitative findings from the first phase of the study revealed that women in these environments often have up to four different strategies for dealing with their basic sanitation needs in any given 24-hour period. Findings also suggested that even these daily sanitation routines may be interrupted or changed based on a number of factors. Results from a latent class analysis of quantitative data suggested that there are 5 common patterns (sanitation profiles) representing women's typical sanitation practices in Mathare. Qualitative findings were used to confirm these generalized sanitation profiles.

In order to address the second, third, and fourth research aims several analyses were conducted. The first part of the process involved a thorough literature review to identify potential factors influencing women's sanitation utilization and behaviors in general. Subsequently, qualitative analyses (cross-case, thematic) and quantitative analyses (boosted logistic and logistic regressions) were carried out to determine which and to what extent the multi-level factors were associated with women's sanitation profiles in Mathare. Results revealed a number of factors at the social/macro-, community/ neighborhood-, family/household-, individual-, and habitual-levels influence women's sanitation utilization in informal settlements in Nairobi including issues of insecurity, fear of sanitation-related victimization, privacy and social disorganization.

Even though most development policies call for the involvement of women in sanitation-related interventions and projects, women's voices and needs are still often unintentionally left out or ignored in the planning, implementation, and management of sanitation-related development. The final aim of the dissertation was to encourage women to think about solutions to sanitation issues in informal settlements in Nairobi and to document their thoughts to help better inform future sanitation policy and interventions. Data for this portion of the dissertation were qualitative in nature. Cross-case and thematic analyses were carried out on responses from 55 qualitative interviews and on verbatim responses to qualitative questions from the 550 household surveys. Women identified a number of gender-specific solutions to sanitation. These findings mimic several scholars' sentiments about redefining sanitation-related policies and interventions to not just "include" women in projects, but to integrate gender into the very structure of these policies and interventions.

**Conclusions:** The most critical limitations of the study were that the data were cross-sectional, the sample size was relatively small for the complexity of the analyses, and many of the measures were exploratory. However, the findings from the study had a number of implications for sanitation-related policy, development, intervention, and education. The most prominent implication was that gender needs to be more than an after-thought in sanitation policies and interventions. It needs to be at the center. The disproportionate sanitation-related burden born by women stems not only from their disadvantaged position in society and access to services like sanitation, but in the way sanitation decisions are made, in the interventions that are carried out, and in the policies that govern sanitation development. Even more so, findings from this study confirmed a number of results and anecdotal claims from previous studies and provided new insights about the gendered-disadvantages women face when trying to deal with their sanitation needs on a daily basis. The methods, analysis strategies, and interpretation of results in this study were guided by principles that cut across a plethora of disciplines. The interdisciplinary approach used to carry out this research and analyze the findings highlighted a critical need to expand our perspectives and approaches to researching and teaching about issues like sanitation coverage if we have any hope of trying achieve lofty sanitation development goals.

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## INTRODUCTION

Despite many recent policies and interventions to reduce the number of people living without sustainable access to sanitation around the world, 2.5 billion people, globally, still lack access to basic sanitation (WHO & UNICEF, 2015). While sanitation is a persistent problem in all parts of the globe, the burden of lack of access to sanitation falls disproportionately on certain geographic, economic, and social divisions. Lack of access to sanitation, for example, is a particularly persistent problem in sub-Saharan Africa. Between 1990 and 2015, the proportion of the population with access to basic sanitation in this region barely increased from 24 to 30% (United Nations, 2015).

An analysis of 35 countries in sub-Saharan Africa reported that only 42% of the poorest households in urban areas have access to improved sanitation compared to 91% of the richest 20% of urban households (WHO & UNICEF, 2015). Additionally, the issue of poor sanitation is of critical concern for individuals living in informal settlements where high population densities combined with poor sanitation conditions make it challenging for residents to avoid contact with human waste. Approximately one in every three urban residents around the world currently live in informal settlements, and the number is growing by approximately 4.53 percent per year, worldwide (UN-Habitat, 2008a). Annual urban and informal settlement growth rates are even higher in cities in sub-Saharan Africa (UN-Habitat, 2008a). In Nairobi, Kenya, for example, approximately 60% of the city's estimated 3 million people live in informal settlements. Of these residents, 68% rely on shared toilet facilities and an additional six percent have no access to toilets at all--relying on open spaces, plastic bags ("flying toilets"), or buckets as their primary means of meeting daily sanitation needs (Ruhiu et al., 2009).

The burden of inadequate sanitation falls not only disproportionately on the poor but, more specifically, on women and children. Studies suggest the majority of informal settlement residents in East African cities are women and children, many of whom are living in single-mother households (Swadener, 2000). Literature also suggests that the majority of households in Sub-Saharan Africa still lacking access to improved sanitation are located in urban/peri-urban informal settlements (Tumwebaze & Lüthi, 2013)--highlighting the disproportionate burden of sanitation challenges that rests with women (Bosch, Hommann, Rubio, Sadoff, & Travers, 2001; Cairncross, 2003; Khosla, 2000).

Progress on most international sanitation development targets (e.g. Target 7c of the Millennium Development Goals to 'halve the number of people living without sustainable access to basic sanitation' by 2015 or Target 6 of the Sustainable Development Goals to 'ensure access to water and sanitation for all' by 2030) is measured as a function of people *using* improved sanitation, i.e. facilities that ensure that humans do not come into contact with fecal matter (WHO & UNICEF, 2015); yet, literature focused on the factors influencing individual's utilization is sparse. Until recently, sanitation-related literature focused primarily on demand for new technologies, hygiene practices, and linkages between health and sanitation (Isunju, Schwartz, Schouten, Johnson, & van Dijk, 2011; Tumwebaze, Orach, Niwagaba, Lüthi, & Mosler, 2013). In a recent study focused on the socio-economic aspects of improved sanitation in informal settlements in Kampala, Uganda, Isunju et al. (2011) acknowledged that although improved health may be the most important motivator of sanitation improvements for public health officials, practitioners, and scholars, choices regarding the use and improvements of sanitation for individuals surviving in informal settlements



are likely motivated by other factors that contribute to their overall well-being. Only within the last decade has literature started to acknowledge the non-disease-related factors influencing individuals' choices regarding utilization, current sanitation practices, and solutions to sanitation (Isunju et al., 2011; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Mazeau, 2013; O'Reilly & Louis, 2014; Thilde Rheinländer, Keraita, Konradsen, Samuelsen, & Dalsgaard, 2013; Tumwebaze et al., 2013).

Tumwebaze et al. (2013), in one of the notable exceptions, emphasized the importance of understanding factors that contribute to users' satisfaction with their current sanitation, and, consequently, the factors that influence people's use and maintenance of sanitation facilities, particularly in the densely populated informal settlements of developing countries. The study suggests that people are likely to shift or revert to unhygienic sanitation practices such as open defecation or "flying toilets" if they are unsatisfied with improved sanitation options, i.e. *improved* sanitation alone may not lead to improved health and vice versa (Tumwebaze et al., 2013). In general, between 30-70% of sanitation projects fail within a few years (del Carmen Morales, Harris, & Öberg, 2014; J. R. McConville & Mihelcic, 2007; World Bank, 2003), due, at least in part, to insufficient community participation and acceptance (del Carmen Morales et al., 2014; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Katukiza et al., 2010; Rodgers, Ajono, Gyapong, Hagan, & Emerson, 2007; Rubin, Stern, & Vehovar, 1995; Sohail, Cavill, & Cotton, 2005).

While there is a well-established body of literature recognizing that women, as caretakers of the home and family, have a unique relationship to water, sanitation, and hygiene (WASH), in general (Fisher, 2008), there is only a small subset of the literature

that focuses on the health effects of inadequate sanitation specifically on women, e.g. increased risk of infection and hemorrhoids associated with urine and feces retention, particularly during pregnancy, and risk of toxic shock syndrome and vaginal infection resulting from neglectful menstruation practices (Benova, Cumming, & Campbell, 2014; Bosch et al., 2001; Mahon & Fernandes, 2010; World Health Organization, 2004).

Beyond the health-related impacts of inadequate sanitation on women, there are only a handful of empirical studies focused on women's daily relationship with sanitation, i.e. studies specifically focused on women's sanitation practices and the factors that influence them (del Carmen Morales et al., 2014; Dreibelbis, Greene, et al., 2013; Kulkarni, Pune, O'Reilly, & Bhat, 2015; Rubin, 2004; Rubin et al., 1995). Most of these studies are focused on regions in South Asia.

Evidence from these studies, as well as anecdotal and qualitative claims from grey literature focused on these issues in sub-Saharan Africa, suggest that women in developing countries who lack suitable, local sanitation facilities often have to walk long distances to find private places to defecate, and, consequently, risk humiliation, violence, sexual assault, and harassment, particularly when traveling independently and/or at night (Bosch et al., 2001; Jewitt, 2011; Massey, 2011; Rubin, 2004; Sommer, Ferron, Cavill, & House, 2014; World Health Organization, 2005). Furthermore, preliminary research findings from informal settlement regions in Kampala, Uganda (Massey, 2011) and Nairobi, Kenya (Amnesty International, 2010), suggest that women's fear of physical and sexual violence, i.e. low perceived sense of safety, associated with having to walk to and use inadequate sanitation facilities, has forced many of them to revert to unimproved forms of sanitation (e.g. plastic bags or bucket toilets)—potentially contributing not only

to persistent sanitation development challenges and the public health concerns associated with exposure to pathogens in human feces, but also obstacles to women's day-to-day efforts to manage their sanitation needs.

### **Dissertation Aims**

While there are numerous policies, reports, and health-related studies that mention an important connection between women's health and sanitation, there are few studies that focus exclusively on women's experiences with and perceptions of their current sanitation environments and how these factors influence their daily sanitation practices in informal settlements; those that do exist are based in South Asian contexts (del Carmen Morales et al., 2014; Dreibelbis, Greene, et al., 2013; Kulkarni et al., 2015; Rubin, 2004; Rubin et al., 1995). Additionally, much of the literature has failed to give voice to women's solutions to improve sanitation conditions in these settings.

Therefore, this dissertation explores women's sanitation utilization practices, the factors associated with those practices, and women's solutions to sanitation challenges in informal settlements in Nairobi, Kenya through an investigation of data collected during a 12-month, multi-phase, mixed methods project in Mathare Valley Informal Settlement (Mathare). The overall goals of the dissertation are to examine: (1) women's sanitation utilization practices in Mathare; (2) the factors that women identify as influencing their utilization practices; (3) the role that women's fear of victimization/perceived sense of safety plays in women's utilization practices; (4) the role that the proximal social context plays in women's utilization practices; and (5) women's solutions to current sanitation challenges in informal settlements of Nairobi, Kenya.

Data and interpretation of the results of the project are presented in the form of three papers. The first paper investigates women's sanitation utilization practices in Mathare—exploring not only women's primary sanitation utilization during the day, but their sanitation utilization at night as well; their specific strategies for disposing of urine and feces, separately; and, developing general sanitation profiles for women in Mathare. The second paper explores the factors associated with women's sanitation utilization in Mathare. Exploring, specifically, the associations between factors that are commonly cited in the scholarly literature and women's sanitation utilization; the nature (direction and magnitude) of those associations; whether fear of victimization/sense of safety emerges as an important factor; and, finally, whether proximal social context (social cohesion and/or social disorganization) emerges as an important factor in women's sanitation utilization in Mathare. The third paper investigates women's solutions to sanitation challenges in informal settlements in Nairobi, Kenya.

The literature reviewed for this dissertation was drawn from a variety of sources and disciplines. While many of the terms used in the text are common language, there are some terms that will be repeated throughout the dissertation that are understood to have specific meanings or connotations. For detailed definitions of the terms used in this dissertation, please reference the Glossary of Terms at the end of this dissertation. Although the definitions for the terms in the glossary are not, by any means, exhaustive or universal, they are meant to provide a baseline of understanding between reader and researcher.

## **Women and Water, Sanitation, and Hygiene**

The purpose of this dissertation was to explore women's perceptions, experiences, utilization choices, and solutions related to their current sanitation environments in informal settlements in Kenya. While there are no studies that directly address this particular issue, there are a number of studies that have focused on women's unique relationship to water, sanitation, and hygiene (WASH), more generally.

As the primary caretakers of the home, women in many parts of the world are responsible for supplying water for drinking, cooking, bathing, hygiene, and other domestic tasks (Fisher, 2008). Women are also primarily responsible for raising children and, frequently, for taking care of sick members of the household (Fisher, 2008). These roles and responsibilities put women in a critical position for establishing and maintaining safe and hygienic spaces within the household, ensuring that children form hygienic health- and sanitation-related habits, and helping to minimize illness from preventable diseases (Fisher, 2008).

Literature has identified several ways in which women have a unique, and frequently inequitable, relationship to WASH at the household and community level: (1) gendered health outcomes and WASH, (2) gendered cultural norms related to WASH, (3) menstruation and WASH, (4) pregnancy, childbirth and WASH, (5) women's safety and WASH, (6) caring for the disabled and WASH, (7) gendered school attendance and WASH, (8) gendered economics of WASH, and (9) gendered utilization of WASH.

**Gendered health outcomes and water, sanitation, and hygiene.** Lack of adequate sanitation is associated with negative health consequences, including infectious diseases, child mortality, wasting, and stunting (Lim et al., 2013). Over the last couple of

decades, studies have started to recognize that the health burden associated with absent or poor sanitation facilities falls disproportionately on women (Bosch et al., 2001; Cairncross, 2003; Greed, 2015; Khanna & Das, 2016; Khosla, 2000; K. O'Reilly, 2016; Sahoo et al., 2015; Sommer et al., 2014).

Sanitation-related health consequences for women include increased risk of toxic shock syndrome, vaginal infection, and dysmenorrhea resulting from neglectful menstruation practices and unhygienic toilet facilities and infections and hemorrhoids associated with feces and urine retention (Bosch et al., 2001; Corburn & Hildebrand, 2015; Greed, 2015; Mahon & Fernandes, 2010; World Health Organization, 2004). In some areas, the facilities that are available may not be designed to meet the physical and psychological needs of women (Fisher, 2008). Research suggests, for example, that women risk additional infection as a result of inadequate washing facilities (Sommer et al., 2014; E Tilley, Bieri, & Kohler, 2013). Fisher (2008) describes a situation in South Africa in which it is women's responsibility to periodically empty the contents of a poorly-designed, pour-flush toilet called the Aqua Privy. Fisher (2008) goes on to suggest that these particular toilets are uncomfortably small for pregnant women and women with children. These toilets often face the street and require women to fetch water for each use--"an obvious sign that a woman needs to use a toilet" (Fisher, 2008, p. 224)--increasing women's risk of embarrassment and exposure to harassment (Fisher, 2008)

Literature suggests that WASH improvements can result in lower incidence of water-borne and communicable disease. For women, this outcome is associated with both direct and indirect benefits for their health. As the primary caretakers in the home, women also benefit from more widespread health improvements in their homes and

communities. Healthier children and family members means less strain from collecting additional water and taking family members to urinate/defecate (especially if open defecation is a must) and fewer days missed at work and school (Corburn & Hildebrand, 2015; Khanna & Das, 2016).

**Gendered cultural norms related to water, sanitation, and hygiene.** A number of WASH-related studies suggest that cultural, religious, and/or social norms can play an important role in women's relationship to WASH. A number of studies suggest, for example, that there are many more public toilets available to men than women and, often, only women have to pay to urinate (Corburn & Hildebrand, 2015; Greed, 2015; E Tilley et al., 2013). Fisher also reports that in many areas where women follow 'purdah'--a Muslim or Hindu practice which requires women to follow strict social practices and cover their bodies to avoid the gaze of men or strangers--women without access to adequate sanitation facilities must wait until nightfall or early morning to seek a private place to defecate or urinate, which is particularly problematic for women who are pregnant or menstruating (2008). Findings from other studies focused on community-led total sanitation (CLTS) interventions found that cultural taboos in some African contexts (e.g. Mali, Liberia, and Kenya) prevent daughters in-law from utilizing the same toilets as their fathers in-law and/or prevent pregnant women from using latrines for fear they will lose their unborn children (Bongartz, Musyoki, Milligan, & Ashley, 2010; Musyoki, 2010a, 2010b).

**Menstruation and water, sanitation, and hygiene.** Women menstruate for approximately 2,100 days or 6 years of their life--one of several physiological differences that separates women's sanitation needs from men's (E Tilley et al., 2013). WASH plays a

critical role in women's menstrual hygiene and management. A number of studies have looked at challenges women and girls face during menstruation including days missed at school, increased risk of health issues, lack of places to change sanitary pads/cloth, etc. (K. O'Reilly, 2016; Sommer, 2010, 2013; Sommer et al., 2014; Sommer, Kjellén, & Pensulo, 2013; WaterAid, 2009). There are many researchers who also provide suggestions and/or solutions to some of these issues including private and safe places to change sanitary products and rubbish bins in toilets to prevent women from having to carry soiled materials and water for both hand and body washing (K. O'Reilly, 2016; Sommer, 2010, 2013; Sommer et al., 2014; Sommer et al., 2013; WaterAid, 2009). Without access to adequate sanitation and washing facilities and/or hygienic menstrual management, women risk contracting urinary and vaginal infections and/or toxic shock syndrome (Fisher, 2008). Therefore, WASH interventions have the potential to help women manage their needs and improve their health and psychological well-being. A research from a study in Tanzania found that women with access to water near their homes reported improvement not only in their menstrual hygiene, but in their confidence in front of other people (Fisher, 2008).

**Pregnancy, childbirth, and water, sanitation and hygiene.** A number of studies suggest that WASH interventions can be particularly important for women during pregnancy and the post-natal period. Lack of access to adequate sanitation and washing facilities during pregnancy increases women's risk of disease and infection, for example, pathogen-related anemia (Campbell, Benova, Gon, Afsana, & Cumming, 2014). Unhygienic practices in labor and delivery cause puerperal infections that are said to be the cause of 15% of all maternal deaths worldwide (Fisher, 2006). Pregnant women are,



for example, particularly vulnerable to hookworm infestations--a water-borne pathogen frequently associated with low birth weight (Fisher, 2008).

**Women's safety and water, sanitation and hygiene.** A growing body of literature suggests that WASH may be associated with an increase in women's vulnerability to violence (Sommer et al., 2014). According to much of the literature, lack of access to sanitation and washing facilities has serious health and safety-related repercussions for women. In areas where there are no facilities for defecation, for example, women and girls, in particular, often wait until nightfall and travel long distances from their homes to find a private place to defecate (Cairncross, 2003; Khanna & Das, 2016; Pardeshi, 2009; Pearson & Mcphedran, 2008; Sommer et al., 2014). According to these references, traveling away from home in the dark to find a private place to defecate increases women's risk of sexual harassment and assault, particularly when they are travelling alone (Amnesty International, 2010; Cairncross, 2003; Massey, 2011; Pardeshi, 2009; Pearson & Mcphedran, 2008). Other authors have suggested that lack of access to adequate sanitation may increase women's and girls' vulnerability to rape and other forms of gender-based violence (Amnesty International, 2010; Bosch, Hommann, Rubio, Sadoff, & Travers, 2002; Corburn & Hildebrand, 2015; Fisher, 2008; ITDG - Practical Action, 2005; Khosla, 2000; Mahon & Fernandes, 2010; Massey, 2011; Pardeshi, 2009; Pearson & Mcphedran, 2008).

Some reports suggest that women may fear using shared community or public toilets (Corburn & Hildebrand, 2015; ITDG - Practical Action, 2005). Studies suggest that some community or shared toilets require women to walk through or by the men's section of the facility and that doors and/or locks are often missing or deteriorating in

many of these toilets (Abrahams, Mathews, & Ramela, 2006; Corburn & Hildebrand, 2015; Khosla, 2000). Additionally, some women in the informal settlements of Nairobi, Kenya, report that they risk physical and sexual violence because they have to walk long distances to reach shared, public toilet facilities (Amnesty International, 2010; Corburn & Hildebrand, 2015). This literature suggests that such factors lead women to feel particularly insecure, unsafe and vulnerable to harassment when using shared community or public toilets (Corburn & Hildebrand, 2015; Khosla, 2000).

Another growing body of literature focuses on women's increased vulnerability resulting from inadequate sanitation and washing facilities specifically in camps for internally displaced persons (IDPs). Recent reports on the aftermath of the Haitian earthquake suggest, for example, that open-air sanitation facilities, lack of washing facilities, and poor lighting in IDP camps increased women's risk of sexual assault (Bird, Emery, Shaw, & Santosa, 2011). Approximately a third of the women in the study reported never feeling safe when utilizing the sanitation and washing facilities and an additional six percent reported feeling safe only during the day (Bird et al., 2011).

**Caring for the disabled and water, sanitation, and hygiene.** Physiologically, urination and defecation require women to squat, which can be particularly challenging for women and girls with disabilities (Greed, 2015; Sommer et al., 2014). Additionally, people with disabilities can have serious challenges accessing private places for urination/defecation when there is a lack of sanitation facilities or the available facilities are not designed with consideration for people of varying abilities (Fisher, 2008; Greed, 2015; Sommer et al., 2014). Lack of access to water and sanitation can add an additional

burden for women who are responsible for taking care of sick or disabled members of the household (Corburn & Hildebrand, 2015; Fisher, 2008; Khanna & Das, 2016).

**Gendered school attendance and water, sanitation, and hygiene.** A number of studies suggest that lack of water and sanitation is associated with poor school attendance, particularly for women and girls in developing countries. Some studies suggest that school attendance by both boys and girls is affected by their exposure to water and sanitation-related diseases (Fisher, 2008). Studies suggest that girls are deterred from attending school if there are no private sanitation facilities for women, particularly during times of menstruation (Fisher, 2008). According to a study carried out by the Interagency Task Force on Gender and Water, for example, providing separate boys and girls toilets at school resulted in an 11% annual increase in girls' attendance. Beyond access, there is also some evidence that the quality of sanitation may be an important factor associated with school attendance for both boys and girls (Dreibelbis, Greene, et al., 2013). However, more recent literature appears to contest some of these findings--suggesting that school attendance is influenced by a wide variety of structural factors and that there may be insufficient evidence to make claims about the influence of sanitation and water factors on attendance (Sommer, 2010, 2013; E Tilley et al., 2013).

**Gendered utilization of water, sanitation, and hygiene.** Sanitation provision has traditionally been treated as a technical and/or engineering issue. However, an increasing body of literature suggests that sanitation is not merely an issue of building more toilets or better toilets (K. O'Reilly, 2016; E Tilley et al., 2013). This literature is focused, instead, on the social and economic factors that are associated with toilet

acceptability (Greed, 2015; O'Reilly & Louis, 2014). There is some recognition in the literature that sanitation interventions need to account, specifically, for differences in the physical needs of men and women; the social norms that regulate individual, household, and community needs; and natural and built environments (Greed, 2015; E Tilley et al., 2013). This aspect of the women-WASH relationship and, specifically, the relationship between women and sanitation utilization was the primary focus of this research and, accordingly, will be discussed in more detail in later sections of the dissertation.

### **Theory and Models for Understanding Sanitation Utilization**

Within the acceptability and demand literature, there are a suite of theories and frameworks that have been developed to organize and categorize the factors that influence acceptability of, demand for, and motivation to adopt improved sanitation. Recently, a number of scholars and organizations have developed frameworks to help conceptualize, organize, and, in some instances, generalize the stages and drivers that influence individual, household, and community demand for, acceptance of, and/or utilization of improved WASH practices (Curtis, Danquah, & Aunger, 2009; Devine, 2009; Dreibelbis, Winch, et al., 2013; M. W. Jenkins & Scott, 2007; Mazeau, 2013; O'Reilly & Louis, 2014; Thilde Rheinländer et al., 2013). Some of these frameworks are based largely on behavioral theory (e.g. Curtis et al., 2009; Devine, 2009; M. W. Jenkins & Scott, 2007) while others take a more ecological approach to modeling the factors that influence people's sanitation perceptions and preferences (e.g. Dreibelbis, Winch, et al., 2013; Mazeau, 2013; O'Reilly & Louis, 2014).

The purpose of this section of the dissertation will be to summarize, briefly, some of the frameworks that have been used to conceptualize, organize, and/or generalize

sanitation demand/acceptability, acceptance, and/or utilization of sanitation. While this list of models is certainly not comprehensive, it is meant to provide the reader with a foundation for understanding the general structure and approach of existing WASH models. Additionally, several of these models build on or incorporate the theoretical approach or structure of previous models from the literature (e.g. Dreibelbis, Winch, et al., 2013). After reviewing a range of extant WASH frameworks, one of them, the IMB-WASH model (Dreibelbis, Winch, et al., 2013), specifically, will be applied to organize a wide range of sanitation utilization factors that were gathered from a careful review of the demand/acceptability, acceptance and utilization literature.

**Behavioral theories.** The SaniFOAM approach (Devine, 2009) applies psychological behavior theories (e.g. theory of planned behavior, trans-theoretical models of change, social cognitive theory, and the health belief model) to identify three groups of sanitation determinants:

1. Opportunity, which describes the access/availability, product attributes, social norms, sanctions and enforcement surrounding sanitation.
2. Ability, which is described as the knowledge, skills and self-efficacy, social support, roles and decisions, and affordability of sanitation.
3. Motivations, which includes attitudes and beliefs; values; emotional, physical, and social drivers; competing priorities; intentions; and willingness to pay for sanitation.

Critics of the SaniFOAM framework suggest that the assignment of factors to the groups is arbitrary and not guided by psychological theory (Mosler, 2012). Furthermore, the model fails to provide ecological, behavioral, or temporal structure for the factors.

Curtis and colleagues developed a model that uses social psychology and biological anthropology to explain water, sanitation and hygiene behaviors more generally (2009). Within this model, factors are grouped into two categories:

1. Environment, which consists of social, physical and biological factors associated with hand-washing behavior
2. Brain, which includes planning (long-term objectives, e.g. health of family), motivation (reward-based behavior, e.g. disgust, status, affiliation, attraction, nurture, comfort, and fear), and habit factors (behavior developed through automation and repetition)

While this model is strongly rooted in empirical findings from qualitative research carried out in 11 countries, the model focuses heavily on post-adoption behaviors, e.g. after people already have access to improved hygiene alternatives--a situation which may vary importantly from women's sanitation environments in informal settlements in Nairobi where sanitation choices are limited or unavailable.

Finally, M. W. Jenkins and Scott (2007) used data derived from rural Ghana to develop a preference-intention-choice decisional model to understand an individual's or household's decision to build a toilet (2007). Preference included factors such as users' motivation to purchase (stemming from dissatisfaction with current sanitation facilities or methods of disposal and awareness of other alternatives) and their perceptions of the relative advantages, benefits, and reasons for wanting a new sanitation facility or method of disposal. In Jenkins and Scott's model, intention is defined by prioritization of acquiring a new sanitation alternative and the absence of permanent constraints to acquisition (e.g. technical or economic restrictions). Choice was defined as a user's actual

ability to adopt a new sanitation facility or method of disposal (including acquisition of knowledge, money, and technology).

**Ecological theories.** In addition to the behavioral models, some water, sanitation, and hygiene acceptability and demand literature use an ecological approach (Bronfenbrenner & Bronfenbrenner, 2009)—organizing factors that influence demand, acceptability, or utilization into categories based on transactions between a person and his/her environment (Greenfield, 2011). Mazeau (2013), for example, applied this person-in-environment approach to develop an ecological framework that organizes and relates factors that influence acceptability of sanitation alternatives in informal settlements in urban Ghana into micro- (household structure, socio-economic characteristics, housing patterns), meso- (population density, urban planning, political and religious power) and macro- (institutional and legal frameworks, development funding, land ownership and regulation) levels. Within each of these ecological levels, he also explores the roles that sanitation alternatives (technologies), providers, and users play in influencing overall acceptability of sanitation.

More recently, O'Reilly and Louis (2014) applied a political ecological framework to understand toilet adoption in rural India. According to this model, sanitation adoption and sustained usage occurs "at the intersection of political will, proximate social pressure, and political ecology" (p.4), where:

- "political will" included factors such as international protocols (e.g. the MDGs); national programs, local and regional sanitation policies, local, national and regional funding for sanitation; and "local mobilization of human resources".

- "proximate social pressures" included elements such as individual or household wealth, the "connectivity" between urban areas on rural villages, and the influence of relatives/neighbors.
- "political ecology" included factors such as land use, availability of water, and the availability of feces disposal options.

Finally, Dreibelbis, Winch, et al. (2013) developed an integrated behavioral model for water, sanitation, and hygiene (IBM-WASH). This person-in-environment model (Greenfield, 2011) takes into account the socio-ecological conditions that influence individuals' WASH behaviors. The IBM-WASH framework was developed through an iterative process that involved a review of extant WASH-related behavioral and ecological models from peer-reviewed and grey literature, findings from a pilot study of two clustered randomized control trials focused on technology and hygiene promotion interventions in Bangladesh, and, finally, from feedback based on presentations of the model at several workshops at WASH-related conferences in Bangladesh and the United States. The model breaks factors into contextual, psychosocial, and technology groupings and then further categorizes them into the following ecological categories: individual, interpersonal/household, community, societal/structural, and habitual. The details of the model are summarized in Table 1.1. For example, psychosocial factors at the community level might include shared values, collective efficacy, social integration, and stigma with regard to sanitation acceptability or adoption (Dreibelbis, Winch, et al., 2013).



Table 1.1.  
*Integrated behavioral model for water, sanitation and hygiene*

	Contextual Factors	Psychosocial Factors	Technology Factors
Societal/ Structural	Policy and regulations, climate and geography	Leadership/advocacy cultural identity	Manufacturing, financing, and distribution of the product; current and past national policies and promotion of products
Community	Access to markets, access to resources, built and physical environment	Shared values, collective efficacy, social integration, stigma	Location, access, availability, individual vs. collective ownership/access, and maintenance of the product
Interpersonal /Household	Roles and responsibilities, household structure, division of labor, available space	Injunctive norms, descriptive norms, aspirations, shame, nurture	Sharing of access to product, modeling/demonstration of use of product
Individual	Wealth, age, education, gender, livelihoods and/or employment	Self-efficacy, knowledge, disgust, perceived threat	Perceived cost, value, convenience, and other strengths and weaknesses of the product
Habitual	Favorable environment for habit formation, opportunity for and barriers to repetition of behavior	Existing water and sanitation habits, outcome expectations	Ease/effectiveness of routine use of product

Each of the frameworks presented in this section of the dissertation was derived from a theoretical and/or empirical understanding of WASH-related behaviors and phenomena, and thus, may be less applicable in different physical, social, political, and economic contexts. As it was not the intent of this research to test the relevance of a particular theory within the context of the Mathare setting, the IBM-WASH model, which

provides a fairly comprehensive yet general framework for conceptualizing and organizing the potential factors influencing sanitation utilization, was used to guide the dissertation research.

### **Applying the Integrated Behavioral Model for Water, Sanitation, and Hygiene**

Recent literature acknowledges that engineers, developers, policy-makers, and social scientists need to focus on understanding and engaging the social and economic factors that encourage toilet utilization rather than exclusively on expanding toilet coverage (O'Reilly & Louis, 2014; E Tilley et al., 2013). Several studies have focused specially on identification of general or, more commonly, context-specific socio-cultural, political, and/or economic factors that influence demand or acceptability for, acceptance of, and/or utilization of sanitation (M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; O'Reilly & Louis, 2014). A thorough review of the literature identified a number of factors associated with sanitation acceptability and/or utilization. The IBM-WASH framework was used to organize these factors into overarching groups and ecological categories. Table 1.2 illustrates the way in which the IBM-WASH framework was applied to organize these factors and each factor is discussed in more detail below.

Table 1.2.  
*Application of integrated behavioral model for water, sanitation, and hygiene*

Levels	Contextual Factors	Psychosocial Factors	Technology Factors
Societal/ Structural	<ol style="list-style-type: none"> <li>Policies               <ol style="list-style-type: none"> <li>Sanitation</li> <li>Land Use (Tenant rights)</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>Cultural/religious norms</li> </ol>	
Community	<ol style="list-style-type: none"> <li>Environment</li> </ol>	<ol style="list-style-type: none"> <li>Proximal Social Context               <ol style="list-style-type: none"> <li>Landlord/tenant relationships</li> <li>Policing</li> <li>Social disorder</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>Facility Structure (public facility)               <ol style="list-style-type: none"> <li>Superstructure</li> <li>Facility attributes (e.g. doors, locks, gender blocks)</li> <li>Cost of using facility</li> <li>Convenience (distance, time to use, number of people sharing)</li> </ol> </li> <li>Availability of alternative facilities               <ol style="list-style-type: none"> <li>Cost of alternative facilities</li> <li>Characteristics of alternative facilities (convenience, structure)</li> </ol> </li> </ol>
Interpersonal/ Household	<ol style="list-style-type: none"> <li>Household Structure</li> <li>Socio-economic demographics               <ol style="list-style-type: none"> <li>Wealth</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>Dignity</li> </ol>	
Individual	<ol style="list-style-type: none"> <li>Demographics               <ol style="list-style-type: none"> <li>Age</li> <li>Education</li> <li>Employment</li> </ol> </li> <li>Experiences of violence</li> <li>Health outcomes</li> </ol>	<ol style="list-style-type: none"> <li>Perceived sense of safety</li> <li>User satisfaction</li> <li>Sense of privacy</li> <li>Biological drivers               <ol style="list-style-type: none"> <li>Odors</li> <li>Visibility of feces</li> </ol> </li> </ol>	<ol style="list-style-type: none"> <li>Facility Structure (private)</li> <li>Perceived cost of sanitation</li> <li>Convenience               <ol style="list-style-type: none"> <li>Location of facility</li> <li>Distance/time to facility</li> <li>Time to use (queuing)</li> <li>Number of people sharing facility</li> </ol> </li> </ol>
Habitual	<ol style="list-style-type: none"> <li>Access to water</li> </ol>	<ol style="list-style-type: none"> <li>WASH Knowledge, attitudes and practices (KAP)</li> </ol>	<ol style="list-style-type: none"> <li>Hygiene and cleanliness of facility (management and upkeep)</li> </ol>

### **Social/structural factors.**

#### ***Contextual factors.***

*Policies.* The dynamics of the political process underlying provision of sanitation is largely absent from the literature despite the fact that land ownership and investment, provision of service, administration, and regulation of sanitation, whether in the private or public sector, are part of a political process likely to affect available sanitation options as well as people's personal sanitation preferences and choices (Isunju et al., 2011).. Such policies and processes will likely have an effect on people's sanitation preferences and choices, particularly in informal settlements where there is a large array of stakeholders (landlords, tenants, ministries, non-governmental organizations, donors, international lending agencies) with their own, potentially conflicting, sanitation interests.

#### ***Psychosocial factors.***

*Cultural/religious norms.* Cultural and religious factors affect people's attitudes towards sanitation (De Bruijne, Geurts, & Appleton, 2007; Okurut, Kulabako, Chenoweth, & Charles, 2015). According to Douglas (2003) defecation is frequently considered 'dirty' or 'polluting' when it is "out of place." Her theory suggests that defecation has to be understood in a wider social and cultural context. Norms and behaviors are created to establish social order with regard to 'dirt.' These norms and practices define the social structure surrounding defecation and sanitation, i.e. what is and is not acceptable (e.g. locations where it is acceptable to defecate) (Budge, 2013; Douglas, 1966, 2003). Some literature suggests, for example, that people's sanitation behaviors and adoption are strongly influenced by peer pressure (Waterkeyn & Cairncross, 2005).

One study carried out in Kenya, Tanzania, and Ethiopia found that open defecation in fields was considered acceptable because it was practical, e.g. excreta was considered a good fertilizer (Almedom, 1996; Almedom, Blumenthal, & Manderson, 1997). The study also found that socio-cultural norms defined who was allowed to share a latrine (Almedom, 1996; Almedom et al., 1997). A study carried out in southwestern Uganda found that improved sanitation was common because, according to cultural and religious beliefs, it is considered distasteful for a household to be constructed without a latrine (Okurut et al., 2015).

In informal settlements, where the population is dense, it is particularly important to understand each user's sanitation preferences and choices in the context of other users' behaviors, including members of the household and neighborhood (Assefa & Frostell, 2007). According to recent literature, individual sanitation preferences and choices are informed by the "historical construction" defined by the characteristics and social structure of the group, especially in densely populated urban areas (Mazeau, 2013).

### **Community factors.**

#### ***Contextual factors.***

*Environment.* Environment is considered one of the "hardware" factors influencing sanitation preferences and choices. Research suggests this is particularly true in informal settlements where the local environment (e.g. lack of access roads, broken or non-existent central water supply and/or sewer infrastructure, high population densities, complicated land ownership dynamics, and environmental barriers such as high water tables, unstable soils, heavy rains, and/or uneven geography) make it very difficult for public or private entities or individual users themselves, to develop sanitation alternatives

(Okurut et al., 2015). Some sanitation options may not be available to individuals in certain social environments, e.g. informal settlements, because technical standards, regulations, land tenure systems, and population density limits access to or development of sanitation alternatives (Mazeau, 2013; Tumwebaze & Lüthi, 2013; Tumwebaze et al., 2013).

***Psychosocial factors.***

*Proximal social context.* Sanitation preferences and choices in informal settlements are often limited by the complicated land tenure and landlord/tenant relationships in these areas (Isunju et al., 2011). Capital investment by landlords in sanitation options is frequently low in informal settlements. Yet, sanitation preferences and choices of tenants largely depend on the sanitary facilities provided by landlords, public entities, or private companies and organizations (Isunju et al., 2011). Most of the discussions of the proximal social context, e.g. the landlord/tenant relationships in informal settlements, are focused on user demand for alternative sanitation options rather than user's use of existing facilities; however, the social context is associated with available sanitation alternatives that subsequently affect user's sanitation preferences and utilization choices (Isunju et al., 2011).

***Technological factors.***

*Structure/features of facility.* Technology is the primary "hardware" factor associated with people's sanitation preferences and choices. Facility technology in the literature usually refers to the type of facility (e.g. traditional pit latrine, improved pit latrine, communal pit latrine, composting toilet, pour flush toilet, flush toilet, etc.). Facility technology can also refer to specific characteristics of the design, e.g. a

superstructure, locks on the doors, separate toilet blocks for women/men, hand washing facilities, pit covers, ventilation systems, lighting), particularly in the case of shared/public/community toilets (Okurut et al., 2015).

*Cost of facilities.* Some literature suggests that the cost of regularly using communal sanitation facilities (e.g. between 3 to 5 Kenyan shillings in informal settlements in Kenya) can be prohibitively expensive, particularly for mothers of several children (Amnesty International, 2010). When the cost of sanitation is too much of a burden, literature suggests that users will revert to open defecation or flying toilets (Mazeau, 2013).

*Availability of alternative facilities.* A lot of the demand and motivation for investment in sanitation is focused on the availability of alternative facilities. Some literature suggests that residents in informal settlements frequently have two or three sanitation alternatives that they cycle through according to time of day, convenience, etc. (Mazeau, 2013). Literature suggests that it is important to assess people's preferences and choices in the context of sanitation alternatives (Mazeau, 2013). For example, people may have preferences for certain facilities, but, due to cost of the facility, location, and convenience, people may not choose to use that facility as their primary sanitation option. For example, shared toilets are the most common sanitation facilities in informal settlements (Tumwebaze & Lüthi, 2013), but these facilities may not always benefit women, children, the elderly, the poorest, or the disabled due to social, economic, or physical barriers. While these populations may choose to use these facilities, they may also choose other options.

## **Family and household factors.**

### ***Contextual factors.***

*Household structure.* Although there are no studies directly investigating family structure as it relates to people's sanitation preferences and utilization choices, recent literature asserts that children may influence sanitation behaviors and practices. One study suggests that 'ease of use by children' was an important factor influencing whether mothers would use communal or shared toilets in informal settlements (Lagerkvist, Kokko, & Karanja, 2014). Another study suggests that many women feel that traditional pit latrines are "unsafe for children" (Mazeau, 2013) and, consequently, will not take their children to use these types of facilities. While empirical evidence suggesting that children influence the sanitation behaviors of other members of the family, particularly mothers, is limited, it may be reasonable to assume that the inconvenience of having to assist children to use facilities that are deemed "unsafe" for them may influence adult choices as well.

*Socio-economic factors.* According to recent literature, attitudes, waste generation and management can be influenced by gender, religion, wealth and other socio-demographic variables (De Bruijne et al., 2007; Okurut et al., 2015). Although there is a paucity of research relating sanitation preferences and choices to the socio-economic characteristics of the individual or household, wealth, literacy, and age are demographics that have been empirically linked to the demand and adoption of improved sanitation technologies (M. W. Jenkins & Scott, 2007; Kema et al., 2012; Okurut et al., 2015).



### ***Psychosocial factors.***

*Dignity.* There are a number of studies suggesting that people's sanitation preferences and utilization behaviors are associated with privacy, dignity, and/or self-esteem. According to some scholars, toilets convey social dignity and prestige (Biran, Jenkins, Dabruse, & Bhagwat, 2011; Lagerkvist et al., 2014). One study carried out in 10 communities throughout Zimbabwe found that social acceptance and conformity with prevailing sanitation norms were important drivers for sanitation adoption (Whaley & Webster, 2011). M. W. Jenkins and Curtis (2005) found that prestige-related factors were strong motivators for people to install latrines in rural Benin (e.g. being affiliated with the 'urban elite' and experiencing new lifestyles). A multi-country study in peri-urban regions of East Africa and Sweden found that prestige and status were significant drivers for men, in particular, to adopt improved sanitation (e.g. latrines) (Drangert, 2004; M. W. Jenkins & Curtis, 2005; Lagerkvist et al., 2014).

### **Individual-level factors.**

#### ***Contextual factors.***

*Experiences of violence.* Exposure or fear of exposure to violence, crime, or harassment is cited as an important factor influencing people's, particularly women's, sanitation preferences and behaviors. Some studies suggest open defecation is associated with fears of sexual harassment or other forms of harassment resulting from lack of privacy and dignity, especially during menstruation, and from having to stand up and hide from passing pedestrians (Pardeshi, 2009; Sommer et al., 2014; UN-HABITAT, 2008b). There is some suggestion that violence against women (VAW), particularly verbal or emotional harassment, may be compounded by the challenge of dealing with

menstruation, pregnancy, and the post-natal period without access to improved sanitation and hygiene facilities in both urban and rural districts (Fisher, 2008).

While much of the literature suggests that lack of access to sanitation facilities is the main contributor to incidence of VAW related to sanitation, there are a few studies proposing that inadequate sanitation facilities seriously compromise the safety and dignity of women and girls. According to a number of studies, women, who often rely on early morning and night hours to defecate, are at risk of sexual and physical violence in the vicinity of public, communal toilets (Amnesty International, 2010; Cairncross & Mundial, 1992). Another study, carried out in the village of Berege, Tanzania, asserted that placement of shared toilets, e.g. facing the road, can often result in embarrassment and harassment of women (Fisher, 2008). Studies suggest that women who have to walk long distances to a communal toilet or to find a private place to defecate in the open are at risk of violence and sexual abuse (Amnesty International, 2010; ITDG - Practical Action, 2005; Pearson & Mcphedran, 2008). This is particularly true in informal settlements where there is a general lack of effective policing and security (Amnesty International, 2010).

Avoiding danger and violence are cited as important factors contributing to both men's and women's sanitation choices (Lagerkvist et al., 2014; Mazeau, 2013; Rosenquist, 2005). Studies suggest women in informal settlements, in particular, choose to use plastic bags or open defecation in gutters running close to their houses rather than going alone to a shared toilet at night (Amnesty International, 2010; ITDG - Practical Action, 2005; Mazeau, 2013; Pearson & Mcphedran, 2008).

*Health (outcomes).* Some studies suggest that the perception or anticipation of health improvements is an important factor in driving behaviors to avoid fecal-oral transmission of disease and, therefore, sanitation preferences and behaviors (Cairncross & Mundial, 1992; M. W. Jenkins & Curtis, 2005; Lagerkvist et al., 2014; Schouten & Mathenge, 2010).

***Psychosocial factors.***

*Sense of safety.* Numerous studies have found safety to be one of the most important factors associated with people's sanitation preferences and decisions (M. W. Jenkins & Scott, 2007; Lagerkvist et al., 2014; Mazeau, 2013; Rosenquist, 2005; Schouten & Mathenge, 2010). Safety has been identified as an important factor in rural and peri-urban Ghana (M. W. Jenkins & Scott, 2007) and in several studies in informal settlements in East Africa (ITDG - Practical Action, 2005; Schouten & Mathenge, 2010). In the literature, safety is associated with a variety of observed factors, e.g. lighting of sanitation facilities, direct access roads to the facility, and avoidance of danger and violence (Lagerkvist et al., 2014; Mazeau, 2013). In another sanitation development study that took place in several provinces across India, women felt that separate women's and men's toilets would be safer for women. Women felt so strongly about the issue that they agreed to relocate to nearby empty land at the edge of the settlement where there was space to construct gender separate toilets (Fisher, 2008).

Recent literature also suggests that women's and girls' perceived sense of safety increases when they have access to improved sanitation facilities. A 2009 study, consisting of 1037 surveys from women in rural India, claimed that all women reported a sense of security, privacy, comfort, and dignity as a result of gaining access to improved

sanitation. They felt access to improved sanitation facilities helped them overcome the embarrassment, shame, fear, and anxiety of having to defecate in the open. Furthermore, pregnant women and menstruating girls, in particular, felt safer since gaining access to improved sanitation (Pardeshi, 2009). There was an additional study, published in 2010, that provided empirical evidence showing a positive correlation between access to improved sanitation and an increase in women's and girls' perceived sense of safety. The intervention provided private improved pit latrines to individual households in 12 villages in the Tiruchirappalli district in Tamil Nadu, India. Results of the intervention were compared with control villages located in the adjacent sub-districts of Manachanallur and Uppiliyapuram. Overall, the intervention increased the perceived sense of safety for women and girls from 59% in the control villages to 72% (Arnold et al., 2010).

Lack of perceived safety, often measured as fear of violence (Blöbaum & Hunecke, 2005; Keane, 1998; Rollwagen, 2014), is a form of psychological violence (Nussbaum, 2005; Rader, May, & Goodrum, 2007). Fear-of-crime literature suggests that fear of victimization is often associated with avoidance behaviors such as limiting activity outside the home and avoiding insecure areas at night (Rollwagen, 2014). Some literature suggests that women, may revert to unimproved forms of sanitation out of fear of violence (Amnesty International, 2010; ITDG - Practical Action, 2005). Several studies suggest, for example, that women, in lieu of adequate sanitation options or during facility closures, resort to disposing of their waste in plastic bags and throwing the bags into the open to avoid the risk of sexual and other forms of violence, particularly after dark (Amnesty International, 2010; ITDG - Practical Action, 2005; Pearson & Mcphedran, 2008). This suggests that the relationship between women's experiences of

violence in their community and their sanitation utilization choices may be a function of women's overall sense of safety, i.e. sense of safety mediates the relationship between experiences of violence and women's sanitation utilization profiles.

In addition to women's safety, studies also suggest that users' acceptability of sanitation may also be influenced by their families' safety. For example, findings from a study focused on acceptability of toilets in Ghana suggested that respondents were dissatisfied with pit latrines because they considered them unsafe for their children (Mazeau, 2013).

*User satisfaction.* Recent studies suggest that user satisfaction is significantly associated with individuals' use of sanitation facilities (Isunju et al., 2011; Tumwebaze et al., 2013). These studies suggest that individuals who are dissatisfied with improved sanitation facilities will shift to open defecation or defecation in plastic bags (Tumwebaze et al., 2013). Similarly, studies suggest that dissatisfaction with current defecation or excreta management practices (open defecation, for example) is a strong motivator to change sanitation behaviors and/or adopt new technologies (M. W. Jenkins & Scott, 2007). In a recent study carried out in informal settlements in Kampala, Uganda, Tumwebaze et al. (2013) found that satisfaction is associated with nature and type of facility, cleanliness of the facility, and number of people sharing the facility. In a study carried out in rural and peri-urban Ghana, M. W. Jenkins and Scott (2007) found that distance to communal toilets and restricted hours of operation were associated with user dissatisfaction of these facilities. User satisfaction in the literature appears to be a subjective, latent variable influenced by a number of the other potential factors such as cleanliness and location of facility (Tumwebaze et al., 2013). This suggests that user

satisfaction, a compilation of a variety of other factors, might also be an overall mechanism associated with women's sanitation utilization.

*Sense of privacy.* Numerous studies also suggest that privacy and embarrassment avoidance are strongly associated with people's sanitation preferences and choices. A study in rural and peri-urban Ghana found that women's sanitation choices and behaviors are associated with well-being factors, e.g. convenience, privacy, and comfort (M. W. Jenkins & Curtis, 2005; Lagerkvist et al., 2014). In a study assessing user demand for sanitation (latrines) in urban communities in low-income countries, Cairncross and Mundial (1992) found that privacy and avoided embarrassment were strongly associated with people's desire for improved sanitation. One study, carried out in Bapat and Agarwal, India, however, reported that women had to squat on the road and railway lines to defecate after dark resulting from a lack of sanitation facilities and privacy (Pearson & Mcphedran, 2008). According to a study carried out in 2006, privacy might be one of women's key motivations to invest in and take advantage of sanitation facilities (Moe & Rheingans, 2006). The survey, conducted in the Philippines and Benin, reported that women and girls are more interested in the increased convenience, comfort, privacy, and reduced fear and embarrassment provided by sanitation than the stated health benefits resulting from access to improved sanitation.

A recent study in Ghana found that privacy concerns were associated with facility construction. Findings from the study suggested that most of the shared toilets in this study had individual cubicles for men and women often with two different entrances (Mazeau, 2013). People did not report privacy concerns when they shared these facilities with a large number of users; however, when toilets were constructed with less than three

cubicles (all of them being neighbor-shared toilets), privacy was rated poorly (Mazeau, 2013).

*Biological drivers.* Studies suggest that biological drivers, such as disease avoidance, is an important factor influencing people's sanitation-related behaviors (Lagerkvist et al., 2014). Odor and direct observation of human feces are often associated with health hazards and poor social status (Aiello, Coulborn, Perez, & Larson, 2008; Drangert, 2004; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Whaley & Webster, 2011). Long before the discovery of bacteria, pathogens, and germ theories, people believed that bad smells, for example, were associated with contamination of the air and disease (Thilde Rheinländer et al., 2013). Despite evidence to the contrary, people still frequently associate smells with the transmission of disease (Rheinlander et al., 2012). Studies have also found that users relate smell to cleanliness (M. W. Jenkins & Curtis, 2005; Tumwebaze, Niwagaba, Günther, & Mosler, 2014). Thus, many studies have found that avoiding bad smells is an important factor in people's sanitation preferences (M. W. Jenkins & Curtis, 2005; Thilde Rheinländer et al., 2013; Tumwebaze et al., 2014). According to one study, male residents in informal settlements chose to rely on open defecation to avoid bad smells in shared toilets (Mazeau, 2013). Other studies found that latrine owners in Niger and Malawi considered smells from human feces to be a serious disadvantage to installing latrines near the home (Diallo et al., 2007; Grimason, Davison, Tembo, Jabu, & Jackson, 2000). In addition to smells, studies have also found that participants may associate heat coming from pit latrines with a higher risk of disease (Mazeau, 2013). Finally, findings from a recent study focused on implementation, usage, and acceptability of toilets in urban Ghana suggested that people dislike more traditional

pit latrines because they can "see the feces" and relate this exposure to increased risk of disease (Mazeau, 2013).

***Technological factors.***

*Structure/features of facility.* Demand-oriented literature suggests that technology influences user's sanitation choices (Katukiza et al., 2010; Okurut et al., 2015). Kema et al. (2012), for example, found that people were more likely to use toilet facilities, specifically latrines, if they included a door, walls, and a roof.

*Perceived cost of sanitation.* In the literature, "value for money" is defined as the "quality of service or utility by the sanitation technology relative to the price paid for it" (Lagerkvist et al., 2014). Affordability of communal facilities is an important factor influencing people's sanitation preferences and choices, particularly in informal settlements where communal and shared public toilets are the most common facilities (Schouten & Mathenge, 2010). There is some suggestion in the literature that cost, alone, does not necessarily determine user's sanitation preferences and practices. Mazeau (2013), for example, found that residents in informal settlements in Ghana may not choose to use the cheapest facilities because they may be too far, too dirty, or too busy.

Literature also suggests that the cost of open defecation, when calculated in terms of time taken to find a safe and private place for defecation, personal risk, health costs associated with poor sanitation, and the cost of environmental problems arising as a result of this process, is much higher than any investment in alternative sanitation facilities (Hutton & Haller, 2004; Okurut et al., 2015). Studies suggest that the cost of poor sanitation in Kenya, for example, is estimated to be about USD \$324 million per year (Okurut et al., 2015). While these costs are clearly substantial, and are, more than



likely, born by the poorest individuals, there is no evidence that these costs are factors in influencing people's daily sanitation preferences and choices or their investment in new sanitation alternatives.

*Convenience.* Convenience is among the most cited factor in the literature associated with sanitation preferences and choices. Convenience is frequently considered an "endowment factor" because it is most valued by households and individuals who have access to more than one type of excreta management strategy (e.g. open defecation and/or "flying toilets" are not the only options) (M. W. Jenkins & Scott, 2007). Convenience is considered an important factor both for influencing current sanitation preferences and behaviors (M. W. Jenkins & Scott, 2007; Lagerkvist et al., 2014) and/or motivating user's to adopt new sanitation technology (M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007). Literature suggests that convenience is represented by variables such as accessibility of the facility (e.g. distance to toilets from user's home, hours of operation for the facility) (Biran et al., 2011); toilet design and management (e.g. private facilities versus shared facilities) (Lagerkvist et al., 2014; Schouten & Mathenge, 2010); availability of other sanitation options (Mazeau, 2013); time expenditures related to facility (e.g. walking time to facility and/or queuing time at the facility) (Lagerkvist et al., 2014; Tukahirwa, Mol, & Oosterveer, 2011).

A recent study in urban informal settlements in Bhopal, India, suggested that distance to communal toilets and restricted hours of operation for those facilities were the most significant factors associated with latrine usage (Biran et al., 2011). A study carried out in rural Benin yielded similar findings--suggesting that distance and hours of operation are associated with sanitation usage (M. W. Jenkins & Curtis, 2005).

Lagerkvist et al. (2014) also found that accessibility is also associated with sanitation usage particularly when public toilets are open only during daytime hours. This study revealed that people in informal settlements consider comfort to be strongly associated with usage. The researchers suggest that comfort in this study was associated with a user's desire for close-by, personal sanitation in comparison to having to share poorly maintained public toilets. Convenience was also associated with saved effort in the form of reduced walking and queuing time and not having to defecate in the open at night. Convenience was considered even more important when users were suffering from diarrhea or had to assist children to use communal and shared toilets (Lagerkvist et al., 2014).

Recent studies suggest that people in informal settlements regularly use two or three sanitation options (including open defecation) (Mazeau, 2013). This research suggests that residents change their means of excreta disposal based on the time of day and/or the length of queues at public or shared facilities, i.e. users frequently base their sanitation decisions on opportunity rather than preference (Mazeau, 2013).

### **Habitual Factors**

#### ***Contextual factors.***

*Access to water.* A number of studies have drawn a link between access to water and people's sanitation-related behaviors. In fact, there are several studies that suggest that they are inseparable (Dreibelbis, Winch, et al., 2013; Sahoo et al., 2015). On a macro-level, piped water supply and sewerage systems allow for large-scale sanitation management (Baum, Luh, & Bartram, 2013; Greed, 2015). But access to water is also particularly important for sanitation in the daily lives of individuals and households. A

number of studies talk about the need for water for hygiene purposes connected to sanitation, e.g. for washing hands, for anal cleansing, for flushing toilets, for cleaning toilets, and for bathing (Corburn & Hildebrand, 2015; D. Joshi, Fawcett, & Mannan, 2011; Sahoo et al., 2015; Tumwebaze et al., 2014). Corburn and Hildebrand (2015), in particular, also draw links between the cost of having to buy water for washing hands and toilet flushing and women's ability to also pay for and access a pay-per-use community toilet in informal settlements in Kenya.

***Psychosocial factors.***

*WASH knowledge, attitudes and practices.* Some studies suggest that health education related to water, sanitation, and hygiene may be associated with increased knowledge, attitudes, and health practices (Mosler, 2012; Quick et al., 2002; Thevos, Kaona, Siajunza, & Quick, 2000). Thevos et al. (2000), for example, suggest that knowledge that contaminated water causes diarrhea was associated with an increase in self-efficacy around better water, sanitation, and hygiene behaviors. Despite the paucity of research suggesting a strong relationship between health-related factors and people's actual sanitation behaviors and choices (Elizabeth Tilley et al., 2014), the public sector's demand for sanitation is usually focused on health improvements, i.e. the absence of disease (Aiello et al., 2008; Isunju et al., 2011; M. W. Jenkins & Sugden, 2006; Whaley & Webster, 2011).

Health-related education and awareness are still considered factors influencing user sanitation preferences and decisions (Isunju et al., 2011). A majority of community-focused sanitation adoption and implementation programs rely largely on health education and training, i.e. users are provided information about disease contraction

related to sanitation and the preventative behaviors to avoid transmission (Curtis et al., 2009). Participants in these interventions are often evaluated based on their water, sanitation, and hygiene knowledge, attitudes, and perceptions (Sibiya & Gumbo, 2013). Psychological theories suggest, however, that these knowledge-based approaches are not sufficient to motivate actual behavior changes (Ajzen & Fishbein, 1980). Recent scholars suggest a broader approach that extends the definition of health and program targets to include quality of life and well-being factors is needed to understand the factors that influence sanitation behaviors better (Isunju et al., 2011).

***Technological factors.***

*Hygiene and cleanliness (maintenance) of facilities.* A number of studies have found that the cleanliness of sanitation facilities is an important factor influencing people's perceptions and choices related to sanitation (Biran et al., 2011; M. W. Jenkins & Scott, 2007; Lagerkvist et al., 2014; Mazeau, 2013; Nyametso, 2012; Schouten & Mathenge, 2010; Tumwebaze et al., 2014; Tumwebaze et al., 2013; Wegelin-Schuringa & Kodo, 1997). For residents living in informal settlements, where the only available form of sanitation facility is often a shared toilet (Mazeau, 2013), cleanliness is considered one of the central determinants of sanitation behaviors (Biran et al., 2011; M. W. Jenkins & Scott, 2007; Nyametso, 2012; Schouten & Mathenge, 2010; Tumwebaze et al., 2014; Tumwebaze et al., 2013; Wegelin-Schuringa & Kodo, 1997). Studies have also found that cleanliness is particularly important for urban poor because 'dirtiness' is often associated with poverty and stigma (Lagerkvist et al., 2014; Rubin, 2004). In a recent study in Kibera (the largest informal settlement in Kenya), cleanliness of the sanitation facility was considered the most important factor associated with user satisfaction with

sanitation facilities (Schouten & Mathenge, 2010). Personal hygiene and cleaning habits can also influence sanitation-related behavior and choices. For example, waterless technologies are an appropriate technology for some individuals; however, for individuals who habitually use water for anal cleansing, waterless toilets may be inappropriate (Elizabeth Tilley et al., 2014). While residents of informal settlements often rate cleanliness as an important factor in their assessment of sanitation options, studies also suggest that they cannot always afford the cleaner, preferred sanitation option (Mazeau, 2013).

### **Women and Sanitation Utilization in Informal Settlements in Kenya**

While the IBM-WASH framework could be researched and applied in any number of places around the world, there are many studies that suggest the women's relationship to WASH is of particular concern in certain geographic contexts (D. Joshi et al., 2011; McFarlane, Desai, & Graham, 2014; O'Reilly, 2012). While most of the WASH literature and the populations it examines are situated in South Asia, particularly studies focused on the factors that influence women's sanitation behaviors, recent anecdotes, news stories, and scholarly articles have illustrated that this relationship may also be of critical importance for women living in informal settlements in Kenya.

While far from scholarly in nature, a number of stories have appeared in mainstream media in recent years that suggest that women in Kenya are becoming increasingly vocal about WASH in their communities. In July 2010 a blog was published on wordpress.com entitled "Kenya, Nairobi: Lack of sanitation leaves women sick and 'prisoners in their home'." Again in October 2013 an article was published in the Guardian called "Kenyan women sue for ownership of Nairobi slum: Fear of sexual

violence in communal sanitation facilities prompts group to launch legal claim against private landlords.” Finally, one year later in October 2014, the Guardian published another article entitled, “Nairobi’s female slum dwellers march for sanitation and land rights: A year on from launching lawsuits, slum dwellers are taking their demands for toilets and housing to the health ministry.”

Several scholars have also begun to explore the relationship between women and WASH, specifically sanitation, in informal settlements in Kenya. In 2010, Amnesty International published a report focused on findings from 130 qualitative interviews carried out in four informal settlements in Nairobi—Kibera, Mathare, Mukuru kwa Njenga, and Korogocho. This study provided perhaps the first empirical evidence linking women’s experiences of violence with their lack of access to essential services, such as sanitation, in informal settlements. The study provided qualitative evidence that women in these settlements fear violence, namely rape and sexual assault, associated with having to walk long distances to reach a toilet/site for defecation and that they are also afraid of violence when utilizing community/public toilets. Women in the study reported reverting to the use of plastic bags/buckets in order to avoid having to walk long distances or use a community toilet.

In the years since the Amnesty International report was published, there have been a few additional studies focused specifically on the factors that influence women’s sanitation practices in Kenya (Corburn & Hildebrand, 2015; Hirai, Graham, & Sandberg, 2016; Winter & Barchi, 2015). Using 2008 Kenya Demographic Health Survey (DHS) data, Hirai et al. (2016) provided quantitative evidence that suggests women’s decision-making power in the home, particularly a woman’s decision-making power on major

purchases, is significantly associated with women's sanitation utilization of improved sanitation facilities in Kenya. Similarly, Winter and Barchi (2015) utilized 2008 Kenya DHS data to provide quantitative evidence that there is a significant association between women's experiences of violence and their lack of access to sanitation (open defecation), particularly in highly disorganized communities in Kenya (e.g. informal settlements).

Additionally, Corburn and Hildebrand (2015) provided qualitative evidence from 22 focus group discussions carried out in Mathare Valley informal settlement between 2011 and 2013. Findings from this study suggested that there may be several factors influencing women's WASH behaviors in informal settlements in Nairobi and, more specifically, in Mathare. These factors included HIV (women with HIV need an additional 20-80 liters of water per day and require hygienic sanitation facilities—both amenities that come at a cost); diarrhea and other pathogen-related/infectious diseases (e.g. added cost of having to visit a toilet frequently and/or inability to leave the home to access a toilet); a lack of adequate facilities and privacy for dealing with menstruation; economic barriers (e.g. pay-per-use toilet fees, lost wages and/or increased daily spending for toilets during time of illness, and the cost of children needing to use the toilet); insecurity and indignity (e.g. lack of doors, locks, and/or lights in public toilets and fear of rape). The researchers suggested that these factors may be linked to a number of sanitation-related behaviors such as limiting food and water intake, using buckets inside the home, open defecation, and using “flying toilets” (plastic bags).

While several scholars have noted factors associated with women's ability to access and utilize WASH in informal settlements in Nairobi, Kenya, the data is limited. Realistically, topics such as sanitation, menstruation, and violence associated with

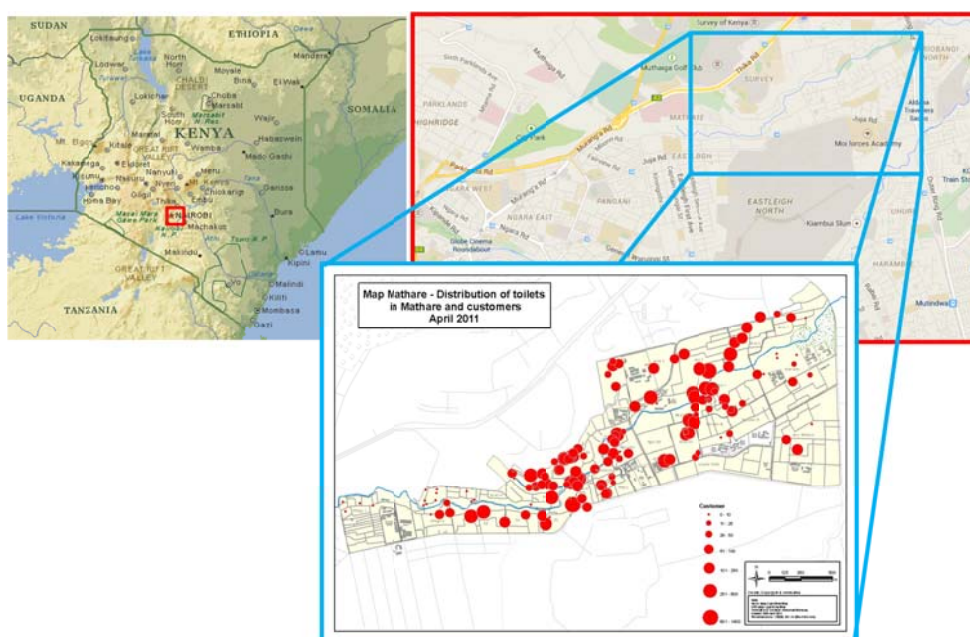
sanitation are sensitive and ethically challenging to discuss and research. That being said, the recent activism on the part of female residents of informal settlements in Nairobi suggests that women in this context are not only willing to talk about these issues, but they are demanding these conversations. Additionally, Nairobi is an influential community in East Africa and surrounding nations. If women in informal settlements are able to push for sanitation-related policy or development interventions, it could have an influence on similar policies and interventions in neighboring communities. Research and data can be a powerful tool for people who are actively “fighting” for their human rights and for influencing policy and practices—suggesting that more data focused on women’s relationship to sanitation in informal settlements in Nairobi, Kenya, could be a beneficial tool for these women as they demand better water, sanitation and hygiene in their communities.

### **Overview of the Current Study**

The present study is situated in the Mathare Valley informal settlement in Nairobi, Kenya (shown in Figure 2.1). Mathare is one of the largest informal settlements in Nairobi and East Africa. According to recent estimates there are approximately 200,000 residents living in a 0.8837 sq-km area designated the Mathare Valley settlements (Corburn & Cohen, 2012; Corburn & Karanja, 2012; Lundine, Kovacic, & Poggiali, 2012). Mathare is made up of four wards that are further divided into 11 smaller villages (Corburn & Karanja, 2014). While the boundaries and titles of these villages are contested in the literature, the women in this study concurred that Mathare consists of the following 11 villages: Mabatini, Mashimoni, 3C, Number 10, 3A, 3B, Village 2, Kosovo,



Gitathuru, 4B, and 4A. There have been several attempts to define and map the Mathare Valley settlement and the sanitation coverage in the area (shown in Figure 2.1)



*Figure 1.1. Mathare Valley Settlement and Sanitation Coverage*

The first settlers in Mathare Valley arrived in the 1920s. The settlements grew quickly between the 1930s-1950s—spreading along Juja Road and the eastern edge of Mathare Valley. Settlement was limited on the western edge by rock quarrying. In 1952 the British colonials destroyed the settlement and detained many residents as part of a State of Emergency. However, by 1963, residents had returned to the valley (Corburn & Karanja, 2012).

After independence in 1963 Mathare residents started establishing schools in the valley and lobbying the Nairobi City Council for services. The city council did not expand services to Mathare despite rapid growth in the settlements (Corburn & Karanja, 2012). A 1971 report drafted by the University of Nairobi (UN) estimated that by 1969

there were approximately 30,000 residents living in nine villages in Mathare. In 1971 that number grew to 53,000 people (as cited in Corburn & Karanja, 2012).

According to the same report, land companies in the late 1960s-early 1970s were responsible for the increase in population in Mathare during this time; however, despite increased availability of housing, there remained a paucity of basic service provision. In fact, according to the University of Nairobi report, up to 5,000 residents shared a single water tap in 1970. In 1971 there was a cholera scare in Nairobi that prompted the City Council to provide free water to some parts of Mathare, but sanitation services were never provided (as cited in Corburn & Karanja, 2012).

**Target Population.** A recent survey of 980 randomly selected houses in the Mathare valley settlements, found a fairly even split between male and female residents (49.7 to 50.3%, respectively) (Kovačič, 2014b). In addition, the survey found that approximately 41% of the sample was below the age of 25 years and an additional 38% were under 35 years of age. In 2003 Kenya introduced free primary education. As of 2009, the World Bank reported that 81.8% of the children in Kenya were enrolled in primary schools and 50% were enrolled in secondary schools (World Bank, 2009). According to the 2013 survey, however, only about 71% of the sample had a primary or secondary education. About 17% reported having either a college degree or university degree with less than one percent of the sample holding any advanced degrees (Kovačič, 2014b). This survey also found that 32% of the study participants were unemployed with an additional 45% who were self-employed.

According to literature, social disorganization is often associated with low residential stability (Parks, 2014). Based on findings from the 2013 demographic study,

less than 46% of the sample had lived in Mathare for ten or more years--suggesting a modestly transient population (Kovačič, 2014b). The survey reports an average household size of 3.5 people.

Mathare has both permanent housing structures (e.g. high-rise apartment buildings that range from about 3-8 floors) and more temporary dwellings (e.g. houses made with mud or tin and wood framing). In the 2014 survey, approximately two-thirds of the study participants lived in tin-shacks or mud huts while the other one third lived in permanent, high rise buildings (Kovačič, 2014b).

**Study Progression.** Because of the exploratory nature of this study, a two-phase, mixed methods data collection approach was used to answer the five research questions. The research was guided by grounded visualization theory developed by Knigge and Cope (2006). Grounded visualization provided the research with an analytical method that allowed for integration of diverse forms of data, including qualitative information (e.g. field notes, transcripts, and photographs) and quantitative findings (such as GPS data, graphs, charts and statistics), towards building theory. Grounded visualization is focused on an exploratory process of research that is rooted in the day-to-day experiences of people living in specific conditions. It combines feminist geography and critical GIS perspectives with the iterative, inductive, and reflexive methodology characteristic of the grounded theory approach to research.

Phase I of the data collection in this study consisted of two qualitative components. The first component, Phase Ia, involved collection of qualitative, in-depth interviews with women. It took place between September 2015 and February 2016. The second part of Phase I (Phase Ib) involved the completion of in-depth case studies and

direct observation. Phase Ib was carried out concurrently with Phase Ia. Finally, Phase, II, the quantitative part of the study, took place between April and August 2016.

***Phase Ia: Qualitative and direct observation.***

*Sample and recruitment.* Data collection for Phase Ia, the qualitative phase, took place in the Mathare Valley informal settlement in Nairobi, Kenya. The researcher worked in conjunction with a local non-profit organization called Life Bloom Services International, the Chief of Mathare, and the chairmen of each of the 11 villages in Mathare to help recruit women to the study. Women were invited by the organization and/or the chairman in each village to attend information sessions about the research. Information sessions were held in all of the villages in Mathare. Women were presented with an overview of the study, including the goals, the risks and benefits of participation, the potential benefits of the research, the sampling strategy, and the timeline of the study. Women who were interested in participating were asked to write their name, contact information, and primary sanitation facilities on a sheet of paper that was circulated after the information sessions. A purposeful sampling strategy was then used to identify 55 women (5 from each of the 11 villages) from the list whose primary, daily sanitation practices represented a range of access to different sanitation alternatives (e.g. 1. open defecation; 2. flying or bucket toilets; 3. public facilities; 4. shared, private facilities; and/or 5. private sanitation facilities). Sampling continued until there were at least 5 women in each of the pre-defined sanitation categories.

*Data Collection.* Because the research methods and/or findings in this topical area are limited, Phase Ia, i.e. the qualitative exploration of these phenomena, was a critical phase of the study. As the first phase of an exploratory study, it focused on developing an

in-depth description and analysis of multiple cases through qualitative inquiry and direct observation. During this phase of the study, the author and a local research assistant from the University of Nairobi carried out in-depth, in-person, semi-structured interviews with each of the 55 women. All qualitative interviews were conducted in English or Swahili, depending on the preference of the participant. The interviews lasted approximately 35-60-minutes and were guided by a set of sensitizing concepts related to (1) women's day-to-day experiences and perceptions of sanitation and (2) how these factors influence their sanitation practices, and (3) women's solutions to sanitation issues in Mathare. All interviews, with the permission of each participant, were audio-recorded on digital recorders. Recordings were transcribed by a professional transcriber from the University of Nairobi.

***Phase Ib: Case studies and direct observation.***

*Sample and recruitment.* All of the women who completed Phase Ia of the study also agreed to participate in an in-depth case study as part of Phase Ib. Women were given the option to complete Phase Ib immediately following the interview in Phase Ia or to schedule another time in which to participate in Phase Ib. Fifty-four out of 55 women chose to complete Phase Ib directly following Phase Ia.

*Data Collection.* Phase Ib helped the researchers to develop a geospatial and observation-based exposition of women's daily access to, mobility patterns and distance from sanitation in informal settlements in Nairobi, similar to the "structured walkabouts" conducted by Almedom (1996). Women from Phase Ia were asked to physically walk the research team (consisting of the author and a research assistant) through their daily and nightly sanitation routines, including allowing the research team to accompany them to

and from their primary location(s) for daily and nightly urination/defecation (if different). The team used GPS to track these routes. Women were also asked to identify their primary locations for sanitation and to describe their experience with utilization. Women were asked about the reasons they chose to use these facilities during the day/night. The team collected GPS coordinates, field notes, and photographic evidence at the sanitation facility/site of urination/defecation based on the women's descriptions. In addition, the team took photographs and notes to fill out a modified sanitation observation checklist similar to the one used by Tumwebaze and Lüthi (2013) in informal settlements in Kampala, Uganda.

In order to triangulate with data which were subsequently collected in the quantitative surveys (Phase II), women were also asked to describe the reasons for choosing their respective daily/nightly sanitation routes. To minimize women's risk and to avoid putting them in any danger as part of the study, the team did not ask women to take them anywhere which made them uncomfortable. The team did, however, collect and label separate GPS coordinates in or near any regions women indicated or described as unsafe. Women's responses during the interviews and sanitation walks were triangulated with field notes, photographs, GPS data, and observations made by the research team at the site of urination/defecation.

### ***Phase II: Household surveys.***

*Sample and recruitment.* A power analysis was conducted using G\*Power Statistical Power software to predict the necessary sample required to analyze quantitative data from Phase II of the study using logistic regressions (2-tailed, 2-probabilities where  $P_0=0.1$  and  $P_1=0.5$ ). Power analyses were run using guidelines laid

out in power analysis for social science literature (Cohen, 2013; Faul, Erdfelder, Buchner, & Lang, 2009). A power of 80% was assumed with an  $R^2$  of 0.0, a medium effect size, and an alpha of 0.5. Based on the model specifications and adjusting for an estimated 20% missing/incomplete data, the required sample size for Phase II of the study was 315 women. The sample size for the quantitative phase of the study was increased to 550 to allow for stratification across the 11 villages in Mathare, i.e. 50 surveys were collected in each of the 11 villages.

Sampling in informal settlements can be a big challenge for researchers, particularly when striving for a random, uniform sample. There were, however, several household surveys recently conducted in Mathare or similar informal settlements in Nairobi or other East African cities (Corburn & Karanja, 2012, 2014; Kovačič, 2014b; Tumwebaze & Lüthi, 2013) that published clear methods for household-level sampling. This study employed similar methodology. First, the author imported satellite imagery of Nairobi from the MapMathare project into ESRI's ArcGIS version 10.2. A village boundaries layer was also added. A fishnet grid layer was superimposed on the satellite imagery of Mathare Valley informal settlement. Each grid cell in the fishnet represented a 9 square meter (3m by 3m) block (approximately the size of a tin or mud house or a room in a high-rise) (Kovačič, 2014a). A random selection function in ArcMap was used to identify 50 random grid cells in each of the 11 villages, i.e. the approximate location of 50 houses and/or apartments in each village in Mathare.

In order to participate in the study, women had to be 18 years of age or older and residents in their current informal settlement region for at least six months prior to the start of the study. In addition, women had to speak either Swahili or English. As with

other studies carried out in informal settlements (Corburn & Karanja, 2012; Kovačič, 2014a), a neighboring house was selected for survey if there were no women who met the inclusion criteria available in the randomly selected household. In households where there was more than one eligible woman for the study, a Kish grid (Kish, 1965) was used to identify a single participant.

*Data Collection.* The survey instrument was written in English and a process of back translation was used to translate the survey instrument into Swahili. Survey questions were modified based on findings from Phase I of the project, but, in general, they focused on obtaining information related to: 1) women's current sanitation practices in the day and night, 2) factors that might be associated with women's utilization of different methods of urine/feces disposal in informal settlements, 3) women's perceived sense of safety in their villages, 4) women's perceptions of the proximal social context in their villages, and 5) their solutions to the sanitation challenges in informal settlements in Kenya.

The surveys were administered to one woman in each selected household. Surveys were read out loud to participants and filled in by 11 female residents of Mathare (1 representative from each village). All participants were provided with the option of taking the household survey in either English or Swahili. Surveys lasted approximately 40-60 minutes and were administered in each woman's home. Surveyors recorded the responses on paper surveys. Women were asked to provide oral consent prior to participating in the study.



### **Specific Notes about Ethics in the Study**

As a white, American-born PhD candidate interested in exploring women's access to and utilization of sanitation in informal settlements in Nairobi, Kenya, ethical research was at the forefront of my research agenda. Given my commitment to the protection of human subjects and my dedication to ethical science, there were a number of factors to consider while planning for and carrying out this research, e.g. Kenya's history of colonialism; the power dynamics between myself, a well-educated scholar from a "developed country", and the women in Mathare Valley informal settlements, arguably one of the most vulnerable groups in Nairobi, Kenya; the potential language challenges; and the sensitivity of the research topic (including issues of menstruation, privacy, and safety related to sanitation—to name a few). I spent years planning this research, studying the history and culture of Kenya, carrying out multiple pre-dissertation trips to Nairobi, learning Swahili, forging relationships with local educators and organizations, spending time at the study site, obtaining official consent to carry out the research from the chief of Mathare Valley and the chairman of the villages, and meeting with women in Mathare. The purpose of all of these steps was to conduct an ethical research study that would involve the women and have a positive impact on their lives in informal settlements in Nairobi.

Prior to commencing sample recruitment or data collection, this study was approved by the National Commission for Science, Technology and Innovation (NACOSTI) in Nairobi; the Chairman of the Department of Sociology and Social Work at the University of Nairobi; members of my dissertation committee at Rutgers

University, University of Nairobi, and the London School of Hygiene and Tropical Medicine; and the Institutional Review Board at Rutgers University.

**Inclusion and exclusion criteria.** In order to be included in this study participants had to identify as female. They had to be over the age of 18 years and residents of Mathare for at least 6 months leading up to the study. They had to speak either English or Swahili.

**Ethics training for researchers.** As the primary research of this study, I complied with all required training and certification programs for conducting research with human subjects through my university (CITI). I also took graduate-level classes related to ethical research in “developing countries.” For the first phase of the two-phase, study, I trained my research assistant/translator in methods of ethical research with human subjects and ensured she also completed the CITI training program for conducting research with human subjects.

During the second phase of the study, 11 female residents of Mathare (each representing one village) carried out the quantitative surveys with randomly-selected women from their villages. These 11 women were participants from the first phase of the study, i.e. interviewees, who seemed particularly interested in becoming more involved in the research. Prior to the Phase II data collection, these women were trained over a five-week period on topics such as the basics of research, general guidelines of ethics in research, ethics of researching sensitive topics (including violence and safety), and general WASH knowledge. In addition, women were presented with detailed information on the study and on preliminary findings from the first phase of the study. The women were also given the opportunity to discuss historical and fictional ethics cases in research

and to carry out role-plays of challenging scenarios that could arise in the field. Women were provided with protocols for if or when they had a challenge in the field. Finally, my research assistant and I stayed in the field at a known location for eight hours a day, five days per week throughout the data collection period in case the women had questions or problems. Field staff was compensated for attending the trainings and for the days spent collecting data in the field.

**Benefits and risks to participating.** This study focused on women's current sanitation practices, the factors that influence those practices, and women's solutions to sanitation issues in informal settlements. This study was intended to uncover and assist this population in voicing their experiences, practices and solutions related to sanitation in informal settlements in Nairobi. No significant risks were anticipated or reported by the field staff or the participants of the study. All study participants were compensated for their time. Women who participated in Phase Ia, the qualitative interviews, were given 100 Ksh; women who participated in Phase Ib, the sanitation walks, were given 150 Ksh; and those who participated in Phase II, the quantitative surveys were given 200 Ksh for their time.

Questions in this study did not single out specific individuals or groups for critical judgment and did not solicit the attribution of blame. There was little risk of retribution. The only discernible risk that participants were likely to face was individual discomfort about revealing personal information related to their sanitation practices and experiences; however, we did not witness nor did field staff report any cases of extraordinary participant discomfort. That being said, all participants were given the option to withdraw from the study before, during or after the interview, sanitation walk, or survey. Field staff

was trained not to force women to answer any questions they did not wish to answer or to push women to complete the survey if they wished to stop at any point.

**Minimizing risk during collection of sensitive information.** There were two particular sections of this study that I felt posed greater risk to study participants. First, were the sanitation walks (Phase Ib), and, second, were questions in the interviews and surveys related to women's experiences of violence associated with their daily sanitation practices. The sanitation walks were a challenge because I was, not only collecting digitally recorded audio data, but also GPS coordinates and photographs. Because we were going out into the community with women, informed consent, safety protocols, and protecting confidentiality of data was critical in this phase of the study. Prior to commencing sanitation walks, women were given a detailed explanation of the purpose, benefits, risks, the option to not participate and/or withdrawal from the study at any time, and the different types of data that were going to be collected. After receiving this explanation, women were given the opportunity to ask questions and were asked to sign separate consent forms for each different type of data collected (the walk itself, GPS coordinates, photographs, and audio recordings). In order to protect women's confidentiality, several additional precautions were taken. First, all GPS coordinates were displaced according to the Demographic Health Survey's Geographic Displacement Procedures (Burgert, Colston, Roy, & Zachary, 2013). Second, we avoided taking any photographs of people's faces or other identifying features. We focused solely on characteristics of sanitation, water, trash, hygiene, and the neighborhood (e.g. rivers/dumpsites). We also obtained oral permission from all toilet and water point managers and/or any people who might be associated with features in the photographs.

Finally, we hired a well-known female resident of Mathare to accompany us on these walks in case we came across any unforeseen security challenges. I felt having a female resident of the community—a community health worker; a woman who was familiar with the people, leaders, security personnel and features of the whole Mathare settlement; and a woman who knew the fastest and most effective security protocols—was the most appropriate form of security for this phase of the study. I also believed having a female resident, as opposed to a male or an outside person, would help the study participants to feel comfortable.

The second aspect of this study that required special attention was the portion of the survey and/or interviews during which we asked women about their experiences of violence associated with sanitation. To the extent that it was appropriate, we followed the WHO's Ethical and Safety Recommendations for Research on Domestic Violence Against Women (Ellsberg & Heise, 2002; Ellsberg, Heise, Pena, Agurto, & Winkvist, 2001; Ellsberg, Heise, Watts, & Garcia-Moreno, 2005). First and foremost, during the consent discussions, we informed women that we would be asking questions related to violence and safety associated with sanitation during the interviews and surveys. Women were then asked to complete a written consent to participate in the interviews (confidential) and oral consent (anonymous) to participate in the surveys. At the start of any section in the interviews or surveys that included sensitive questions, women were reminded of their right to withdrawal from the survey/interview or refuse to answer any questions without consequences and/or deductions from the cash compensation. Additionally, field staff were trained and carried out many role play exercises specifically focused on protocols for asking sensitive questions and for helping a distressed

participant. The interviewers for Phase II of the study, for example, were trained not to ask sensitive questions in the presence of another person, particularly a spouse, intimate partner, father, brother, or other male member of the family/community. They were also trained to stop asking sensitive questions if the survey was interrupted by another person.

As an additional safety precaution, I had a local advisory board that was on standby in the event a woman became distressed during an interview, sanitation walk, or survey. At the suggestion of the advisory board, women were also provided with a list of agencies that may be contacted at any time during or after the interview, sanitation walk, or survey if a woman felt she was in need of counseling, health, or support services. All of the contacts were listed as health services, including counselling and violence-related services, in the event that the list was reviewed by someone other than the participant.

### **Format of the Dissertation**

This dissertation follows a three-paper format. The overall aim of the dissertation was to investigate: (1) women's sanitation utilization practices in Mathare Valley Informal Settlement; (2) the factors that women identify as influencing their utilization practices; (3) the role that fear of victimization/perceived sense of safety plays in women's utilization practices; (4) the role that the proximal social context plays in women's utilization practices; and (5) women's solutions to current sanitation challenges in informal settlements of Nairobi, Kenya.

The first paper in the dissertation (manuscript 1) focuses on women's sanitation utilization practices in Mathare—addressing the first aim of the dissertation. Research in the first paper was guided by three general research questions: (1) Are women's daily and nightly sanitation utilization strategies the same? (2) Are women's strategies for

disposing of urine and feces the same? and (3) Are there general sanitation profiles for women in Mathare?

Manuscript 2 of this dissertation was developed to address the second, third, and fourth aims of the research. Specifically, the second manuscript explores whether factors cited in the literature are associated with women's sanitation utilization in Mathare and the nature (direction and magnitude) of those associations (specific aim 1); whether fear of victimization/sense of safety emerges as an important factor in women's sanitation utilization (specific aim 2); and, finally, whether proximal social context (social cohesion and/or social disorganization) emerges as an important factor in women's sanitation utilization in Mathare (specific aim 3).

The third paper (manuscript 3), in response to specific aim 5 of the dissertation, investigates women's solutions to sanitation challenges in informal settlements in Nairobi, Kenya.

**MANUSCRIPT 1****WOMEN'S SANITATION UTILIZATION IN INFORMAL SETTLEMENTS IN  
NAIROBI, KENYA—A COMPLICATED MATTER**

by

**SAMANTHA C. WINTER**

Manuscript 1 of 3 of a dissertation entitled:

**IDENTIFYING FACTORS ASSOCIATED WITH WOMEN'S SANITATION  
PRACTICES IN INFORMAL SETTLEMENTS IN SUB-SAHARAN AFRICA**

A dissertation to be submitted to the

Graduate School—New Brunswick

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Social Work

Written under the direction of

Dr. N. Andrew Peterson



## ABSTRACT

**Introduction:** While access to sanitation is a global issue, there are large disparities in access. At least six percent of residents in informal settlements in Nairobi, Kenya have no access to toilets. Women living in these settlements, in particular, are disproportionately affected by this lack of access. Without adequate sanitation, women in settlements may resort to unsafe sanitation strategies to manage their daily sanitation needs. Limited research has focused specifically on exploring women's sanitation utilization during the day and night in these settlements.

**Methods:** Qualitative and quantitative data were collected from women in 11 villages in Mathare informal settlement in Nairobi, Kenya in 2016. Quantitative data (550 household surveys) were used to carry out a latent class analysis (LCA) to develop general sanitation profiles (SPs). Qualitative data (55 case studies) were subsequently used to verify results from the LCA.

**Results:** The LCA yielded 5 common sanitation utilization profiles among women in Mathare: (1) No security at night (Respondents use toilets for urine and feces during the day, and bags/buckets/open defecation for urine and feces at night); (2) Limited funds/limited access (Respondents use toilets for feces and bags/buckets/OD for urine during the day and bags/buckets/OD for urine and feces at night); (3) Toilets accessible at all times (Respondents use toilets for all urine and feces during the day and night); (4) Emergencies only (Respondents use toilets for urine and feces during day, and use toilets in emergencies for feces and bags/buckets/OD for urine at night); (5) No access (Respondents use bags/buckets/OD for all urine and feces during the day and night).

**Conclusions:** Women's sanitation utilization in Nairobi informal settlements is complex.

This study illustrates a need for researchers to modify common measures of people's sanitation utilization to capture this complexity. Taking into account women's actual sanitation practices and the reasons for those choices may have important health and environmental implications.

## Introduction

Access to sanitation was declared a basic human right in 2010 (United Nations General Assembly, 2010a). In addition to being recognized as a human right, global access to sanitation is a critical component of international development goals including the Sustainable Development Goals (SDGs) and, consequently, instrumental to the eradication of extreme poverty around the world (UN General Assembly, 2000). The objective of Target 6 of the SDGs is to eliminate the population living without basic sanitation by 2030. However, despite many recent sanitation-related policy changes and interventions 2.4 billion people still lack access to improved sanitation facilities around the world (WHO & UNICEF, 2015).

While access to sanitation is a global issue, there are large disparities in access across different regions, countries, and social and geographical contexts. Lack of access to sanitation is a persistent problem in sub-Saharan Africa, where less than 20% of the current population have access to sanitation (WHO & UNICEF, 2015). The problem of poor sanitation is also a particularly critical issue for people living in informal settlements, where high population densities combined with a deficiency of sanitation services makes it difficult for residents to avoid contact with human waste (House, 2007; Isunju et al., 2011; Sclar, Garau, & Carolini, 2005). Almost a third of the world's urban population, close to 1 billion people, lives in these urban or peri-urban informal settlements (UNDESA, 2015).

In informal settlements in Nairobi, Kenya, where more than half of the city's population lives, access to improved sanitation is severely lacking (Amnesty International, 2010; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014; Ruhui et al.,

2009). According to the Joint Monitoring Project (JMP), an improved sanitation facility is one which “hygienically separates human excreta from human contact” and is not shared by more than one household (WHO & UNICEF, 2015). Findings from recent studies suggest that over 68% of the residents in Nairobi’s informal settlements use shared toilet facilities and an additional six percent have no access to toilets at all--relying on open spaces, “flying toilets” (plastic bags), or buckets as their primary means of meeting daily sanitation needs (Amnesty International, 2010; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014; Ruhiu et al., 2009).

The health and environmental repercussions of poor sanitation coverage around the world are well established (Clasen et al., 2014; House, 2007; Prüss, Kay, Fewtrell, & Bartram, 2002). Poor sanitation is linked to water-borne diseases such as diarrhea, typhoid, and other parasitic infections (Interagency Task Force on Gender and Water, 2006). In developing countries almost half of the population has, at one time, suffered from diseases associated with poor sanitation (Bartram & Cairncross, 2010; Bartram, Lewis, Lenton, & Wright, 2005; Interagency Task Force on Gender and Water, 2006). Evidence also suggests that poor sanitation is the biggest killer of children under five through diseases like diarrhea and cholera (Bartram & Cairncross, 2010; COHRE & WaterAid, 2008).

In informal settlements there is a high risk of spreading communicable diseases like cholera and dysentery due to poor sanitation conditions and overcrowding in these environments (Isunju et al., 2011). In particular, the burden of poor sanitation in these informal settlements falls disproportionately on women (Corburn & Hildebrand, 2015). Women are often the most vulnerable to the effects of poor sanitation partly because of

their biology (e.g. menstruation and pregnancy) and partly because they are, due to their lower social and economic status, less likely to have access to good sanitation and hygiene (COHRE & WaterAid, 2008; Unilever Domestos, WaterAid, & (WSSCC), 2013).

Recently, women in informal settlements have spoken out about these issues—reporting that poor sanitation conditions negatively impact their health (Amnesty International, 2010; M. Anderson, 2013; Mark Anderson, 2014). Findings from one study carried out in Mathare Valley informal settlement (Mathare) in Nairobi, Kenya revealed that almost 30% of female respondents reported at least one case of diarrhea in the month leading up to the study (Corburn & Hildebrand, 2015). Absent private and hygienic toilets, women also suffer from urinary tract infections and hemorrhoids due to urine and feces retention and, during, menstruation, increased risk of infection and toxic shock syndrome (Bosch et al., 2001; Burt, Nelson, & Ray, 2016; Gosling, Irvine, Schechtman, & Velleman, 2015; Mahon & Fernandes, 2010).

Recent literature and media reports suggest that lack of access to sanitation may also be associated with other less studied phenomena, including risks to women's safety and dignity. As a result of inadequate sanitation, women are forced to use unsafe facilities or walk long distances, often at night, to find a place to relieve themselves—increasing their vulnerability to physical and sexual assault (Fisher, 2008; Gosling et al., 2015). Going out to toilets at night, especially, is often perceived as dangerous for both women and young girls (Gosling et al., 2015; Lasagabaster, 2014). Findings from the Corburn and Hildebrand (2015) study in Mathare suggest that women feel particularly vulnerable when using public toilets that are far from their homes or those that do not have locks on

doors and/or proper lighting. Women fear violence in the public toilets, at sites for open defecation, and along the routes leading to these sanitation alternatives. While searching for places to defecate women are often exposed to verbal insults, stabbing, and even rape (Gosling et al., 2015; Lasagabaster, 2014).

Access to safe sanitation can improve public health and save lives in the least expensive and most efficient way (Montgomery & Elimelech, 2007). Water, sanitation and hygiene interventions reduce the incidence of water-borne and communicable diseases—often yielding widespread health improvements for the whole community (Corburn & Hildebrand, 2015). However, improvements to sanitation require knowledge about the state of existing access to sanitation. Knowing and understanding what exists leads to more sustainable interventions (Tumwebaze et al., 2013). According to the literature, many of the recent solutions and interventions to the persistent lack of access to sanitation have not been effective largely because they fail to consider the specific sanitation needs and utilization practices of women and girls (Amnesty International, 2010). Findings suggest that women living in informal settlements may resort to using different sanitation methods at night, e.g. bags and buckets in the home, than they do during the day in order to limit their exposure to verbal, physical, and or sexual harassment (Amnesty International, 2010; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014).

Despite recent efforts to explore women's unique sanitation behaviors in informal settlements (Burt et al., 2016; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014; Sahoo et al., 2015; Unilever Domestos et al., 2013), much of this evidence is anecdotal or exclusively qualitative. The aim of this research, therefore, was to develop a more

nuanced understanding of daily sanitation practices in Mathare. In particular, this study sought answers to the following research questions: (1) Are women's daily and nightly sanitation utilization strategies the same? (2) Are women's strategies for disposing of urine and feces the same? and (3) Can these different strategies be categorized as 'sanitation profiles' according to variability in diurnal and nocturnal practices and the underlying motivation for using them?

## **Methods**

Data for this study were collected in all 11 villages that make up the Mathare Valley informal settlement in Nairobi, Kenya. Mathare is one of the oldest informal settlements in Kenya and one of the largest informal settlements in East Africa. Because of the exploratory nature of this study, a three-phase, mixed methods approach was used to guide analysis. First, a qualitative phase involved 1) the collection of data through in-depth interviews with 55 women aged 18 years and older purposefully sampled from each of the 11 villages, and 2) the use of photographs, field notes, observation checklists, and geospatial information collected during sanitation "walks" with women in their communities. All interviews and sanitation walks were conducted in English or Swahili. The interviews, with the written permission of each participant, were audio-recorded on digital recorders and recordings were transcribed. Preliminary findings from the qualitative phase were used in the development of the in-depth survey questions and refinement of data collection strategies used in the subsequent, quantitative phase of the research.

In the second phase of this study, a field staff of 11 women (one from each of Mathare's villages) was drawn from among the sample of women interviewed in the first

phase to work with the research team in the administration of 50 household-level surveys in each village for a total of 550 surveys. Households were randomly selected within each village. Surveys were administered to one woman in each selected household. All participants were asked to provide oral consent prior to participating in the study. The questionnaires were read out loud to participants in either English or Swahili (depending upon the respondent's preferences) and filled in using paper surveys. Surveys were administered in each woman's home and lasted approximately 40-60 minutes.

In the final phase of the study, the analysis phase, descriptions and explanations relating to the sanitation utilization practices reported by women in the qualitative sample were used to provide a richer context in which to understand utilization profiles that were identified in the analysis of the quantitative data. The combination of these data enabled the study team to explore common strategies for urine and feces disposal among women in Mathare.

**Analytic sample.** The first part of the study involved 55 case studies focused on women and their relationship to sanitation in the Mathare Valley informal settlement. Case studies were stratified across Mathare's 11 villages, i.e. 5 women were selected from each village. The second part of the study involved the collection of 550 household-level questionnaires—50 surveys from each village.

**Measures.** Recent literature has started to suggest that women's sanitation utilization may differ between the night and day. Studies focused on sanitation in informal settlements often recognize that public sanitation facilities are frequently closed, e.g. unavailable to the public, at night (Amnesty International, 2010; Massey, 2011). These same studies also suggest that women may not feel comfortable going outside their



homes to urinate or defecate during the night, thereby introducing the idea that women may not use the same sanitation methods during the day and night. Questions on the survey were modified to account for these potential differences in sanitation practices during the day and at night and for urine and feces separately.

Questions for the quantitative measurement of sanitation utilization were based on the WHO's Core Questions on Drinking-Water and Sanitation for Household Surveys; however, they were modified to capture variation in methods of urine and feces disposal and variation in diurnal and nocturnal patterns of use (WHO & UNICEF, 2006). Four nominal variables (i.e. 1. feces disposal, day; 2. urine disposal, day, 3. feces disposal, night; 4. urine disposal, night) with six categories each (1. private toilet; 2. private toilet-shared between more than one household; 3. plot toilet; 4. bags/buckets in the home; 5. public toilet and 6. no facility/open defecation outside the home) were created from responses to the following survey questions: "what kind of toilet or method of disposal do you usually use for short call (urine)/long call (feces) during the day/night?" Responses included, flush, pour flush; ventilated improved pit latrine (VIP); pit latrine with slab; pit latrine without slab/open pit; composting toilet; bucket toilet; hanging toilet/hanging latrine; plastic bag; no facility, bush or field; other (specify). Responses from follow-up questions were then used to identify the location of the facilities and whether or not these were private, shared with other households or public.

Questions for the qualitative portion of the study were broad--allowing women to speak openly about their sanitation utilization choices. Women were asked, for example, to describe their daily and nightly sanitation routines for urine and feces disposal, separately. Follow-up questions and probes were pursued if the women were confused or

did not provide enough detail about the type and nature of the facility or their method of disposal.

**Analysis strategy.** This analysis utilized responses from both the quantitative (550 surveys) and qualitative (55 case studies) data. There was minimal missing data on the responses to the questions pertaining to this analysis (less than one percent). Therefore, random, single-response imputation was used to fill in the values using the user-written program *hotdeckvar* in Stata v.14 (M. Schonlau, 2012).

The first stage in the analysis was to run a two-step latent class analysis (LCA) with data from all 550 quantitative surveys. Analysis was carried out using the University of Pennsylvania's *doLCA* plugin in Stata. The four nominal variables created to represent women's sanitation facility or methods of urine and feces disposal during the day and night were used as the primary indicator variables for the LCA. The purpose of the LCA was to develop a set of common sanitation utilization profiles for women in informal settlements in Kenya. The first step of the two-step LCA was to determine the appropriate number of factors in the LCA and the second step was to determine the common sanitation profiles (SPs) for women in Mathare. A covariate for village (a nominal variable with 11 categories for each of the villages in Mathare) was used in the model to control for the stratified nature of the sampling method used in this study.

Atlas.ti software was used to carry out a cross-case analysis of responses from the full transcriptions of all 55 qualitative interviews. Guided by the question, "what are women's current sanitation practices in Mathare Valley Informal Settlement?" three researchers independently coded each of the 55 transcriptions. A list of pre-defined codes and sensitizing concepts, related to the questions and response categories in the

quantitative survey, was used in Atlas.ti in addition to each coder's own individual concepts and codes. Codes and concepts were compared among the three researchers. The comparison of the codes related to women's current sanitation practices yielded 97% agreement between the three researchers. In instances where the codes did not agree, a meeting was held with all members of the research team to discuss the discrepancies and to agree upon final codes and resulting findings.

### **Quantitative Results**

Descriptive statistics of the full quantitative sample (n=550) are summarized in Table 2.1. The average age of the respondents in this study was 32 years (SD=8.4), with the youngest participant being 18 years and the eldest being 70. Approximately 45% of the respondents had completed primary school with no or some secondary education and approximately 31% of the women in the study completed secondary education. Only two percent of the population reported having never attended school. About 37% of the women were employed at the time of the survey and about 23% reported owning a business. In addition, close to 50% of the women in the study have a self-reported health status of good or very good.

The average size of the households was 4 members (SD=2.1). Although 54% of the women were legally married at the time of the survey, over 57% of the women in the sample reported that they were living in households headed by a female. An additional 35% of the women were not involved in a relationship at all (single) at the time of the survey.

More than 56% of women report using a public tap as their primary source for drinking-water and an additional 16% of woman report using an outside tap. Only about 14% have access to a tap and/or piped water in their house, plot, or building.

Descriptive statistics for the qualitative sample (n=55) are also summarized in Table 2.1. About 50% of the respondents in the sample were between the ages of 25 and 34 years—with the youngest respondent being 18 years and the oldest being 72 years. Similar to the quantitative sample, only about two percent of the sample reported having never attended school. About 17% of the sample reported having completed secondary school while about 57% reported having completed primary school or primary and some secondary school. Over 60% of the women in the sample reported that they were not formally employed; however, about 17% reported having odd jobs (e.g. contract work or housework for a wealthier family) and almost 59% reported having some form of informal business (e.g. selling vegetables, fries, phone credit, or second-hand clothes).

About 50% of the women who were interviewed were married and about 32% reported they were single. An additional 17% reported they were divorced. The majority of women in the qualitative study, 53%, had 1-2 children and an additional 23% had 3-4 children. Only 2 women, about four percent of the sample, reported having no children and only 4 women, about eight percent of the sample reported having more than 7 children.

Table 2.1  
*Descriptive Statistics of quantitative and qualitative samples*

	<u>Quantitative</u>		<u>Qualitative</u>	
	Frequency	Percent	Frequency	Percent
<u>Number of children</u>				
None	101	18.4	1	1.8
1-2 children	247	44.9	29	52.7
3-4 children	155	28.2	14	25.5
5-6 children	41	7.5	4	7.3
7+ children	6	1.1	4	7.3
<u>Age</u>				
18-24	85	15.5	3	5.5
25-34	300	54.5	25	45.5
35-44	116	21.1	17	30.9
45-55	36	6.5	4	7.3
55+	13	2.4	4	7.3
<u>Monthly income</u>				
Less than 5,000 Ksh/month	136	24.7	14	25.5
5000-10,000 Ksh/month	275	50	17	30.9
10,000-15,000 Ksh/month	103	18.7	3	5.5
Over 15,000 Ksh/month	31	5.6	6	10.9
Does not know	5	0.9	13	23.6
<u>Education</u>				
None	11	2	1	1.8
Some primary, not complete	91	16.5	12	21.8
Completed primary	136	24.7	18	32.7
Come secondary, not complete	121	22	12	21.8
Completed secondary	172	31.3	9	16.4
Higher education	17	3.1	1	1.8
<u>Marital status</u>				
Married	297	54	26	47.3
Living with a man, not married	11	2		
Regular partner, live apart	46	8.4		
Not involved in a relationship	191	34.7	15	27.3
Separated or divorced			11	20
Respondent has a business	126	22.9	31	56.4
<u>Employment</u>				
Employed	205	37.3	11	20.0
Odd jobs	-	-	9	16.4
Unemployed	-	-	9	60.0
Female-headed household	315	57.3	-	-

<u>Reported health status</u>				
Very good	16	2.9	-	-
Good	302	54.9	-	-
Fair	205	37.3	-	-
Poor	25	4.5	-	-
Very poor	2	0.4	-	-
<u>Primary source for water</u>				
Tap/Piped water in residence	74	13.5	-	-
Outside tap (piped water)	88	16	-	-
Public tap	310	56.4	-	-
Outside/public well	1	0.2	-	-
Tanker/truck	1	0.2	-	-
Water vendor	74	13.5	-	-
N	550		55	

**Sanitation utilization frequencies.** Frequencies for women's reported sanitation utilization patterns in both samples are summarized in Table 2.2. Almost 40% of women in the survey sample reported using a public toilet facility as their primary method of disposing of feces during the day. Many fewer, just under 19%, reported using public toilets for disposing of urine during the day. Approximately 32% and 35% of women reported using a plot toilet during the day for long calls and short calls, respectively. Approximately 8-9% of women reported using a private-shared facility for both short and long calls during the day. Just over 11% of women reported using buckets or bags in the home for disposing of feces during the day, but close to 29% of women reported using these unimproved methods of disposal for urine during the day. Among those women reporting use of open defecation during the day, almost 11% of women primarily used this method of disposal for short calls as compared to only three percent of women who followed a similar practice for daytime disposal of feces. Very few women, only about two percent, reported having access to a private toilet facility for short calls or long calls during the day.

Diurnal and nocturnal sanitation methods differ greatly as well. From the results in Table 2.2, it is clear that the majority of women utilized bags or buckets in the home for disposing of both feces (59%) and urine (69%) at night compared to 12% and 29%, during the day. While many women reported using public toilets for urine (19%) and, especially, feces (40%) disposal during the day, only a small proportion of the women in the sample reported using public toilets at night for feces (four percent) or urine (two percent) disposal. About one-quarter of women reported using plot toilets during the night for long calls (27%) or short calls (19%) compared to women using plot toilets during the day (35% for feces and 32% for urine). The proportion of women reporting open defecation was slightly higher for feces disposal at night (five percent) than during the day (3%) and slightly lower for urine disposal (6%) at night than during the day (11%). Finally, access to private sanitation remained low (about two percent) for both long calls and short calls during the night.

Table 2.2.

*Sanitation descriptive statistics of quantitative and qualitative samples*

	<u>Quantitative</u>		<u>Qualitative</u>	
	Frequency	Percent	Frequency	Percent
<u>Day time</u>				
Long Call (feces)				
Private toilet (family members only)	13	2.4	2	3.6
Bags/buckets at home	63	11.5	3	5.5
Open defecation	16	2.9	0	0
Private-shared (1-9 additional people)	48	8.7	1	1.8
Plot (10-99 people)	192	34.9	16	29.1
Public (100+ people)	218	39.6	33	60.0
Short Call (urine)				
Private toilet (family members only)	12	2.2	2	3.6
Bags/buckets at home	157	28.6	27	49.1
Open defecation	58	10.6	6	10.9
Private-shared (1-9 additional people)	44	8	0	0
Plot (10-99 people)	177	32.2	13	23.6
Public (100+ people)	102	18.6	7	12.7
<u>Night Time</u>				
Long Call (feces)				
Private toilet (family members only)	9	1.6	2	3.6
Bags/buckets at home	324	58.9	40	72.7
Open defecation	28	5.1	2	3.6
Private-shared (1-9 additional people)	21	3.8	1	1.8
Plot (10-99 people)	146	26.6	7	12.7
Public (100+ people)	22	4	3	5.5
Short Call (urine)				
Private toilet (family members only)	8	1.5	2	3.6
Bags/buckets at home	379	68.9	44	80.0
Open defecation	33	6	2	3.6
Private-shared (1-9 additional people)	14	2.6	0	0
Plot (10-99 people)	103	18.7	6	10.9
Public (100+ people)	13	2.4	1	1.8
N	550		55	



Sanitation utilization frequencies for women in the qualitative sample are also summarized in Table 2.2. According to these frequencies, about 58% of the women in the sample utilized a public toilet for long calls during the day (about 19% more than in the quantitative sample) and an additional 29% used plot toilets. For short calls during the day, the proportion of women using toilets was much lower—with only 13% using public toilets and about 24% using plot toilets. Approximately 49% of the women reported using bags or buckets for short calls during the day (about 20% higher than the frequencies reported in the quantitative sample) and another 10% defecated in the open. Only 2 women in the sample reported having access to a private toilet and only 2 women reported using a private-shared toilet during the day. The proportion of women reporting using a private (two percent) or private-shared (8-9%) toilet for long or short calls during the day was also quite small in the qualitative sample.

At night close to three-quarters of the women interviewed during the qualitative phase of the study reported using bags and/or buckets for both long and short calls. An additional four percent (n=2) reported using open defecation for long and short calls at night. Just under 13% of women reported using a plot toilet for long calls at night and about 11% reported using a plot toilet for short calls at night. Only about four percent of women reported having access to a private toilet facility at night.

**Sanitation utilization profiles.** First, an LCA was run using four nominal variables created from the quantitative dataset. The first step in the LCA was to determine the number of profiles based on model fit statistics. The replicated log likelihood, BIC, CAIC, AIC, adjusted BIC and entropy values from the 1-6 profile models are summarized in Table 2.3. Literature suggests that the CAIC and BIC are often

the best fit statistics to determine the number of profiles in LCA with AIC and the adjusted BIC sometime overestimating the number of profiles (Nylund, Asparouhov, & Muthén, 2007). The CAIC and BIC suggest that the 5-profile model is the best fit for the data—with values for the CAIC and BIC decreasing for the 2-5 profile models and increasing for the 6-profile model. The entropy-squared values also suggest the 5-profile model is the best fit for the data and is quite good with a value of 0.989 for the 5-profile model.

Table 2.3.

*Comparison of 1-6 profile LCA models*

	1-profile	2-profiles	3-profiles	4-profiles	5-profiles	6-profiles
df	1275	1254	1233	1212	1191	1170
Entropy-squared	NA	0.975	0.967	0.984	0.989	0.977
Adjusted BIC	2486	1498	1306	1038	886	837
CAIC	2570	1670	1565	1385	1320	1359
BIC	2550	1629	1503	1302	1216	1234
AIC	2463	1452	1236	944	768	696
G-squared	2423	1370	1112	778	560	446
Log-likelihood	-2785	-2258	-2129	-1962	-1853	-1796

Sanitation utilization profiles based on the 5-profile LCA are summarized in Table 2.4. Findings suggest that there are five common sanitation utilization profiles for women living in Mathare. Women in the first profile (about 33% of the women) have a high probability of using public toilets for long calls (97.5%) and, to a lesser extent, short calls (43%) during the day and using bags/buckets in the home for both long (87%) and short calls (92.8%) during the night. In the second profile (about six percent of the sample) women have a higher probability of using a public toilet (48.5%) during the day for long calls, but they have a higher probability of using OD (45.1%) for short calls during the day and both long (75%) and short calls (99.2%) during the night. In the third profile (about 34% of the sample) women have a higher probability of using a plot toilet

for all long and short calls during the day and night (day-long: 95.5%, day-short: 92.2%, night-long: 70.6%, night-short: 51.3%). Women in the fourth profile (about 11% of the sample) have a higher probability of using a private-shared or plot facility for long (75.1%) and short calls (68.9%) during the day and for long calls (private-shared: 32.2%; plot: 14.7%) during the night; however, these women have a higher probability of using bags/buckets for short calls during the night (58.1%). Finally, in the fifth profile (about 16% of the sample), women have a higher probability of using bags/buckets in the home for all long (71.1%) and short calls (90.4%) during the day and for long (95.9%) and short calls during the night (99.8%).

Table 2.4.

*Sanitation utilization profiles based on 5-profile LCA*

		Long call	Short call
<b>Profile 1 – Safety</b> (32.8%)	Day	<b>Public (97.5%)</b>	<b>Public (43.0%);</b> Bags/buckets (38.7%); OD (18.3%)
	Night	<b>Bags/buckets (86.6%);</b> Public (11.6%)	<b>Bags/buckets (92.8%)</b>
<b>Profile 2 – No money</b> (6%)	Day	<b>Public (48.5%);</b> OD (27.2%); Plot (15.3%)	<b>OD (45.1%);</b> Public (42.3%)
	Night	<b>OD (75.3%);</b> Bags/bucket (18.3%)	<b>OD (99.2%)</b>
<b>Profile 3 – Toilet all times</b> (34.3%)	Day	<b>Plot (95.5%)</b> <b>Plot (70.6%);</b> Bags/Buckets (29.4%)	<b>Plot (92.2%)</b> <b>Plot (51.3%);</b> Bags/bucket (47.6%)
	Night	<b>Private-shared (75.1%);</b> Private (20.8%)	<b>Private-shared (68.9%);</b> Private (19.2%)
<b>Profile 4 – Emergencies</b> (11.3%)	Day	<b>Private-shared (75.1%);</b> Private (20.8%)	<b>Private-shared (68.9%);</b> Private (19.2%)
	Night	<b>Private-shared (32.3%);</b> <b>Plot (14.7%);</b> Bags/buckets (38.5%)	<b>Bags/Buckets (58.1%)</b> Private-shared (22.4%);
<b>Profile 5 – No access</b> (15.6%)	Day	<b>Bags/bucket (71.1%);</b> Public (17.6%)	<b>Bags/bucket (90.4%)</b>
	Night	<b>Bags/bucket (95.9%)</b>	<b>Bags/bucket (99.8%)</b>

## Qualitative results

All women in the qualitative sample were asked to describe their primary methods of disposing of urine (short calls) and feces (long call) during the day and night. Many of the women, while describing their daily/nightly sanitation practices, cited reasons for their sanitation utilization choices. These responses were used to help name, expand, and better define the common sanitation profiles from the LCA.

Based on simple frequencies of the qualitative data, 22% of the women in the qualitative sample fit the first sanitation utilization profile, i.e. using private, public, plot, or private-shared toilets during the day for both long and short calls and using bags/buckets for both long and short calls during the night. An additional 51% of the 55 women in the sample could be described as fitting into the second sanitation utilization profile—utilizing a private, public, plot, or private-shared toilet during the day for long calls and some combination of bags/buckets/no facility for all other calls during the day and night. About 15% of the women in the sample could be described as following the third sanitation utilization profile—using a private, private-shared, or plot toilet for all calls during the day and night. Very few women in the qualitative sample (about seven percent) fit neatly into the fourth sanitation utilization category, i.e. women who primarily use a private, private-shared, public, or plot toilet for their long and short calls during the day and their long calls during the night and buckets for their short calls at night. Only 2 women (four percent) in the qualitative sample fit into the fifth and final sanitation profile—using bags/buckets/no facility for all long and short calls during the day and night.

**Profile 1 – “Lack of security at night”.** Women in this first profile (SP1) primarily utilize toilets (e.g. public, plot, or private-shared facilities) for long calls and short calls during the day and use bags/buckets/OD for long and short calls during the night. Approximately 22% of the women in the qualitative sample report using a public, private, private-shared, or plot toilet for both long and short calls during the day and a bucket and/or bag for both long and short calls during the night. The majority of women in this category reported using a toilet during the day for both long and short calls: 1) because there was an easily accessible toilet and/or 2) because they were able to pay a monthly fee for toilet use.

For several women, they reported having access to a plot toilet during the day, i.e. “there is a toilet in the plot” (Cat 3A; Mwe, 3B) or “close to the plot” (Dor, 3C; Sha, Village 2). Other women stated that they lived near a community toilet and, consequently, had “no problems” accessing the toilet during the day (Lor, Gitathuru). For women using a public toilet, being able to pay a monthly fee made it possible for them to use the toilet not just for long calls, but for short calls and showering as well. For example, one woman explains, “if we go per month you pay 100 bob. With that hundred you can shower there inside and you can go to the toilet...without that one, you cannot go” (Sha, 4B). As a few women explained, 100 Kenyan shillings covered the cost of the whole household to use the toilet for the month, not just the person who paid, i.e.,

[If you pay 100 per month] they give you a receipt...so here, I live with my sister, therefore, we can all go, but my mom, she stays in a house in another plot, so she cannot make them agree to let her enter even though we have paid. (Sus, 3B)

While most of the women reported using a plot or public toilet near their home during the day, there were a few women in this profile that reported using a private, private-shared, public, or plot toilet at or near their place of work. Regardless of whether the women in

this profile accessed a toilet near their work or home, they all reported using buckets and/or bags during the night for both short and long calls. Almost all of the women in this profile stated that they used bags or buckets in the home because they could not go outside at night. Women in this profile often stated that they could not go outside to seek a toilet at night because of “insecurity.” Some women described their fears of going outside their houses at night to find a toilet, i.e.,

At night, it's this, whatever, bucket because at night, you cannot go outside. Often, maybe, you can get a person who can even rape you. You see? Now, people here fear the night because this is Mathare. It is the real Mathare, it's not good. (Sha, 4B)

Although women in this profile reported using a variety of different toilets throughout the day, e.g. plot, private, public, at work, near home, all of them reported using buckets or bags during the night. The majority of these women reported using these unimproved methods of urine and feces disposal because they feared going outside at night—suggesting security in Mathare/their respective village is very bad. For this reason, this cluster of women represent “the lack of security at night” profile. Photos representing SP1 are shown in Figure 2.1.



Public Toilet



Public Toilet - Stall



Flying Toilet



Potty - Buckets

*Figure 2.1. Example representation of SP1*

**Profile 2 – “Lack of funds and accessibility”.** Profile 2 (SP2)—utilizing a private, public, plot, or private-shared toilet during the day for long calls and bags/buckets/no facility for all other calls during the day and night—was the most common sanitation category for women in the qualitative sample. While their descriptions and explanations of their sanitation practices varied, there were many similarities in the way they described their daily sanitation routines. Many women, for example, reported that using a toilet, particularly for long calls, is a “must” (“inabidi” in Swahili) or a “good example” of what you are supposed to do during the day. One woman, in particular, explained,

If I look at the distance [to the toilet], it is a bit far and me, with my bucket here, I'll use it [the bucket] then I'll pour it there, outside. But for the long call, it is a must you should go there [to the toilet] if there is no line. It is a must you go there...Like now, me, I am with older children. Sometimes the biggest child, she is here. You see, I cannot use that [bucket]...the paper [bag] now. It is a must you go there [to the toilet], even if I fear infections. I feel when I am with the biggest child, she is in form 3, I cannot use the bag here because she might see me. I want to show her she should use the toilet. Even if I fear it, I go there [to the toilet]. Even if I know the risk, it is a must that I go. (Mil, Mabatini)

However, despite many women mentioning the importance of using a toilet, particularly for long calls during the day, women in this profile do not choose to visit a toilet for short calls during the day nor for either type of call during the night. Women cited several reasons for not using a toilet for short calls during the day. One of the most common reasons was difficulty paying the fees to use a public toilet. For example, one of the women explained,

Now, for short call here, we use a bucket in the house because if you go to the toilet, you pay 5 shillings, you see. If it is urine, you won't survive if you're paying all the time. You urinate in a bucket, you go, you pour it in the drainage. But if it is a long call, you pay the 5 shillings to enter the toilet (Sus, Kosovo).



The other common reason women cited for not using a toilet during the day for short calls was that the toilet was located far away. For example, one woman, while describing her daily sanitation practices, stated, “for short calls, we always use the bucket because we do not have a toilet near. The toilets are down there [by the river] completely” (Est, Mabatini).

While some women continued to cite lack of funds and the distance to the toilet as primary reasons for not using a toilet during the night for long calls and short calls, the more common reasons were that 1) the toilets were closed at night and 2) women cannot go outside the house at night. In some cases, the women mentioned both of these factors as reasons they use a bucket and/or bag inside the house for long and/or short calls at night. For example,

At night, the toilets close between 9:30-10p. So after that, they are not open. So, in case of anything, it is a must you just use a bucket or you use a polythene [paper bag]. Also for security matters, you cannot go outside. (Kav, Mashimoni)

More than half of the women who reported using buckets/bags in the home at night stated that this was because women, and often men as well, cannot go outside at night, i.e. “at night we use the buckets because we don’t come out at night” (Car, 4A). While some did not specify, without prompting, why they felt they could go outside at night, some women automatically described their fears if they were to go outside to use a toilet at night. One woman, for example said,

At night, for security purposes, you cannot go outside...mostly, at night, there are two issues. They will come to your house and steal or they will rape you. And they can even stab you with a knife. Therefore, for security purposes, you should not go outside...so, at night, I will just use that [a bucket]. (Jul, Kosovo)

Many women across and outside of the four common sanitation profiles cited security and closed toilets as issues preventing them from using toilets for short calls and/or long

calls during the night. What makes the women in the second category particularly different from those in the remaining sanitation utilization profiles is that they utilize bags, buckets, showers, or open defecation methods for short calls during the day. According to the qualitative data, this is largely because they cannot afford to go to a public toilet and/or they cannot easily access a toilet during the day, most often because it is far away, i.e. it is the “lack of funds and accessibility” utilization profile. Figure 2.2 illustrates a potential combination of sanitation options for SP2.



Public Toilet



Public Toilet



Bucket/basin



Open Defecation

*Figure 2.2. Example representation of SP2*

**Profile 3 – “Toilet is accessible at all times”.** Approximately 15% of the qualitative sample of women in this profile (SP3) reported that they had access to and utilized a private toilet, a private-shared facility, or a plot toilet for all calls during the day and night. There were only two women in the sample who had a private toilet connected directly to their home. The other women in this profile reported that their toilets were located within their building and, often, on their floor. One woman also mentioned that “there is security in [her] plot, so, it is possible to go outside” to use the toilet, even at night (Mar, Number 10). This sanitation utilization profile was labeled the “toilet is accessible at all times” profile because it consists of women who, for the most part, have access to toilets which are safe and close by at all times during the day and night—making it possible for women to access them for all calls throughout a 24-hour period.

Figure 2.3 shows some typical sanitation options for SP3.



*Figure 2.3.* Example representation of SP3

**Profile 4 – “Only in an emergency”.** According to the LCA results, women in the fourth profile of sanitation utilization profiles (SP4) have a higher probability of using a private-shared sanitation facility for long and short calls during the day and for long calls during the night; however, these women have a higher probability of using a bucket for short calls during the night. This was not a common sanitation utilization strategy among the women in the qualitative sample. Only about seven percent (4 women) fit clearly into this category and only if the definition was expanded beyond that of the LCA. For example, one woman utilizes a plot toilet (instead of a private-shared facility) for all calls during the day and for long calls during the night, but uses a bucket for short calls during the night. The woman stated that “during the night,” she does not “go outside;” and that she only visits the toilet for long calls “during those times when it is an emergency” (Her, Number 10). Another woman in the qualitative sample reported using a public toilet for all long and short calls during the day and for long calls during the night, but she reported using a bucket for short calls at night. She, too, reported that it was “a must” to visit the toilet at night for long calls, but only if she was experiencing “stomach problems” (Ros, 4A). Several women in this profile stated that they had trained themselves not to urinate and/or defecate at night and that they would, under most circumstances, try to retain their urine/feces until morning, i.e. “[at night] it is a must you constrict yourself, even if there is a toilet here [in the plot], often there is no security” (Hel Mabatini). Again, women in this profile felt that they would resort to going outside to use a toilet only in an emergency, i.e. “if you are having stomach problems” (Eli Gitathuru; Eli Village 2).

One woman reported using a neighbor's household toilet (private-shared) during the day for long calls and during the night for long calls if it was emergency. However, this woman uses a bucket for short calls because she has to wait for the owner to open the toilet, i.e., "sometimes, I can go and I find she [the neighbor] is not there, she has gone about her business. So now, it is a must you hold yourself tight, you just sit like that until the time when she returns...so sometimes, I take a basin and I urinate and pour it" (Hel, Mabatini).

Based on the qualitative responses, women in the fourth sanitation utilization profile did not go outside at night to use a toilet unless they were experiencing an emergency, e.g. "stomach problems;" therefore, sanitation utilization profile 4 was labeled the "only in an emergency" category. Figure 2.4 shows an example profile for SP4.



Plot Toilets



Private-shared Toilet



Bucket

*Figure 2.4.* Example representation of SP4



**Profile 5 – “No money or no access”.** There were no women in the qualitative sample who used open defecation for all calls during the night and day. There were, however, two women who reported using bags/buckets in the home for all calls during the day and night. There were also many other women who utilized bags, buckets, and/or open defecation at different times. The two women who stated that they used bags, buckets, and/or open defecation for all calls during the day and night on a regular basis suggested that this was because they could not afford to go to a public toilet and the toilets were a bit far. Both women talked about the affordability of the public toilets being an issue. For example, “for me, if I miss [to get money], it is a must I put a paper bag there... I cannot go to help myself...it is a must I just do this” (Ros, Gitathuru). The other woman reported,

I want to go [to the toilet]...you see, I don’t have money, see, I will just hold tight, I just come for that bucket...often you even fear to pour it, like people will see you, it’s a problem, often you just put it in the house, when it turns to night, you pour it outside. (Jan, Kosovo)

The latter woman also stated that she is sometimes harassed at the toilets for not being able to pay, “like if you don’t have money, you beg...if they refuse, you just suffer...if I don’t have money, see, I will just hold it, I’ll come here [to the house] to this bucket” (Jan, Kosovo). In addition to having no money to go to the toilet, one woman also expressed that the toilet was far away. For example, “when you work here, close-by, you know, the toilet is far...that toilet is somewhere there, it is far, so a woman will just hold it then she just goes. There is no toilet around here” (Jan, Kosovo).

Both of these women expressed shame about having to use a bag/bucket for all calls during the day and night. For example,

You know, we pray to God that he will help us one day to get even a good toilet—that kind where a person will go and doesn’t pay. It disturbs us so much.

These days, if I get a visitor, they harass me. They ask me, ‘where should I go to the toilet’ and I explain to them their options. Even a person from your home, if you tell them you have to urinate there, she can’t. If you give her the bucket she says, ‘what is that? That is dirty.’ You know that is why we pray to God that He will have mercy on us that we just get a good toilet.” (Jan, Kosovo)

Photos for a typical SP5 profile are shown in Figure 2.5.



Figure 2.5. Example representation of SP5

## Discussion

The purpose of this study was to explore women’s current sanitation practices in informal settlements in Nairobi, Kenya. Since access to basic sanitation was recognized in Target 7 of the Millennium Development Goals in 2000, there have been countless global- and local-levels efforts to quantify people’s access to sanitation all over the world. In fact, with the establishment of the Joint Monitoring Programme (JMP), there is yearly monitoring of global access to sanitation (WHO & UNICEF, 2015). However, most measures of access to sanitation are based on survey responses to questions about participants’ *primary* toilet facility and/or method of urine/feces disposal (WHO & UNICEF, 2006). As results from this study have illustrated, these simple measures of



participants' *primary* sanitation methods/toilets have not provided an adequate representation of the range and complexity of women's sanitation practices in informal settlements—at least, not in Nairobi, Kenya.

Results from this study are consistent with previous studies that indicate that women's sanitation utilization profiles in Nairobi informal settlements, particularly Mathare, are quite complex (Amnesty International, 2010; Corburn & Karanja, 2014; Massey, 2011); however, they also suggest that there are some common sanitation utilization profiles that could be used to better represent women's current sanitation practices in these contexts. In the past there have been a number of studies that have used direct observation techniques or qualitative data collection methods to try to develop a more in-depth and accurate representation of people's sanitation utilization patterns in informal settlements (Amnesty International, 2010; Corburn & Karanja, 2014; Massey, 2011; Tumwebaze et al., 2013). For example, studies that utilized direct observation have noted that the observed presence of “flying toilets” suggest that people are underreporting their utilization of these unimproved methods of sanitation (Tumwebaze et al., 2013). Other qualitative studies have shown that women report reverting to unimproved methods of sanitation, e.g. buckets and bags, because they fear walking to and/or using toilet facilities outside of their homes (Amnesty International, 2010; Corburn & Karanja, 2014; Massey, 2011; Sahoo et al., 2015). The results from this study validate those previous findings. In addition, evidence from this study shows that, while these studies have attempted to get a more in-depth representation of sanitation practices in informal settlements, they still failed to capture the full range and complexity of women's sanitation utilization profiles in these contexts. Results from this study reveal a need for

sanitation monitoring to ask questions that explore sanitation beyond *primary* methods of urine and feces disposal—to ask questions, instead, about methods of urine and feces disposal, separately, and about women’s practices both during the day and during the night.

This study utilized a mixed-methods technique of data collection and analysis. While the goal of this study was to develop common clusters or profiles of sanitation utilization among women in informal settlements, the qualitative data in this study was essential in order to develop a meaningful quantitative tool for measuring such complex sanitation profiles and, furthermore, for explaining the quantitative findings. Qualitative analysis also allowed for more flexibility in the definition of each sanitation category. Multinomial LCA, for example, requires all categories of a variable (e.g. private-share toilets, plot toilets, public toilets, and/or bags/buckets) to be compared to a base category (e.g. private toilets). While this is statistically important, it limits the model’s ability to include the base category as part of the sanitation utilization definition. Qualitative analysis does not have this limitation; so profiles could be expanded to include the use of private toilets, not just as a base for comparison, but as a comparable sanitation practice.

The quantitative LCA revealed that there are five common sanitation utilization profiles for women living in Mathare. Qualitative data helped validate these common profiles, but also helped to identify women who may not fit neatly into any one of these categories, i.e. the qualitative findings suggested that these profiles still may not fully represent the complexity of women’s sanitation practices in these localized contexts. Results from the qualitative analysis exposed a number of unique sanitation profiles that may be similar to, but different from the five LCA profiles. For example, qualitative

findings suggest that some women who work during the day may have access to a different set of sanitation options, i.e. they might have access to private toilets or private-shared facilities at their jobs. While these women may be captured, statistically, in the first, third or fourth profiles, this unique access to a toilet because of daily migration and employment is not captured in the definition of the five sanitation profiles.

Based on the quantitative LCA, there were five common sanitation utilization profiles among women in Mathare. According to these results, women in SP1, SP2, SP4, and SP5 are relying on unsafe forms of sanitation (e.g. bags, buckets, or open defecation) for at least one call (short and/or long) during the day and/or night. This has serious implications for developers and policy-makers focused on access to sanitation. These sanitation profiles suggest that women, despite having access to toilets for at least some portions of the day, are unable to use these facilities for one or more calls during the day and/or night for a variety of reasons. While access, e.g. availability and hours of operation of toilets, is a key issue that emerged in the characterization of these profiles, the results from this study also suggest that there may be a number of other factors associated with sanitation utilization that have yet to be considered by most development and policy-making agencies. For example, insecurity at night manifested as a critical issue across a number of sanitation profiles.

Although this study marked the first effort to capture the complexity of women's daily sanitation routines in Mathare and to provide a useful framework for characterizing sanitation utilization, it had a number of limitations. First, the small sample size limited our ability to keep the granularity of the sanitation variables in the models. In the survey women were asked many details about their sanitation methods/facilities including the

type (e.g. flush, pour-flush, composting, bags, buckets, open defecation, pit latrine with slab, pit latrine without slab), where the urine/feces flows/is disposed (e.g. sewers, rivers, open drainages, septic tanks, pits), and technological features of toilet facilities (e.g. presence of superstructure, roof, doors, water for flushing and hygiene). For the purposes of these analyses these variables had to be collapsed into simpler variables with limited categories. Additionally, while the study used a stratified random sample, there are 200,000 residents in Mathare. It is unlikely that these 550 women represent the sanitation profiles of all women in the settlement. Finally, although the data was collected at different times and on different days to try to capture the sanitation profiles for a wide variety of women, the majority of the survey collection took place Monday-Sunday during the day; therefore, it is possible that certain groups of women, e.g. those who work seven days a week (not an uncommon practice for women who help families with domestic chores or childcare), were not fully represented in the sample.

## **Conclusion**

The findings from this study are important for sanitation researchers, developers and policy-makers, and public health and urban development representatives. First, this is the first attempted to assess the complexity of women's diurnal and nocturnal sanitation practices for urine and feces and to understand the underlying reasons behind their practices. Most quantitative efforts to enumerate people's access to sanitation rely on questions about primary sanitation facilities/methods. This study illustrates a need for researchers to modify common measures of people's sanitation utilization to capture the complexity of sanitation behavior, particularly in informal settlements. In addition, while many studies have shown that unimproved sanitation remains a serious issue in informal

settlements, the results of this study indicate that the proportion of women reverting to unimproved sanitation, e.g. bags, buckets, and open defecation, is perhaps much higher than previously documented. Taking into account women's actual sanitation practices and the reasons for those practices may have huge health and environmental implications. For example, almost all of the women in this study who reported using bags and buckets also reported emptying them into open drainage systems in Mathare. People, particularly children, who are exposed to raw sewage in their environments have a much greater risk of getting sick or dying from pathogen-related illnesses. In addition, there is a higher risk of large-scale outbreaks such as cholera and/or typhoid. Finally, many women reported using buckets and bags because they fear going outside at night. This suggests that toilet access for women is not only a function of availability, but of security, particularly in areas where crime rates and social disorganization are high. While there have been some recent studies that have attempted to empirically assess the relationship between access to sanitation and violence, there is a need for more studies that explore, not only the direct relationship between women's access to sanitation and violence, but also the influence exerted by women's perception of safety/security and fear of violence.

**MANUSCRIPT 2****FACTORS ASSOCIATED WITH WOMEN’S SANITATION UTILIZATION IN  
INFORMAL SETTLEMENTS IN NAIROBI, KENYA**

by

SAMANTHA C. WINTER

Manuscript 2 of 3 of a dissertation entitled:

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## ABSTRACT

**Introduction:** Despite a surge in recent efforts to reduce the number of people around the world without access to sanitation, 2.4 billion people are still without a toilet. The failure to meet global and local sanitation coverage goals suggests that our understanding of the factors that influence sustainable access, utilization, adoption, and demand for sanitation may be hampering these efforts. There is evidence, for example, that women in informal settlements may continue to use unimproved sanitation despite the growing availability of toilets, but empirical data documenting the motivations underlying such practices are limited.

**Methods:** Data for this study were collected in 2016 from women in the 11 villages comprising Mathare, an informal settlement in Nairobi, Kenya. Boosted regressions, followed by multinomial regressions, were used to investigate which factors were associated with women's sanitation utilization in Mathare and the nature of those associations. Common sanitation utilization profiles (SPs) were used as outcome variables in these analyses.

**Results:** Lack of privacy emerged as an important factor across all five sanitation profiles. Social disorganization was also an important factor in four of the five profiles. Insecurity associated with women's current and/or alternative toilet facilities and their primary water sources were important factors in three of the five profiles. A number of other factors emerged in individual profiles.

**Conclusions:** This study marked the first attempt to consolidate and organize factors from sanitation literature and to determine which are associated specifically with women's sanitation utilization in informal settlements in Nairobi. Factors such as

sanitation-related insecurity and social disorganization showed up as prominent factors. These findings are of particular relevance for sanitation policy and development because they suggest that sanitation strategies must address social challenges and barriers to access in these rapidly-growing settlements.



## Introduction

Despite many recent policies and interventions to reduce the number of people without access to sanitation around the world, 2.4 billion people are still living without a toilet (WHO & UNICEF, 2015). Poor sanitation is a serious public health issue and a violation of people's human rights (Acharya, Kaphle, & Thapa, 2015; UN General Assembly, 2010). In fact, recent statistics suggest that lack of access to sanitation is responsible for approximately 280,000 diarrhea-related deaths every year (Fewtrell et al., 2005). In addition, poor sanitation is linked to the transmission of a number of other water-borne diseases including cholera, typhoid, diarrhea, hepatitis A, and schistosomiasis (World Health Organization, 2016). With close to a third of the world's population still lacking access to basic sanitation and the failure to achieve Target 7 of the Millennium Development Goals (MDGs) to 'halve the number of people without access to basic sanitation by 2015,' there have been increasing efforts to explore the factors that influence people's ability to access and utilize sanitation, particularly in "developing" countries (Corburn & Hildebrand, 2015; Debesay, Ingale, Gebresilassie, Assefa, & Yemane, 2013; Dreibelbis, Winch, et al., 2013; Greed, 2015; Hirai et al., 2016; Hirve et al., 2015; Isunju et al., 2011; D. C. Jenkins, 2010; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Kema et al., 2012; Khanna & Das, 2016; Lagerkvist et al., 2014; Mazeau, 2013; McFarlane et al., 2014; K. O'Reilly, 2010; Okurut, Kulabako, Chenoweth, & Charles, 2014; Sahoo et al., 2015; Sommer et al., 2013; Tumwebaze et al., 2014; Tumwebaze et al., 2013).

Despite expanding efforts to identify health and non-health related determinants of sanitation adoption, utilization, and demand, there are still 946 million people around

the globe who defecate in the open (World Health Organization, 2016). There is evidence that a number of people, particularly women living in informal settlements, revert to unimproved sanitation alternatives, e.g. open defecation or “flying toilets” (wrapping feces in plastic bags and disposing of it in open garbage pile, drainages, rivers, etc.), despite the growing availability of toilets. Research suggests there may be a variety of reasons for this including lack of access to a toilet, toilet closures, pay-per-use toilet fees, long queues at public toilets, and insecurity at night (Corburn & Karanja, 2014; Greed, 2015). The failure to meet global and national sanitation coverage goals combined with local-level failures to provide universal access to adequate sanitation suggests that interventions to expand sanitation access are failing to address a number of the underlying factors that shape sanitation utilization. This failure underscores the need to construct a more complete understanding of the multi-level factors that influence sustainable utilization, adoption, and demand for sanitation.

There are a number of recent studies that provide empirical and anecdotal evidence that women are disproportionately burdened by global and local deficiencies in sanitation (Amnesty International, 2010; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014; Hirve et al., 2015; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Khanna & Das, 2016; Khosla, 2000; K. O'Reilly, 2010; Pearson & Mcphedran, 2008; Sahoo et al., 2015; Sommer et al., 2013; E Tilley et al., 2013). Some feminist sanitation scholars suggest that our inability to meet international, national, and local sanitation access goals is, in large part, due to a lack of understanding and integration of the gender-related inequalities that are imbedded in sanitation policies and interventions, and our failure to acknowledge the daily barriers and stressors women face in trying to

manage their sanitation and menstrual needs (Greed, 2015; K. O'Reilly, 2016; Sahoo et al., 2015; Sommer et al., 2014; E Tilley et al., 2013). Literature suggests women without access to adequate sanitation not only contract common sanitation-related diseases, but are at higher risk of contracting additional illnesses resulting from urine and feces retention such as urinary tract infections and hemorrhoids (Fisher, 2008; Greed, 2015); toxic shock syndrome and vaginal infections resulting from neglectful menstruation practices (Bosch et al., 2001; Pearson & Mcphedran, 2008); and dehydration and malnutrition resulting from withholding food and water to minimize the need for urination/defecation (Greed, 2015; Khanna & Das, 2016; K. O'Reilly, 2010). Some studies have also recognized gender-specific, non-health impacts associated with lack of adequate sanitation. In particular, research suggests that women are faced with serious threats to their dignity, safety, and general well-being due to limited access to secure and private sanitation facilities (Amnesty International, 2010; Corburn & Hildebrand, 2015; Khanna & Das, 2016; Sahoo et al., 2015; Sommer et al., 2014). A number of studies provide evidence and anecdotes that open defecation and/or community/public toilets in informal settlements expose women to an assortment of psychosocial stressors including harassment and rape (Gosling et al., 2015; Hartmann, Krishnan, Rowe, Hossain, & Elledge, 2015a; Khanna & Das, 2016; K. O'Reilly, 2016).

The majority of studies focused on the factors influencing people's sanitation behaviors, particularly women's, are qualitative in nature—recognizing the complex, context-specific nature of the constellation of determinants associated with individuals' sanitation choices and practices, particularly among people without access to a toilet. Given the infancy of sanitation-related behavior theory (especially gender-specific or

feminist sanitation theory) and the complexity of findings presented in the qualitative studies, there has, to date, been limited research efforts to review, summarize, consolidate, generalize, and organize the factors heretofore documented in sanitation-related literature. There are a few scholars who have proposed sanitation-related behavior frameworks intended to help in this consolidation and organization process (Curtis et al., 2009; Devine, 2009; Dreibelbis, Winch, et al., 2013; M. W. Jenkins & Scott, 2007; Mazeau, 2013; O'Reilly & Louis, 2014; Thilde Rheinländer et al., 2013), but the frameworks have remained largely unapplied.

The purpose of this study is two-fold. First, I review the factors that have been identified to date in the scholarly literature as affecting women's sanitation behavior using, as an organizing framework, the Integrated Behavioral Model for Water, Sanitation, and Hygiene (IBM-WASH) developed by Dreibelbis and colleagues (2013). Secondly, using data from the 2016 multi-phased, mixed-methods study on women's sanitation utilization in Mathare Valley Informal Settlement in Nairobi, Kenya (Mathare) I assess the relevance of these factors to a specific context and identify factors of importance in this setting that have been previously unreported in the literature.

### **Review of Documented Factors Associated with Sanitation Behavior**

**Social and/or structural factors.** National and/or local policies with respect to land ownership and investment; provision of sanitation service; sanitation development; and/or regulation of sanitation policies are *contextual factors* that can diminish or expand overall availability of sanitation alternatives (Isunju et al., 2011). *Psychosocial factors* such as cultural and religious norms with regard to sanitation have also been identified by some scholars as being associated with sanitation behavior and practices (De Bruijne et

al., 2007; Okurut et al., 2015). Specific cultural and religious norms associated with sanitation behavior and practices in the literature include social attitudes towards “dirtiness” (e.g. urine and feces) (De Bruijne et al., 2007; Okurut et al., 2015), social norms defining who should or should not share toilets (Almedom, 1996; Almedom et al., 1997), and religious ablution rituals requiring specific facilities and or resources such as water. Perhaps the most recent society-level psychosocial factor identified in the sanitation literature is inequitable gender norming (Greed, 2015; Khanna & Das, 2016; Khosla, 2000; K. O'Reilly, 2016; Sahoo et al., 2015; Sommer et al., 2014).

**Community-level factors.** These include *contextual factors* such as lack of access roads, broken or non-existent central water supply and/or sewer infrastructure, high population densities, complicated land ownership dynamics, and environmental barriers such as high water tables, unstable soils, heavy rains, uneven geography, technical standards, city or national building regulations, land tenure systems, and population density (Jewitt, 2011; Mazeau, 2013; McFarlane et al., 2014; O'Reilly, 2012; Okurut et al., 2014; Pullan, Freeman, Gething, & Brooker, 2014). Community-level *psychosocial factors* found to be associated with sanitation behavior in the literature include complicated land tenure and landlord/tenant relationships (particularly in informal settlements) (Isunju et al., 2011) and social disorganization within communities and neighborhoods reflecting high levels of crime, violence, vandalism, idle youth, litter, stray animals, and drug/alcohol use (Winter & Barchi, 2015). Finally, community-level *technological factors* linked to sanitation behavior include structural features of the toilet/site for defecation (e.g. type of toilet and whether the facility has a superstructure, locks, doors, separate toilet blocks for women/men, hand washing facilities, pit covers,

ventilation systems, and lighting) (Corburn & Hildebrand, 2015; Okurut et al., 2014); cost of toilet facilities (Amnesty International, 2010; Corburn & Hildebrand, 2015; Mazeau, 2013); and availability of accessible alternative facilities or methods of urine/feces disposal (Mazeau, 2013; Tumwebaze & Lüthi, 2013).

**Family- and household-level factors.** Only a few factors at the level of the family and household have been associated with sanitation behavior in the literature. Household-level *contextual factors* such as the household structure (e.g. the gender of the head of household and number of children) and the decision-making hierarchy in the family have been associated with people's ability to demand or access sanitation (Hirai et al., 2016; Lagerkvist et al., 2014; Mazeau, 2013). Socio-economic demographics such as household wealth, religion, age and education of the head of household, and literacy have also been linked to sanitation-related behavior (M. W. Jenkins & Scott, 2007; Kema et al., 2012; Okurut et al., 2015). Sanitation researchers have also cited dignity as a household-level *psychosocial factor*. For example, studies have found that toilets convey social dignity and prestige and/or social conformity—both driving factors for the adoption of or demand for new sanitation (Biran et al., 2011; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Lagerkvist et al., 2014; Whaley & Webster, 2011). Finally, people's perceptions of improved health outcomes and/or actual health improvements in the household have been shown to encourage people's sanitation adoption and buy-in (Cairncross & Mundial, 1992; M. W. Jenkins & Curtis, 2005; Lagerkvist et al., 2014; Schouten & Mathenge, 2010).

**Individual-level factors.** By far the largest volume of factors associated with sanitation behavior, adoption, demand, or utilization in the literature was at the individual

level. Individual-level *contextual factors* include demographics and women's experiences of violence. The literature identifies several individual-level socio-economic demographics including individual wealth, employment, religion, age, and education and literacy that have been linked to sanitation-related behavior (M. W. Jenkins & Scott, 2007; Kema et al., 2012; Okurut et al., 2015). Exposure or fear of exposure to violence, crime, or harassment is cited as an important factor influencing people's, particularly women's, sanitation preferences and behaviors in a number of studies (Amnesty International, 2010; Khanna & Das, 2016; Sahoo et al., 2015; Sommer et al., 2014; Winter & Barchi, 2015). Some studies are focused on the association of open defecation with women's experience of violence and harassment, particularly sexual (Khanna & Das, 2016; Pearson & Mcphedran, 2008; Winter & Barchi, 2015), while others examine these factors in the context of accessing inadequate public or community toilets (e.g. facilities without gender stalls, walls, doors, locks, lights, or proper management) (Amnesty International, 2010; Corburn & Hildebrand, 2015). In other studies, perceived danger, insecurity, and violence are identified as important factors contributing to both men's and women's decisions to adopt alternative sanitation strategies such as minimizing food and liquid intake, avoiding certain times or places for urination/defecation, and/or using unsafe methods of urine/feces disposal (bags/buckets) in the home (Lagerkvist et al., 2014; Mazeau, 2013; Rosenquist, 2005). Finally, personal health improvements associated with sanitation were also cited as a contextual factor encouraging women to demand and/or adopt improved sanitation (Cairncross & Mundial, 1992; M. W. Jenkins & Curtis, 2005; Lagerkvist et al., 2014; Schouten & Mathenge, 2010).

Individual-level *psychosocial factors* associated with sanitation behavior included sense of safety (Arnold et al., 2010; Corburn & Hildebrand, 2015; M. W. Jenkins & Scott, 2007; Khanna & Das, 2016; Lagerkvist et al., 2014; Mazeau, 2013; Pearson & Mcphedran, 2008; Rosenquist, 2005; Schouten & Mathenge, 2010); user satisfaction (M. W. Jenkins & Scott, 2007; Tumwebaze et al., 2013); sense of privacy (Cairncross, 2003; M. W. Jenkins & Curtis, 2005; Khanna & Das, 2016; Lagerkvist et al., 2014; Mazeau, 2013; McFarlane et al., 2014; Moe & Rheingans, 2006; K. O'Reilly, 2010; Pearson & Mcphedran, 2008; Sommer et al., 2013); and, biological drivers (e.g. disease avoidance) associated with the conditions of certain sanitation facilities, open defecation sites, or methods of disposal. Literature examining biological drivers provides evidence that people associate odor and direct observation of human feces with health hazards, a lack of cleanliness, and poor social status. Accordingly, individuals may modify their sanitation practices based on contact with these drivers (Aiello et al., 2008; Drangert, 2004; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Mazeau, 2013; Thilde Rheinländer et al., 2013; Whaley & Webster, 2011).

Individual-level *technological factors* identified in the literature include the structure and features of accessible toilet facilities (e.g. doors, roofs, sanitary bins, locks, walls) (Katukiza et al., 2010; Kema et al., 2012; Okurut et al., 2015) and perceived cost and convenience of accessing a site/facility for defecation/urination. Perceived cost of sanitation in the literature is a complicated factor. In the sanitation-demand literature scholars talk about cost in terms of user "value for money", i.e. the "quality of service or utility by the sanitation technology relative to the price paid for it" (Lagerkvist et al., 2014). For some users, basic economic barriers, e.g. the affordability of a toilet, can be



the deciding factor for someone using a toilet or choosing an alternative method of disposal such as open defecation (Corburn & Hildebrand, 2015; Greed, 2015; Mazeau, 2013). Cost of sanitation could also be viewed from a gendered perspective, e.g. do women have to pay a higher fee or do they have to pay more often to utilize a toilet, and, if so, will they continue to use it? (Greed, 2015). Alternatively, cost has also been defined in terms of the time associated with sanitation access, e.g. walk-time to a shared facility or a site for open defecation or time lost at work/in school due to sanitation-related illnesses (Khanna & Das, 2016; Okurut et al., 2014; Sahoo et al., 2015). Relatedly, literature suggests that convenience, as it is associated with sanitation behavior, is represented by variables such as accessibility of the facility (e.g. distance to toilets from user's home, hours of operation for the facility) (Biran et al., 2011); toilet design and management (e.g. private facilities versus shared facilities) (Lagerkvist et al., 2014; Schouten & Mathenge, 2010); availability of other sanitation options (Mazeau, 2013); and time expenditures related to accessing a facility (e.g. walking time to facility and/or queuing time at the facility) (Lagerkvist et al., 2014; Tukahirwa et al., 2011).

**Habitual-level factors.** Finally, there were a number of factors identified in the sanitation behavior literature that can be classified as habitual-level factors within the IBM-WASH framework. Availability and access to water for sanitation (e.g. availability of water in toilets or for hygiene after urination/defecation) was identified as an important *contextual factor* influencing people's sanitation behaviors in several studies (Corburn & Hildebrand, 2015; Greed, 2015; Sahoo et al., 2015). The most common habitual-level *psychosocial factors* from the literature can be grouped into one overarching category of factors—i.e. people's water, sanitation, and hygiene knowledge, attitudes, and practices

(WASH-KAP). Some studies suggest, for example, that health education related to WASH may be associated with increased knowledge, attitudes, and health practices (Mosler, 2012; Quick et al., 2002; Thevos et al., 2000). Similarly, habitual-level *technical factors* from the literature are largely focused on the hygiene and cleanliness of sanitation facilities/sites for urination/defecation (Biran et al., 2011; M. W. Jenkins & Scott, 2007; Lagerkvist et al., 2014; Mazeau, 2013; Nyametso, 2012; Schouten & Mathenge, 2010; Tumwebaze et al., 2014; Tumwebaze et al., 2013; Wegelin-Schuringa & Kodo, 1997).

### **Exploring Factors Associated with Sanitation Behaviors in Mathare**

The second portion of this study is focused on testing the associations between the sanitation-related factors previously identified in the literature and women's actual sanitation behaviors in informal settlements in Nairobi, Kenya. The work was guided by four research questions: (1) to what extent are factors cited in the literature associated with women's sanitation utilization in informal settlements in Nairobi? (2) what is the nature (direction and magnitude) of those associations? (3) does fear of victimization/sense of safety emerge as an important factor in women's sanitation utilization? and, finally, (4) does proximal social context (social cohesion and/or social disorganization) emerge as an important factor in women's sanitation utilization in this setting?

### **Methods**

Data for this portion of the study were collected in Mathare in 2016. A comprehensive discussion of the methods is presented in Manuscript 1 (cite paper once published). Qualitative data from case studies of 55 women (five from each of the 11 principle villages in Mathare) and quantitative data from 550 household-level

questionnaires (50 from each of the 11 villages) were used in this analysis. The analysis utilizes responses from all 55 case studies and all 550 surveys. There was very minimal missing data on the variables used in this study (0-3% with most variables missing less than one percent). While the amount of missing data was minimal on individual variables, list-wise deletion leads to the loss of a lot of data and some of the quantitative analysis techniques in this study are particularly vulnerable to missing data; thus, missing data were imputed using single hotdeck imputation (M. Schonlau, 2012).

### **Quantitative measures.**

A large number of quantitative measures were developed for use in this study. All measures were created from responses to quantitative questions from 550 household surveys. Measures were organized according to the IBM-WASH framework.

### ***Social/macro-level factors.***

*Contextual factors.* Data about local and national **sanitation policies** were gathered through background research; however, policies did not seem to differ across the different villages in Mathare. Thus, only one variable was included in the model to try to capture macro-level contextual influences, e.g. people's perspectives about who is responsible for building toilets for individuals in Mathare. Respondents were asked, "in general, whose responsibility is it to build sanitation facilities for you/members of your community?" For analysis purposes, responses were collapsed into three categories: 1) Other (includes self, other family members, and/or charities/churches/organizations); 2) landlord only and 3) landlord and government (included municipal government and/or federal government).

*Psychosocial factors.* Participants were asked several questions to try to capture **religious and cultural factors** around issues of sanitation and hygiene. In particular, individuals were asked “does your religion have any rules about the disposing of human excreta/urine?” and “does your culture have any rules about the disposing of human excreta/urine?” For this analysis, responses were coded as 1=“yes” and 0=“no”.

*Neighborhood/community/proximal factors.*

*Contextual factors.* A variable for village was created with 11 categories (Mashimoni, Mabatini, Number 10, 3A, 3B, 3C, Village 2, Kosovo, Gitathuru, 4A, and 4B). In this analysis, the village variable was used as a way of adjusting the robust standard errors in the model to account for the stratified sampling technique used in the study.

*Psychosocial factors.* Respondents were asked a series of questions regarding their sanitation situation in the context of the **landlord/tenant relationships** in informal settlements. A dichotomous landlord variable (1=has landlord, 0=does not) was created to capture whether or not the respondent had a landlord at the time of the survey. Additionally, respondents were asked a series of questions to try to capture women’s perceptions of the community-level **proximal social context** in Mathare. In particular, this study utilizes social cohesion and social disorganization as measures of the proximal social context in Mathare. Questions for social cohesion were taken from Buckner (1988). Responses for each item in the social cohesion scale were dichotomous (1=“agree”, 0=“disagree”). A social cohesion scale (min=0, max=1) was developed by taking the mean of all 18 items in the scale. A social disorganization measure was also included in the models. Individual items for the scale were taken from Gau and Pratt

(2008). Findings from Gau and Pratt (2008) suggest that social disorganization has two distinct factors: (1) crime, which is the mean of seven items and (2) disorganization, which is the mean of nine items. Respondents were asked to rank the seriousness of certain issues in their neighborhood (e.g. violent crimes, rape/sex crimes, stray dogs, garbage/litter) using the following codes: 1=not a problem, 2=a problem, 3=a serious problem. A score was created for each of the two social disorganization factors by taking the mean of the items in each factor.

*Technological factors.* Literature focused on the acceptability of sanitation suggests that it is important to understand user's sanitation utilization choices in the context of all available sanitation options (Brunson, 1996; Mazeau, 2013). In order to capture information about the **accessibility of alternative sanitation facilities** in each village, women were asked, “are there any other toilet facilities or methods of urine/feces disposal within walking distance to your home that you are eligible to use, but, for whatever reason, choose not to use?” Responses were dichotomous (0=no and 1=yes). If “yes,” respondents were asked to provide a qualitative explanation of why they choose not to use those alternative toilets. Responses from this qualitative question were utilized to develop a dichotomous variable capturing whether a woman identified insecurity as a reason she chooses not to use the alternative toilet.

***Family and household factors.***

*Contextual factors.* All respondents were asked several **household-level socio-economic demographic** questions related to the household or family including the household income (less than 5000 Ksh/month, between 5000-10000 Ksh/month, and over 10000 Ksh/month), whether the respondent’s husband was employed at the time of the

survey (0=no, 1=yes), and whether the husband currently had a business (0=no, 1=yes). Respondents were also asked questions about the family **structure in the household**. For example, women were asked how many people regularly reside in the household and whether or not the head of the household is male (0=no, 1=yes). Finally, in order to capture information about **household health** women were asked whether any member of the household had suffered from a recent bout of diarrhea in the 2 weeks leading up to the survey (0=no, 1=yes).

***Individual level factors.***

*Contextual factors.* All respondents in the qualitative and quantitative phases of the study were asked several basic **individual-level, socio-economic demographic** questions including age (continuous), whether or not she was employed at the time of the survey, and whether or not she had a business. During the piloting of the quantitative instrument, women determined it was inappropriate to ask participants their specific religious and tribal affiliation; thus, these questions about religion and tribal affiliation were omitted from the survey instrument.

Women were also asked several questions about their **experiences with and/or their knowledge of sanitation-related violence** in Mathare. All of these questions were dichotomous. There are no existing quantitative measures to assess women's experiences of violence in relationship to their sanitation practices. Therefore, the researcher was piloting a series of questions she developed based on her experience in the field and qualitative findings from the literature (Amnesty International, 2010; Ellsberg et al., 2005; Massey, 2011). Questions were as follows: (1) In the last 12 months have you ever observed another woman or girl being physically attacked [at her primary location for

defecation/while walking to or from her primary location for defecation]? (2) In the last 12 months have you ever observed a woman or girl being sexually harassed/raped [at her primary location for defecation/while walking to or from her primary location for defecation]? (3) In the last 12 months have you ever observed a woman or girl being verbally harassed [at her primary location for defecation/while walking to or from her primary location for defecation]? (4) In the last 12 months have you been physically attacked [at your primary location for defecation/while walking to or from your primary location for defecation]? (5) In the last 12 months have you been sexually harassed/raped [at your primary location for defecation/while walking to or from your primary location for defecation]? (6) In the last 12 months have you ever been verbally harassed [at your primary location for defecation/while walking to or from your primary location for defecation]? (7) In the last 12 months have you heard of any woman or girl who has been physically attacked [at her primary location for defecation/while walking to or from her primary location for defecation]? (8) In the last 12 months have you heard of any woman or girl who has been sexually harassed/raped [at her primary location for defecation/while walking to or from her primary location for defecation]? (9) In the last 12 months have you heard of any woman or girl who has been verbally harassed [at her primary location for defecation/while walking to or from her primary location for defecation]? Three violence variables were created from the responses to the violence questions: (1) an “observed recent VAW at toilet” variable, in which a woman was given a score of 1=yes if she reported having observed physical, sexual, or verbal VAW to/from or at her site of urination/defecation in the last 12 months and a 0=no if she answered no to questions 1-3; (2) a “heard about recent VAW at toilet” variable, in which a woman was given a score

of 1=yes if she reported having heard about any physical, sexual, or verbal VAW related to a woman's site of urination/defecation in the last 12 months and a 0=no if she answered no to questions 4-6; (3) an "experienced recent VAW at toilet" variable, in which a woman was given a score of 1=yes if she reported having experienced any physical, sexual, or verbal VAW to/from or at her site of urination/defecation in the last 12 months and a 0=no if she answered no to questions 7-9.

Women were also asked the following question to obtain information about their **individual health**, "in general, would you describe your overall health as excellent, good, fair, poor, or very poor?" Responses were collapsed into three categories for the purposes of this analysis (1) poor (includes poor and very poor), (2) fair/neutral, and (3) good (includes good and excellent).

*Psychosocial factors.* Although there are no existing measures to assess women's **fear of victimization** or **sense of safety** in relationship to sanitation, the researcher developed a list of questions based on neighborhood sense of safety and fear-of-victimization literature (Rader et al., 2007). First, women were asked, "Is it safe for you to walk to your primary toilet alone during the [day/night]?" Responses were coded as 0=no, 1=yes. ). If a woman responded "no" she was asked to describe what she would fear might happen if they visited a toilet alone during the [day/night]. Responses from this qualitative question were utilized to develop a dichotomous variable representing women's fear of victimization. If a woman identified violence or insecurity as something she feared she was given a score of 1=fears sanitation-related victimization; if we answered "yes" to the original question about safety or did not identify violence or



security as fears in her verbatim response, she was given a score of 0=does not fear victimization.

In order to capture some elements of **structural safety** in toilets, women were also asked questions about whether or not their toilet had lights [inside the stalls/outside the stalls] during the [day/night]. Responses to the questions were collapsed into a toilet has lights variable in which a woman received a score of 0=no lights if she answered no to all light questions and 1=yes if she answered yes to having light inside or outside stalls.

Women were also asked a series of questions about their **perceptions of crime** and their **perceptions of safety** in the community. First, women were asked “how concerned are you about the levels of crime in your neighborhood?” Response options included: (a) not at all concerned, a little concerned, very concerned. If women responded that they were a little or very concerned, they were asked “what type(s) of crime are you most concerned about in your neighborhood?” Responses from this qualitative question were utilized to develop a dichotomous variable capturing whether a woman identified violence/rape as a type of crime she was worried about in her community. Women were also asked three binary questions about their perception of their neighborhood, i.e. (1) Do neighbors in your neighborhood know each other well? (2) If there was a public display of violence in your neighborhood would people generally do something to stop it? (3) If someone in your family suddenly fell ill or had an accident, would your neighbors offer to help? A neighborhood safety scale for each woman was created by taking a sum of these three questions (min=0, max=3).

For each primary and alternative sanitation facility identified in the sanitation utilization module of the household survey, participants were asked about their **user satisfaction**, they were asked “how satisfied are you with this toilet?” Utilizing the corresponding response options, participants were given an option of five response options ranging from “very dissatisfied” to “very satisfied” with a neutral option of “neither dissatisfied nor satisfied.” Responses were collapsed to create a dichotomous variable, where 1= satisfied (includes satisfied and very satisfied) and not satisfied/neutral (includes very dissatisfied, dissatisfied and neutral).

In order to measure women’s **sense of privacy**, respondents were asked, "do you have privacy when you use your [toilet/method of disposal] during the [day/night]?" Responses were dichotomous, where 0=no and 1=yes. Respondents were also asked, "do you ever feel embarrassed using this [toilet/method of disposal] during the [day/night]?" In order to capture whether women’s toilets had structural characteristics to help ensure privacy, women were also asked whether or not each of their toilets/site for disposal had a superstructure, a roof, a tight-fitting door, and a lock. If the women reported “yes” to all of the components, she received a value of 1=toilet has all structural/privacy components. If she answered “no” to any of the items, she received a score of 0=toilet does not have all structural/privacy components. Lastly, women were asked whether their toilet/site for disposal had separate gender stalls. Responses were dichotomous.

According to Thilde Rheinländer et al. (2013), sanitation utilization and preferences are often driven by **biological drivers** such as odor. Therefore, participants were asked "is there frequently a bad odor coming from your [toilet/method of disposal]?" Responses were dichotomous. Respondents were also asked whether their

toilet/site for disposal had “a cover to minimize bad smells,” “a ventilation pipe” and/or “a window for ventilation.” If the women reported “yes” to any of the odor reducing components, she received a value of 1=toilet has all odor reduction components. If she answered “no” to all of the items, she received a score of 0=toilet does not have all odor reduction components.

*Technological factors.* Women who reported having access to a toilet facility were asked a number of questions about the **accessibility of toilets**. First, women were asked whether their toilet facilities were closed at night (responses were 0=no, 1=yes). Responses were dichotomous (0=no, 1=yes). Women were also asked the following question, “does it sometimes happen that you cannot use the toilet during the [day/night] because [a. it is closed, (b) it is temporarily locked, (c) someone else is using it, (d) it is full/not yet emptied, (e) it is flooded, (f) there is a long queue, or (g) some other reason (specify)]?” Responses were dichotomous. Responses were collapsed into a single “sometimes cannot access the toilet” variable in which a woman received a score of 1=yes if she answered yes to any of the questions and 0=no if she answered no to all of the questions.

Participants were also asked questions about the **cost of the toilet**, i.e. they were asked whether or not they regularly paid a fee to use their toilet/site for disposal and, if so, the amount they paid (per visit or per month, depending on the facility). Responses to questions were recoded to create a single “pays fee” variable with three response values (0=no fee, 1=pay per visit, and 2=pay per month). Questions regarding cost were adopted from the Whittington et al. (1992) household survey on demand for improved sanitation services in Ghana. To capture information about the **distance to the toilet/site for**

**disposal**, respondents were asked whether or not they had to go outside their home to access a toilet/site and, if so, how many minutes they had to walk to reach the toilet/site. Responses from these questions were collapsed to create a single walk-time to toilet/site for disposal, where responses were 0=does not leave house, 1=less than 1 minute, 2=1-2 minutes, 3=3-4 minutes, and 5=more than 5 minutes.

In order to capture the **time to use** of a toilet/method of disposal, women were asked, first, whether they usually have to wait in line before they can use the toilet during the [day/night]. Responses included never, sometimes, often and always. Responses were collapsed into a dichotomous variable where 0=do not wait in line and 1=sometimes, often or always have to wait in line. Although women were asked to approximate the number of minutes they usually had to wait to use their toilet during the [day/night], this variable was not used in these models. Finally women were asked several questions about the **number of people sharing** the facility. Women were asked whether or not their toilet was shared with other people outside of the household and, if so, with how many other people. Responses were coded into a continuous number of people sharing facility variable.

### ***Habitual factors.***

*Contextual factors.* For many women, **access to water** is often connected to which kind of toilet they are able to use or whether or not they have to pay for water/bring their own water for flushing. Women were asked about their primary water source. Responses to the variable were collapsed into (1) tap inside home or building, (2) outside tap, (3) public tap/well, and (4) tanker/vendors. In addition, women's bathrooms (showers) are often connected to their sanitation options; for example, some women use

their bathroom (shower) as a toilet and/or the price of their bathroom (shower) is included in the price of using a public toilet. Therefore, women were also asked about their primary bathing facility. Responses were collapsed into a dichotomous variable where 1=outside the home and 0=inside the home.

*Psychosocial factors.* Although there was no published scale for assessing **knowledge, attitudes and practices (KAP) related to WASH**, there are a number of studies that have assessed WASH KAP. Questions to measure KAP with regard to WASH were adapted from questionnaires developed and used by Sibiya and Gumbo (2013) to assess KAP of secondary school students in South Africa; Pattanayak et al. (2007) to assess a KAP related to WASH before and after implementation of a randomized evaluation of a community-led sanitation intervention in India in 2007; and A. Joshi, Prasad, Kasav, Segar, and Singh (2013b) to investigate WASH KAP in urban informal settlements in India in 2013.

Women were asked whether or not they treated their water (responses were 0=don't treat, 1= treats water). Although women were also asked what they used to treat their water, the responses to that question were not used in the models. Furthermore, women were also asked what they usually used to wash their hands. Responses included (1) water only, (2) water and soap, (3) water and ash, (4) water and sand/leaves, (5) sanitizer, (6) other (specify). Responses were collapsed into a dichotomous variable where 0=uses water only and 1=uses a disinfectant (soap/ash/sanitizer). Additionally, women were asked what they used for anal cleaning. Responses included (1) tissue, (2) leaves, (3) water, (4) paper/newspaper, (5) wood, (6) hand, (7) do not use anything, (8) other (specify). Since over half of the women in the sample reported using tissue,

responses were collapsed into a dichotomous structure where 0=uses tissue and 1=uses other than tissue (leaves, water, paper/newspaper/old flour bags, nothing).

Finally, women were also asked a series of questions such as (1) how does a person get diarrhea? (2) around the world who is most affected by diarrhea? (3) how can you help prevent yourself and your family members from getting diarrhea? and (4) please name the key times to wash your hands? Correct responses to these questions were summed together to create a *WASH Knowledge Score* (min=0; max=20). Correct responses to these questions took into account more complex answers, e.g. a woman received a point for each key time for handwashing she was able to identify.

*Technological factors.* Respondents were asked a series of questions during the surveys about the level of **hygiene and cleanliness** of their primary and alternative sanitation facilities. These questions were based on survey questions developed and utilized by Tumwebaze and Lüthi (2013). Women were asked about the cleanliness of their toilets. Responses include (a) very clean, (b) clean enough to use, (c) neither clean nor dirty, (d) dirty but usable, and (e) very dirty/not usable). Responses were collapsed to a binary variable where 1=clean (very clean/clean enough to use) and 0=not clean (too dirty to use/dirty/neutral). Respondents were asked whether their primary and alternative locations for urination/defecation were equipped with the following items: (a) toilet paper/tissue, (b) water for anal cleansing, (c) a rubbish bin for dirty tissue, (d) a location for disposal of feminine hygiene products, and (e) running water. Each woman received a toilet hygiene attribute score—a sum of all the items (min=0, max=5). Additionally, respondents were asked if there was a location for washing hands after

urination/defecation and, if yes, whether there was soap. Responses to each of these latter variables were dichotomous (0=no, 1=yes).

### **Qualitative measures.**

Qualitative questions about the factors that contribute to women's sanitation utilization were general. In addition to asking women to describe the sanitation environment in their neighborhood and household and their primary and alternative sanitation practices, women were also asked questions about why/what factors influence their utilization of their primary and alternative sanitation options. The purpose of the qualitative portions of the study was to allow the important factors to emerge from the women, not to force the women to answer questions about all of the hypothesized factors. After women described and identified their reasons for using/not using particular sanitation strategies, additional probes were used to gather information about other potential factors from the literature. For example, probes might have been used to ask women about whether time of day/night, the conditions and/or technological characteristics of available sanitation facilities, sense of safety, and/or the location of sanitation facilities/cites for urination/defecation influence their sanitation utilization patterns.

### **Analysis strategy.**

In Manuscript 1 (cite paper once published), qualitative and quantitative data were used to develop generalized sanitation profiles (SPs) for women in Mathare. Qualitative data were used to try to explore the similarities and differences between women across and within profiles and to explain the distinctions between profiles. In the analysis, women's responses to questions about their toilet/method for disposal for (1) defecation

during the day, (2) urination during the day, (3) defecation at night, and (4) urination at night were used to develop the following five sanitation profiles (SPs): (1) Lack of Security at Night, (2) Lack of Funds and Accessibility, (3) Toilet Is Accessible at All Times, (4) Only in an Emergency, and (5) No money/No Access.

Qualitative interviews from Phase I were digitally recorded. Transcripts from these audio recordings were analyzed in Atlas.ti software. Cross-case, thematic analysis was used to investigate the factors that women identify as influencing their sanitation choices within each of the defined SPs.

Quantitative data was analyzed by running a series of boosted regressions using the user-written plugin “boost” in Stata v.14. The purpose of the boosted regressions was to test the influence of all factors on each of the five SPs following the guidance of Matthias Schonlau (2005). The following settings were specified for the models: (1) interactions=1, (2) maximum iterations=4000, (3) shrinkage factor=0.01, (4) fraction of training options=.5, and (5) random number of seed=1.

Results from the boosted regression models were then used to select variables for five logistic regression models looking at the association between the most influential factors (identified in the boosted regressions) and each of the five SPs. All models were run in Stata v.14. Standard errors in the model were adjusted for clustering at the village level.

## **Results**

Table 3.1 summarizes women’s sanitation behaviors by sanitation category. Quantitative findings suggest that approximately 56% of women in SP1 utilize a public toilet for urination/defecation during the day. Additionally, between 23-25% use private-



shared facilities for urination/defecation during the day. At night between 75-80% of women in SP1 utilize bags/buckets and about 13% use OD.

Approximately 98% of women in SP2 utilize public toilets for defecation during the day and 100% of the women in this profile utilize bags/buckets/OD for short calls during the day. About 78% of the women in SP2 utilize bags/buckets during the night for long calls and about 98% of them use bags/buckets for short calls. Approximately 22% of the women in SP2 try to avoid defecating entirely at night.

Results suggest that women in SP3 have access to a variety of different sanitation options. They also suggest that most of these women have access to the same facility/type of facility during the day and the night. For example, about 50% of women in this profile utilize a plot toilet for long and short calls during the day and about 55% utilize plot toilets for long and short calls a night. The 55% at night is a slight increase from the proportion of women using plot toilets during the day. On the other hand, about 27% of women in this profile report using a private-shared facility for all calls during the day and slightly fewer—around 25% utilize private-shared facilities at night. It is quite possible that these discrepancies might be due to the fact that women who work during the day may have access to different types of facilities (e.g. private-shared or private) during the day than they do at night.

Results suggest that women in SP4, like women in SP3, utilize a variety of sanitation options during the day a night. Between 29-35% of these women utilize private-shared facilities for short and long calls during the day and for long calls during the night. Another 50-55% of women utilize plot toilets for long and short calls during

the day and for long calls during the night. About 97% of the women in SP4 use buckets for short calls during the night.

Findings in Table 3.1 suggest that 77-86% of women in SP5 utilize bags/buckets for all calls during the night and day. The remaining 14-23% of women utilize OD for urination/defecation during the day/night.

Table 3.1

*Toilet use by Sanitation Profile (values are percentages)*

	<u>Quantitative Sample</u>					<u>Qualitative Sample</u>				
	SP1	SP2	SP3	SP4	SP5	SP1	SP2	SP3	SP4	SP5
<u>Daytime,</u>										
<u>Defecation</u>										
Private shared	25.0	1.7	26.9	34.9	0.0	0.0	3.6	0.0	0.0	0.0
Plot	11.5	0.0	50.0	41.3	0.0	58.3	10.7	62.5	20.0	0.0
Public	56.1	98.3	12.7	22.2	0.0	41.7	85.7	12.5	60.0	0.0
Bag/bucket	0.0	0.0	0.0	0.0	79.7	0.0	0.0	0.0	0.0	100
OD	0.0	0.0	0.0	0.0	20.3	0.0	0.0	0.0	0.0	0.0
Private	7.4	0.0	12.7	6.3	0.0	0.0	0.0	25.0	0.0	0.0
<u>Daytime,</u>										
<u>Urination</u>										
Private shared	23.0	0.0	26.9	28.6	0.0	0.0	0.0	0.0	0.0	0.0
Plot	12.2	0.0	50.0	33.3	0.0	58.3	0.0	62.5	20.0	0.0
Public	56.8	0.0	12.7	12.7	0.0	41.7	0.0	12.5	20.0	0.0
Bag/bucket	0.0	70.0	0.0	19.0	77.2	0.0	82.1	0.0	20.0	100
OD	0.0	30.0	0.0	6.3	22.8	0.0	17.9	0.0	20.0	0.0
Private	8.1	0.0	12.7	4.8	0.0	0.0	0.0	25.0	0.0	0.0
<u>Nighttime,</u>										
<u>Defecation</u>										
Private shared	0.0	0.0	24.6	34.9	0.0	0.0	0.0	0.0	20.0	0.0
Plot	0.0	0.0	56.7	41.3	0.0	0.0	0.0	62.5	40.0	0.0
Public	0.0	0.0	7.5	14.3	0.0	0.0	0.0	12.5	40.0	0.0
Bag/bucket	75.0	77.5	0.0	0.0	82.3	91.7	89.3	0.0	0.0	100
OD	11.5	0.8	0.0	0.0	13.9	0.0	7.1	0.0	0.0	0.0
None	13.5	21.7	0.0	9.5	3.8	8.3	3.6	0.0	0.0	0.0
Private	0.0	0.0	13.4	4.8	0.0	0.0	0.0	25.0	0.0	0.0
<u>Nighttime,</u>										
<u>Urination</u>										
Private shared	0.0	0.0	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plot	0.0	0.0	55.2	0.0	0.0	0.0	0.0	62.5	20.0	0.0

Public	0.0	0.0	7.5	0.0	0.0	0.0	0.0	12.5	0.0	0.0
Bag/bucket	85.1	97.5	0.0	96.8	86.1	100	92.9	0.0	80.0	100
OD	12.8	1.7	0.0	3.2	13.9	0.0	7.1	0.0	0.0	0.0
None	2.0	0.8	0.0	4.8	0.0	0.0	0.0	0.0	0.0	0.0
Private	0.0	0.0	14.9	0.0	0.0	0.0	0.0	25.0	0.0	0.0
Sample size (n=550, n=55)	148	120	137	66	79	12	28	8	5	2

### **Sanitation profile 1 – Lack of security at night.**

**Boosted Regression.** The boosted regression results for SP1 are summarized in Figure 3.1. According to the findings, a respondent's toilet being closed at night is the largest contributing factor to her being in SP1 compared to other SPs. In addition, several neighborhood-level factors such as a social disorganization in the neighborhood (both violent/serious crimes and general disorganization), her perception of safety in the neighborhood, and social cohesion were also factors contributing to women's categorization into SP1. Other important factors included the number of other people using a respondent's daytime toilet, her age, her WASH knowledge, her sense of privacy when using her chosen toilet, her embarrassment when using her toilet, and whether or not her daytime toilet is at her place of work are also factors influencing her categorization into SP1 compared to other profiles. Additional factors are shown in Figure 3.1.

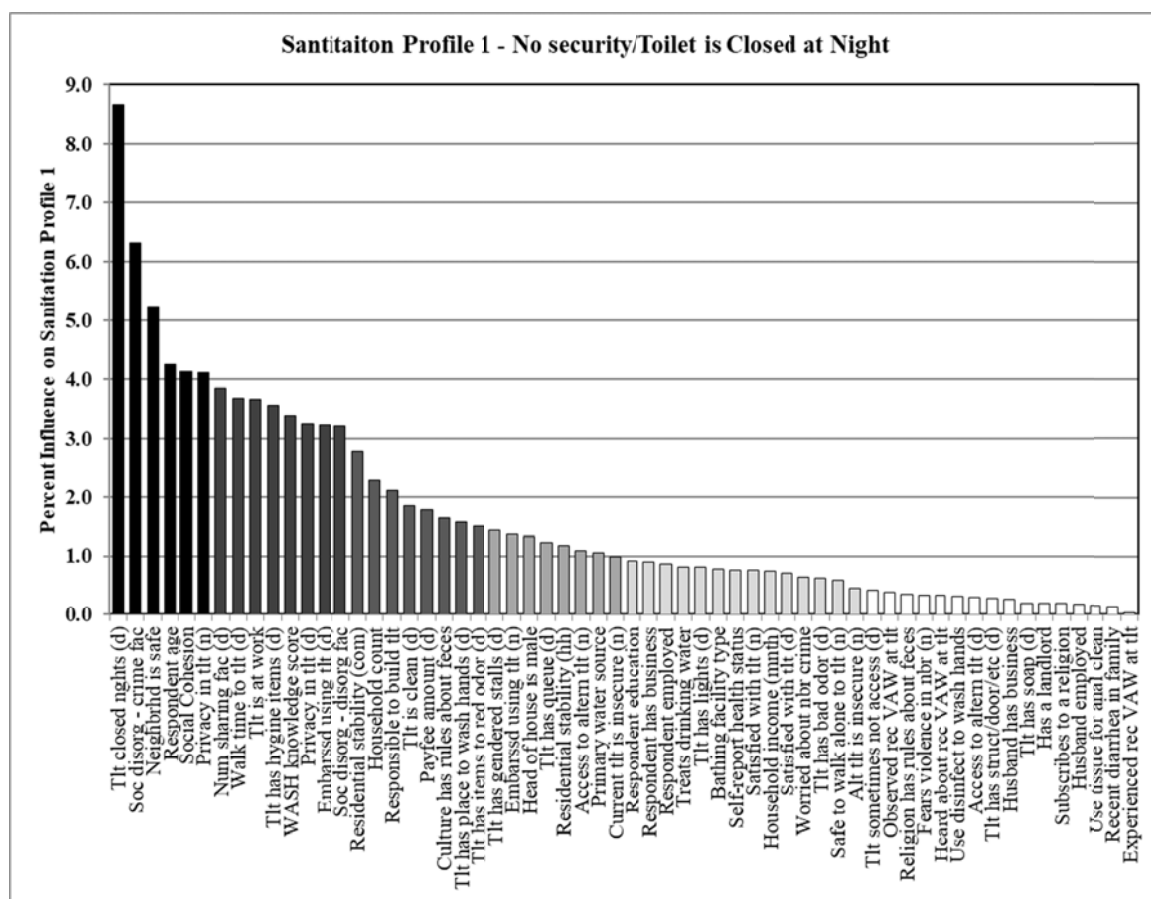


Figure 3.1. Influence of all variables on SP1

**Logistic Regression.** The results from the top 30 factors from the boosted regression were included in a logistic regression model to assess the factors associated with women being in SP1 compared to other SPs. Results from the logistic regression for SP1 are summarized in Table 3.2.

Table 3.2

*Factors associated with SP1*

	Odds Ratio	P-value	CI [95%]
<b>Social Factors</b>			
Culture has rules about feces	2.20	0.068	0.944-5.132
Responsible to build toilet ( <i>ref: Other</i> )			
landlord only	1.90	0.254	0.631-5.708
landlord and government	0.77	0.605	0.287-2.071
<b>Community Factors</b>			
Social cohesion	1.00	0.956	0.968-1.032

Social disorganization - crime	3.87	0.000	1.861-8.052
Social disorganization - disorganization	0.19	0.116	0.024-1.508
Access to alternative toilet (n)	2.30	0.120	0.805-6.541
<u>Household Factors</u>			
Household count	0.94	0.392	0.829-1.076
Head of house is male	0.86	0.678	0.412-1.781
<u>Individual Factors</u>			
Respondent age	1.01	0.442	0.98-1.046
Respondent education			
completed primary	1.04	0.926	0.422-2.586
some secondary	0.72	0.323	0.37-1.388
completed secondary	0.58	0.108	0.298-1.128
Respondent employed	2.08	0.040	1.034-4.173
Respondent has business	2.93	0.020	1.182-7.287
Residential stability (com)			
1-4 years	3.93	0.044	1.038-14.901
5-9 years	6.77	0.000	2.403-19.082
10-19 years	12.17	0.000	3.598-41.19
20+ years	2.88	0.021	1.17-7.081
Residential stability (hh)			
1-4 years	0.43	0.067	0.174-1.059
5-9 years	0.27	0.011	0.097-0.738
10-19 years	0.11	0.001	0.03-0.375
20+ years	0.09	0.001	0.022-0.362
Current toilet is insecure (n)	0.79	0.463	0.428-1.471
Alternative toilet is insecure (n)	2.36	0.023	1.123-4.956
Neighborhood is safe	0.74	0.370	0.387-1.425
Toilet has lights (d)	1.19	0.744	0.422-3.346
Privacy in toilet (d)	6.10	0.003	1.87-19.902
Privacy in toilet (n)	0.28	0.008	0.107-0.716
Embarrassed using toilet (d)	0.13	0.001	0.038-0.433
Embarrassed using toilet (n)	4.55	0.000	2.225-9.291
Toilet has gendered stalls (d)	1.72	0.116	0.875-3.385
Toilet has items to red odor (d)	0.81	0.640	0.339-1.945
Toilet is at work	6.73	0.131	0.566-80.016
Toilet closed nights (d)	6.44	0.000	2.691-15.398
Pay fee amount (d)			
pays per visit	1.21	0.731	0.407-3.605
pays per month	1.61	0.590	0.285-9.07
Walk time to toilet (d)			
less than 1 minute	0.75	0.654	0.214-2.634

1-2 min	0.41	0.293	0.076-2.178
3-4 min	1.68	0.464	0.417-6.799
5+ min	2.56	0.207	0.594-11.051
Toilet has queue (d)	1.75	0.258	0.663-4.639
Number sharing facility(d)	1.00	0.170	0.996-1.001
<u>Habitual Factors</u>			
Primary water source			
outside tap	1.40	0.621	0.373-5.212
public tap/well	1.88	0.466	0.344-10.272
tanker/vendor	0.80	0.720	0.229-2.765
Treats drinking water	1.91	0.157	0.78-4.685
WASH knowledge score	0.91	0.066	0.825-1.006
Toilet is clean (d)	1.01	0.982	0.309-3.323
Toilet has hygiene items (d)	0.97	0.872	0.633-1.474
Toilet has place to wash hands (d)	1.94	0.263	0.608-6.187

The logistic regression confirmed several of the findings from the boosted regression. Statistically significant factors associated with SP1 are shown in Figure 3.2. Whether a woman's daytime toilet is open at night, the level of social disorganization, her sense of privacy, and her embarrassment when using her chosen toilets/methods of disposal were all significantly associated with being in SP1. Approximately 65% of the women in SP1 reported that their daytime toilet is closed at night. Results from the logistic regression suggest that women in SP1 have over 6 times the odds of reporting that their daytime toilet is closed at night compared to women in other SPs.

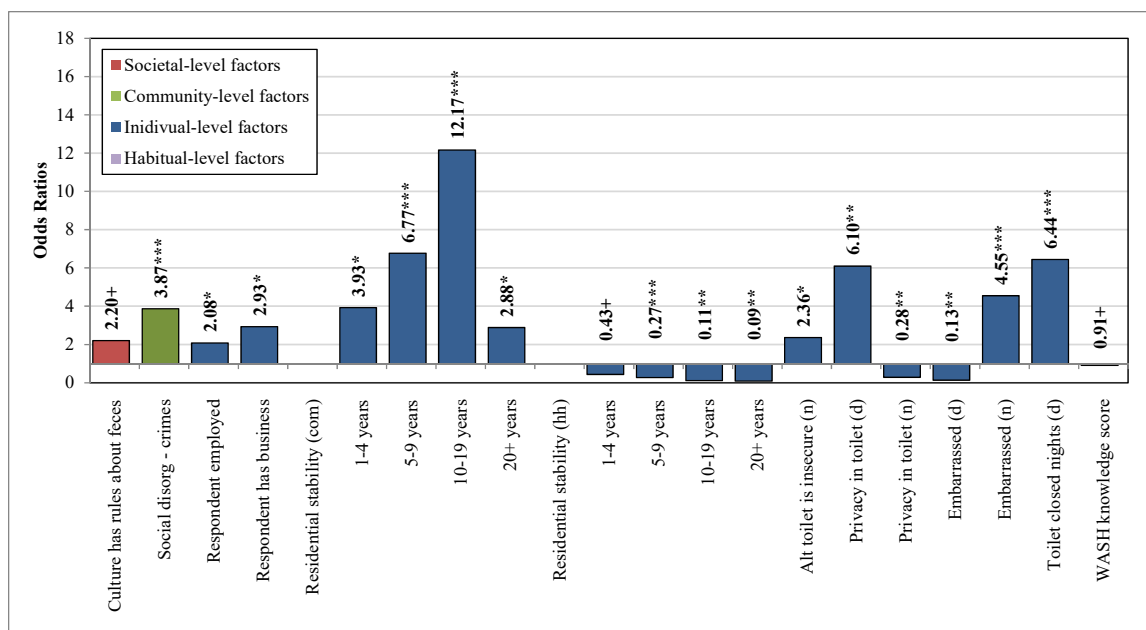


Figure 3.2. Significant factors for SP1

There were several findings that also suggest that women's perception of neighborhood disorganization and/or security may be important factors influencing her SP. For example, results from the logistic regression show that for every point increase in a woman's social disorganization score related to violent and/or serious crimes in the neighborhood is associated with 3.9 times the odds of a woman being in SP1 than other SPs. Approximately 35% of women in SP1 report having access to an alternative toilet during the night, and of those women, 78% reported insecurity as their reason for not using the alternative. Accordingly, logistic statistics suggested that women in SP1 have about 2.4 and times the odds of reporting that their alternative nighttime toilet is insecure ( $p < 0.05$ ).

The majority of women in SP1 (82%) report that they are not embarrassed while using their daytime toilet, and a majority (86%) also report having privacy while using their daytime toilet. On the other hand, 67% of women report feeling embarrassed using

their nighttime method of disposal, and only about 22% report feeling private when using their method of disposal at night. Results from the logistic regression, similarly, show that women in SP1 have 87% lower odds of reporting embarrassment using their daytime toilets than women in other SPs ( $p < 0.01$ ), and 6.1 times the odds of reporting privacy while using their daily toilet than women in other SPs ( $p < 0.01$ ). However, women in SP1 have four and one-half times the odds of feeling embarrassed using their nighttime method of disposal and 72% lower odds of reporting privacy while using their nighttime methods of disposal than women in other SPs ( $p < 0.05$ ).

Several other factors showed up as having a significant association with SP1 in the logistic regression models—whether or not a woman was employed, whether or not a she had a business, and her community/household residential stability. According to descriptive statistics, about 53% of the women in SP1 were employed and approximately 30% had a business. Results from the logistic regression show that being employed was associated with 2 times the odds of being in SP1 compared to other SPs, and having a business was associated with 3 times the odds. Interestingly, women in SP1 had significantly higher odds of having lived in the community for more than one year, but they had significantly lower odds of having lived in their current house for more than one year. See Table 3.2 for details.

***Qualitative Analysis.*** Women in the qualitative phase of the study identified a number of factors that influenced their daily sanitation practices, i.e. reasons they chose or chose not to regularly use certain sanitation options. The most common factors identified by women in SP1 were fear, cleanliness/dirtiness of the toilet, proximity to the toilet, privacy while using the toilet, fear of getting infections or other illnesses, social



disorganization in the community (crimes), security, the ability/inability to go outside at night, accessibility of the toilet, and safety. Eleven out of the twelve women in the SP1 qualitative sample talked about fear as a factor influencing their decision to use a bag/bucket or OD at night. In particular, eight of the women talked about a fear of being raped. While most women just mention a fear of being raped, e.g. “you can enter the toilet and there is no light, but there is a man hiding himself inside...you enter and there is no light and you are seized and you are raped there inside.” (Ann, Mabatini), others talked about actual incidences of recent rape or violence in their community,

At night it is this, whatever, bucket because at night you cannot go outside. Often, maybe you go out you can get a person that can even rape you. You see? Now people really fear the night because...Mathare is not good...like the other day, last week but one, on the other side, there was a child that was lost for like one week and she was wearing a school uniform and she was four years old. There was like a person who took her and put her in his house and raped her. The other night, it was raining from 8pm. Now he removed her, he put her in a sack then he put her in the river and she died. When we went to see her we would not recognize her well. He had removed her tongue and eyes (Sha, 4B)

While not every woman talked specifically of being raped, 10 out of the 12 women talked about being attacked, more generally. For example,

These days you fear for yourself. You can go outside and you meet with [people] chasing each other and if they see you, maybe you know them, and they can do something to you or they throw stones and they hit you. Do you see? (Mar, 3C)

Similarly, women in SP1 also cited insecurity, the inability to go outside at night, the need to protect their safety, and the social disorganization in the community as factors influencing their decisions to stay in the house and use a bucket/bag or OD at night. In terms of social disorganization, women cited the harassment of children, rape, theft, stoning and house robbery as the crimes one might encounter if they were to go outside at night.

Many women in SP1 also talked about the cleanliness of the toilet and the fear of getting infections as important factors influencing their decision to use or not use a toilet. Eight of the women in the SP1 qualitative sample talked about the cleanliness/dirtiness of the toilets as an important factor. Six of the women talked about their fears of getting infections or other illnesses from their toilets. In fact, many women suggested that they would revert to a bucket/bag or open defecation if the toilet was very dirty. For example, “[sometimes] the waste will be scattered everywhere so sometimes, now, you feel, I don’t need to go there, the bucket is here, I should just urinate there [in the bucket]” (Sha, Village 2). In particular, the majority of women in SP1, talked about the fear of getting an illness if the toilets were not clean. For example,

Like the toilet, you know, if it is dirty, it is a must people fear to go because for us [women] it is easy to be affected...if the toilet is dirty, the more you urinate, you know, the urine it splashes...so now, you see, it can splash like that, it gives you some illness. (Max, Mabatini)

While women did not always describe the specific illness, they provided an explanation of how a dirty toilet can cause symptoms of illnesses,

A person can help herself with that toilet like that plastic, she can be by herself--she can use that toilet alone in her house. So, you see, you will be clean in your house, but those public [toilets], you can find you are scratching yourself often...that water has splashed you. Often I have found myself going to the hospital. (Dor, 3C)

In particular, many women in SP1 reported a fear of contracting vaginal infections or candidiasis,

The biggest issue for women is like we can contract diseases easily when the toilets are dirty. Some even I have ever been affected with the, what’s it called, candidiasis...when I was pregnant so I went to the hospital I could feel some pain and they told me no this is candidiasis and you contract it from the toilet when they block--you are pressed, you want to go to the toilet, you don’t care--you just go direct there and, you know, when the toilet is just its floating and you are there the, what can I say, water when its splashes on you...so those germs make women sick. (Sha, Village 2).

Still other women in SP1 reported a fear of contracting feces-related illnesses such as diarrhea and or typhoid, e.g.,

I fear illnesses, typhoid first...typhoid is brought by these toilets because the toilet has already blocked. People open it but even those toilet doors are not clean. So it is a must you touch the dirtiness. You have come with that [dirtiness], you find food on the table, you feel hungry, you continue with the food. Now that is the reason we fear the toilet, it is with dirtiness. (Dor, 3C)

Women in SP1 also talked about the proximity and accessibility of the toilet as an important factor influencing their daily sanitation decisions. Seven of the women stated that their daytime toilet was close by. Seven of the women in SP1 reported using a plot toilet during the day and a bucket/bag at night. The women who had a plot toilet reported that the toilet was close by their house. Even two of the women reporting that they use a public toilet felt the toilet was “nearby” (Sha, 4B; Car, 4B). While many women cited proximity as a reason they were able to use a toilet during the day, many (5 out of 12) suggested that inaccessibility, e.g. blockages, was frequently a factor inhibiting them from using their toilet during the day. Many of the women reported blockages every other month or so. But the biggest issue is that several reported that the blockages could last several weeks (2-3, in general). During this time women reported using another toilet in the plot or building or a close by public toilet, if no other plot toilet was available.

Finally many women in SP1 also talked about the importance of privacy when using a toilet. Seven of the women in the SP1 sample talked about a lack of privacy or a need for privacy in their toilets. Some spoke more generally about a lack of privacy at their toilet, e.g. “you can’t feel comfortable when you are in the toilet, you think you can get seized by maybe a man or something...in the toilet you can see me,” (Cat, 3A). Other women gave specific examples of how their privacy is violated in the toilet, but how they use it during the day despite their discomfort,

Now, we are used to this because that toilet has holes. Now a person can peep at you. It's not a house [superstructure] of stone, this is a house [superstructure] of iron sheets. Now there are times you enter the toilet—there are holes and the door does not have a lock, you hold it with your hand. So, any time a person can hit it, stones can be thrown. Now, you see, you are not comfortable” (Dor, 3C).

Some women talked specifically about women's need for privacy, and, consequently, their need to find a toilet even for short calls. For example,

You know, [a man] will just hide himself like this and just do it, just go, but for a woman it is a scandal, a humiliation if you squat--even sometimes--if you are really pressed or you are down there and can't return to come to the toilet...if you just hide [yourself] some place and urinate there. (Cat, 3A)

### **Sanitation profile 2 – Lack of funds and accessibility.**

***Boosted Regression.*** The boosted regression results for SP2 are summarized in Figure 3.3. According to the findings, paying a fee to access a daytime toilet accounts for just over 34% of the total influence on the dependent variable (SP2). Privacy using her daytime toilet, cultural rules about the disposal of feces, social disorganization pertaining to serious/violent crimes, the number of other people sharing her toilet, her age, her level of embarrassment using her daytime and nighttime toilets, the size of her household, and the walk-time to her daytime toilet were also important factors associated with being in SP2 compared to other SPs. Additional factors are shown in Figure 3.3.

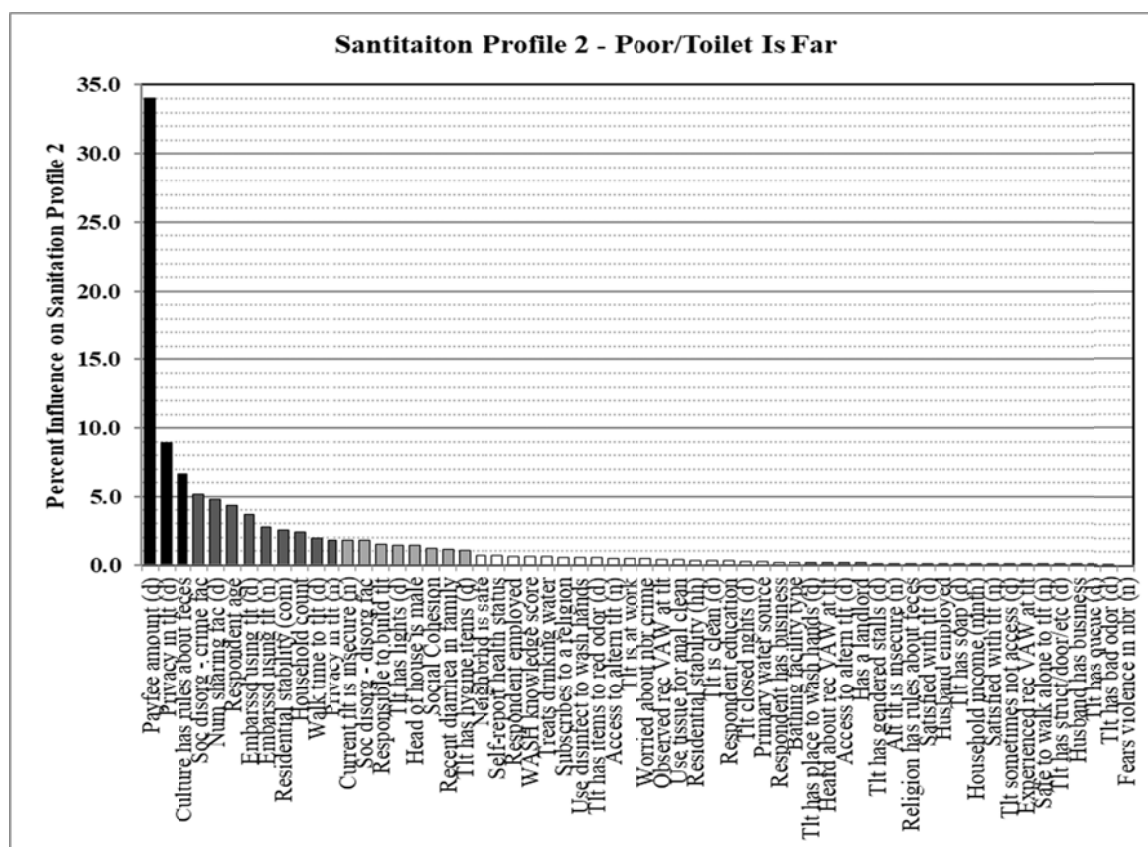


Figure 3.3. Influence of all variables on SP2

**Logistic Regression.** The results from the top 21 factors from the boosted regression were included in the logistic regression model looking at the factors that are associated with women being in SP2 compared to other SPs. Results from the logistic regression for SP2 are summarized in Table 3.3.

Table 3.3  
Factors associated with SP2

	Odds Ratio	P-value	CI [95%]
<b>Social Factors</b>			
Culture has rules about feces	0.12	0.002	0.031-0.472
Responsible to build toilet (ref: Other)			
landlord only	2.36	0.341	0.403-13.813
landlord and government	7.59	0.009	1.673-34.411
<b>Community Factors</b>			
Social cohesion	0.99	0.515	0.95-1.026
Social disorganization - crimes	0.24	0.029	0.069-0.865

Social disorganization - disorganization	2.88	0.093	0.837-9.947
<u>Household Factors</u>			
Household count	1.01	0.953	0.834-1.213
Recent diarrhea in family	2.41	0.339	0.398-14.586
<u>Individual Factors</u>			
Respondent age	0.98	0.115	0.949-1.006
Residential stability (com)			
less than 1yr	0.48	0.687	0.013-17.291
1-4 years	1.76	0.288	0.62-4.989
10+ years	1.56	0.301	0.67-3.652
Current toilet is insecure (n)	4.65	0.001	1.901-11.365
Neighborhood is safe	0.98	0.955	
Toilet has lights (d)	0.66	0.714	0.073-6.013
Privacy in toilet (d)	0.33	0.236	0.052-2.073
Privacy in toilet (n)	0.13	0.012	0.026-0.643
Embarrassed using toilet (d)	4.65	0.048	1.015-21.262
Embarrassed using toilet (n)	0.96	0.951	0.244-3.756
Pays a per visit fee to use toilet (d)	5.78	0.001	2.052-16.254
Walk time to toilet (d)			
3-4 min	3.71	0.021	1.215-11.312
5+ min	1.33	0.600	0.454-3.915
Number sharing facility(n)	1.01	0.000	1.004-1.009
<u>Habitual Factors</u>			
Toilet has hygiene items (d)	1.07	0.769	0.665-1.737

Descriptive statistics suggest that all but two percent of the women in SP2 pay a fee to access their daytime toilet. Of these women, 63% of the women in the SP2 sample pay per visit to use their daytime facility for long calls. The other 35% pay a monthly fee to use their daytime facility. According to findings from the logistic regression model for the profile,, women in SP2 have over 5 ¾ times the odds of paying a per-visit fee than a monthly or no fee. All significant factors associated with SP2 are shown in Figure 3.4.

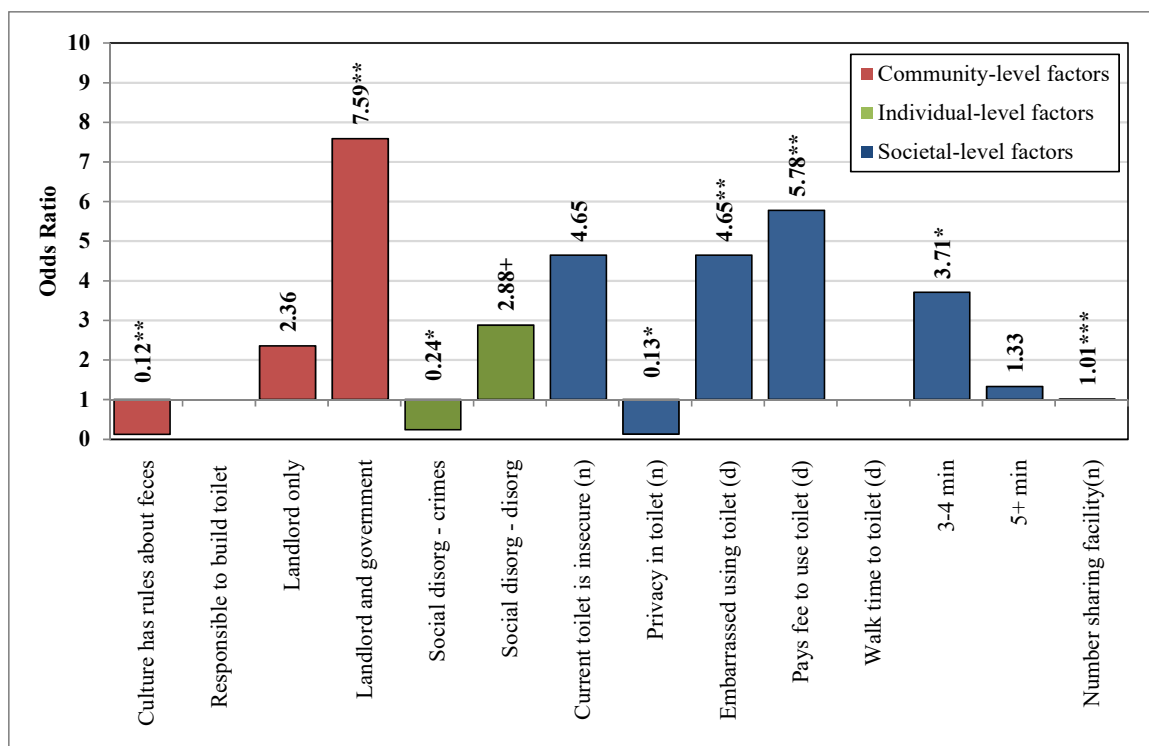


Figure 3.4. Significant factors for SP2

According to the descriptive statistics, over 98% (all but two) of the women in SP2 use a public toilet for long calls during the day. This may explain why almost all of the women in SP2 pay a fee to use their toilet. It may also be linked to women's perspective on who is responsible for building toilets in their community. Findings from the logistic regression suggest that women in SP2 have over seven and one-half times the odds of believing that it is the responsibility of the government and landlord, compared to themselves or other local charities/churches, to construct toilets in their neighborhood ( $p < 0.01$ ). Women in SP2 also have 88% lower odds ( $p < 0.01$ ) of reporting that their culture has rules about disposing of urine/feces than woman in other SPs.

A single point increase on the social disorganization-serious crimes scale is associated with 76% lower odds of a woman being in SP2 compared to other SPs. Women's average social disorganization-serious crimes score in SP2 is 2.32 (SD=0.483),

compared to, for example, 2.38 (SD=0.557) for women in SP1. On the individual-level, however, women in SP2 have over four and one-half times the odds ( $p<0.01$ ) of reporting that insecurity is the primary reason they use their current nighttime method of disposal (bags/buckets/OD).

According to descriptive statistics, 75% of women in SP2 report feeling embarrassed using their daytime short-call methods of disposal, e.g. bags, buckets or OD. These findings seem to be reflected in the logistic regression results where women in SP2 were associated with 4.7 times the odds of reporting feeling embarrassed when using their daytime toilets/methods of disposal than women in other SPs. All women who felt embarrassed when using their toilets/methods of disposal were asked why they felt embarrassed. About 84% of women who reported feeling embarrassed using their daytime, short-call method of disposal cited lack of privacy, fear of people hearing/seeing them, and/or shame as reasons for feeling embarrassed. Descriptive statistics also indicated that only four percent of women in SP2 reported feeling private when using their nighttime methods of disposal. Accordingly, results from the logistic regression showed that women in SP2 had 90% lower odds of reporting privacy when using their nighttime toilets than women in other SPs.

Finally, logistic regression findings for this profile also suggested a significant association between walk-time to reach a toilet and women's categorization into SP2 instead of other SPs. Descriptive statistics show that only four percent of women in SP2 do not have to leave their house or walk less than 1 minute to reach their toilet. An additional 46% walked between 1-2 minutes to reach a toilet. Results from the logistic



regression showed that women in SP2 had over 3.7 times the odds of walking 3-4 min to reach a toilet compared to 2 or fewer minutes.

**Qualitative Analysis.** Women in SP2 identified a number of reasons that influenced their daily sanitation choices. Similar to the findings in the qualitative analysis of SP1, almost all of the women in SP2 (25 out of 28) identified fear as a factor influencing their decision to use a bag/bucket at night. Also similar to the results in SP1, about 75% of the women in the SP2 sample reported a general fear of being attacked at night as a reason for not going outside to use a toilet. The majority of women (about 64%) reported a specific fear of being raped at night as a factor influencing their decision to use a bag/bucket in the house. Again, for many of the women, they just talked about a general fear of being raped, e.g. “[maybe] I have gone to the toilet, and I am scared because...like these days...there are many youth...they are drunk, and they can find me there inside...they can enter, they can rape me or they rape those older girls” (Flo, 3B). Some women also told more specific stories about recent attacks in their community, “there was another madam that was raped down there. She was going down there at night to go to the toilet. She said her stomach was disturbing her.” (Cec, Village 2). Regardless of whether a woman had a specific story or just a general fear, many women cited their fear of rape or other attacks, e.g. robbery, as factors for using a bag or bucket inside the house at night.

In addition to women’s fear of going outside at night, women also cited a lack of ability to access their toilets at night. About 61% of women in SP2 stated that their daily toilets were closed at night and an additional seven percent stated that their plots locked their gates at night—prohibiting them from going outside to reach a toilet. Additionally,

about 10 out of 28 women reported that their toilets were far from their homes. For example, “there are no toilets. There is one, but it is there in the church. There is only that one. There is no other toilet here. Now we are in a bad situation because they are all far away” (Est, Mabatini). According to some of these women, the toilets are often too far away even for short calls during the day, e.g., “there is a toilet far away...but like for a short call, you know, for that, you cannot go running there” (Jen, 4A).

Approximately 36% of the women in SP2 also stated that they used a toilet for long calls during the day because it was a “must.” For example, one woman stated, simply, “for long call you cannot go in the house” (Elz, Village 2) or, as another woman said, “for long call it is a must we go to the toilet outside” (Pau, 4B). About 86% of the women in SP2 use a public toilet for long calls during the day. About 86% of the women in SP2 also report using a bucket for short calls during the day, and the remaining 14% urinate in a shower that drains directly into an open drainage ditch. Sixty-four percent of the women in SP2 report using a bucket or the shower because they cannot afford to pay to use a public toilet for both long and short calls during the day. For example, “for long calls I go to the toilet, but for short calls, often, you will not remove that five shillings for short calls, you use a basket [bucket]. For long calls it is a must you remove that five shillings.” (Elz, Village 2)

Similar to women in SP1, women in the qualitative sample of SP2 cited cleanliness/dirtiness of their toilet as a factor influencing their sanitation decisions. Half of the women in SP2 cited dirtiness of the toilet as a factor and half also reported a fear of infections when using their daytime toilets. In fact, many women suggested that their fear

of infections prevents them from choosing to use the toilet for short calls even during the day. For example,

Like you can go, you urinate in the toilet...you start to scratch down there a lot. If you have already urinated, that place is dirty, that toilet, it might splash on you and you start to scratch yourself...you are always getting these things, every time it is this problem...even it is not one time or two...if you go to the doctor to explain you were so careful. (Elz, Village 2)

Finally, 9 out of 28 women (32%) in the SP2 profile talked about lack of privacy or the need for privacy as important factors influencing their sanitation choices. Some of the women talked specifically about the lack of privacy at their long-call toilets as reason for using buckets or open defecation for their short-call needs during the day, saying, “those toilets have been made with iron sheets, so, even you can peep, you will see me if I am there inside. People pass you see. There are some that peep...children if they are playing there...they always know to peep at the mamas” (Chr, 3C). Other women, however, talk about the fear of being seen or the lack of privacy when having to use bags or buckets inside the house or open defecation right outside the house,

Now like that method of long-call...you know, you can't hold it, it is a must you look for a paper bag, you go outside the door with it and, you know, you are fearing eyes there and you don't know...even though, at that time, outside it is silent and all the people are there inside, but you don't know what thing will happen. (Car, 4A)

### **Sanitation profile 3 – Toilet is accessible at all times.**

**Boosted Regression.** Results from the boosted regression models for SP3 are summarized in Figure 3.5. Findings suggest that the number of people sharing the respondent's toilet accounts for over 45% of the influence for SP3. Factors such as having privacy while using a toilet at night, accessibility of the toilet at night, and toilet having hygiene items also account for a large portion of the influence.

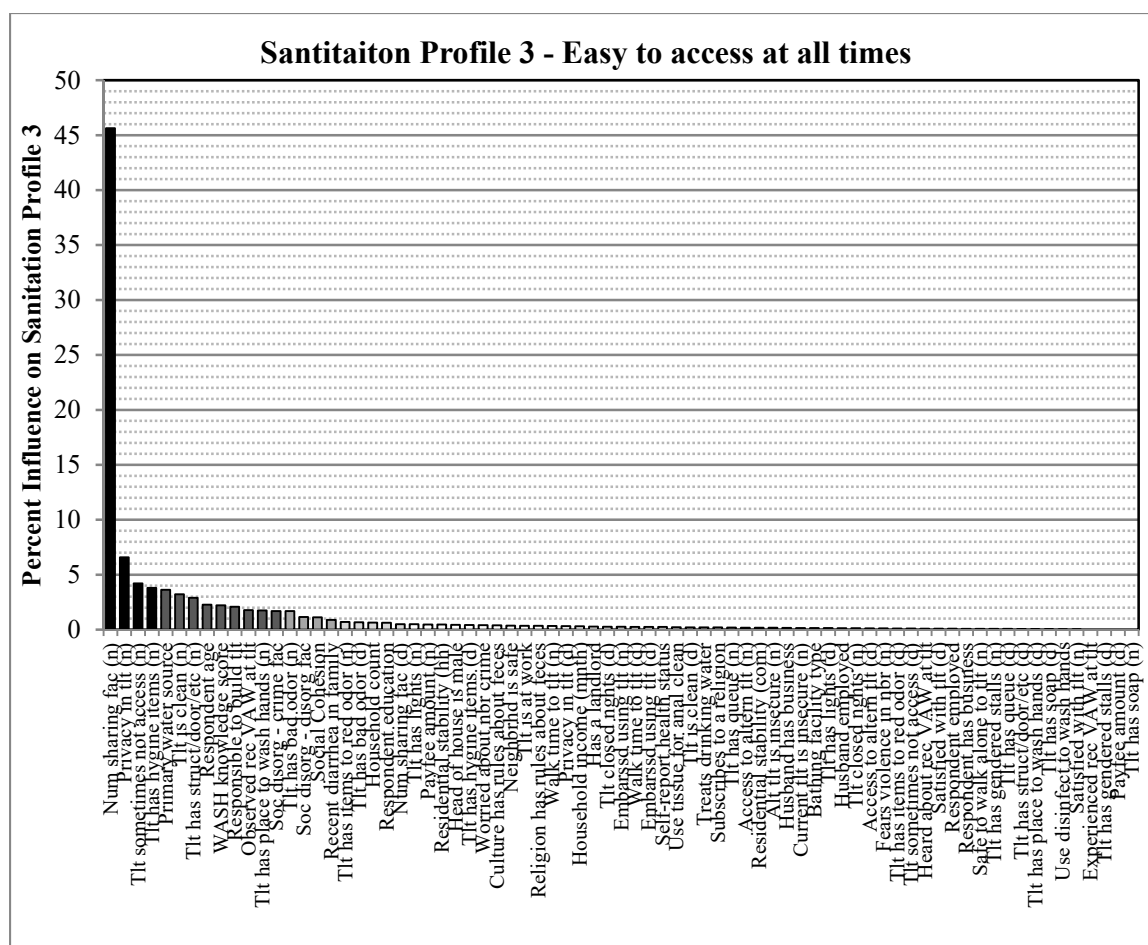


Figure 3.5. Influence of all variables on SP3

**Logistic Regression.** Findings from the logistic regressions of the top factors associated with SP3 are summarized in Table 3.4. Descriptive statistics for this study (shown in Table 3.1) suggest that 50% of the women in SP3 use a plot toilet, 27% use a private-shared toilet with more than 10 people, 13% use a private toilet, and 13% use a public toilet.

Table 3.4  
Factors associated with SP3

	Odds Ratio	P-value	CI [95%]
<b>Social Factors</b>			
Responsible to build toilet ( <i>ref: Other</i> )			
Landlord only	2.08	0.402	0.374-11.6
Landlord and government	0.32	0.164	0.065-1.591

<u>Community Factors</u>			
Social cohesion	1.00	0.821	0.974-1.021
Social disorganization - crime	2.04	0.113	0.844-4.924
Social disorganization - disorganization	0.22	0.040	0.052-0.93
<u>Household Factors</u>			
Household count	1.22	0.002	1.074-1.389
Recent diarrhea in family	1.35	0.176	0.874-2.092
<u>Individual Factors</u>			
Respondent age	0.95	0.002	0.921-0.982
Respondent education			
completed primary	0.75	0.581	0.276-2.056
some secondary	1.02	0.971	0.427-2.418
completed secondary	0.87	0.753	0.371-2.049
Observed recent VAW at toilet	0.90	0.882	0.239-3.42
Toilet has lights (n)	2.73	0.083	0.878-8.512
Satisfied with toilet (d)	2.61	0.048	1.011-6.734
Privacy in toilet (n)	32.37	0.000	7.041-148.866
Toilet has structure/door/etc. (n)	0.52	0.103	0.239-1.141
Toilet has bad odor (all)	0.48	0.360	0.102-2.291
Toilet has items to red odor (n)	1.49	0.538	0.415-5.379
Toilet sometimes not access (n)	22.38	0.000	4.955-101.105
Pay fee amount (d)			
pays per visit	0.25	0.032	0.07-0.889
pays per month	0.30	0.008	0.127-0.728
Number sharing facility(d)	1.00	0.285	0.999-1.004
Number sharing facility(n)	1.00	0.163	0.998-1.009
<u>Habitual Factors</u>			
Primary water source			
Tap inside building	0.89	0.818	0.344-2.323
outside tap	1.39	0.574	0.44-4.396
tanker/vendor	0.17	0.000	0.071-0.405
WASH knowledge score	1.12	0.081	0.986-1.278
Toilet is clean (n)	3.34	0.072	0.899-12.416
Toilet has hygiene items (n)	1.53	0.000	1.21-1.93
Toilet has place to wash hands (n)	0.91	0.870	0.278-2.947

While descriptive statistics show that the number of people using a single plot toilet can be over 100, there are generally much fewer people sharing a plot, private-

shared, or private toilet than the number of people who use a public toilet. According to the descriptive statistics, about 15-18% of women in SP3 share their toilet (night/day) with less than 10 other people. An additional 37-45% of women in SP3 share their toilet with between 10-24 people. Yet, oddly, the number of people sharing a facility showed no significant association with being in SP3 compared to being in other SPs in the logistic regressions. Significant factors associated with SP3 are illustrated in Figure 3.6.

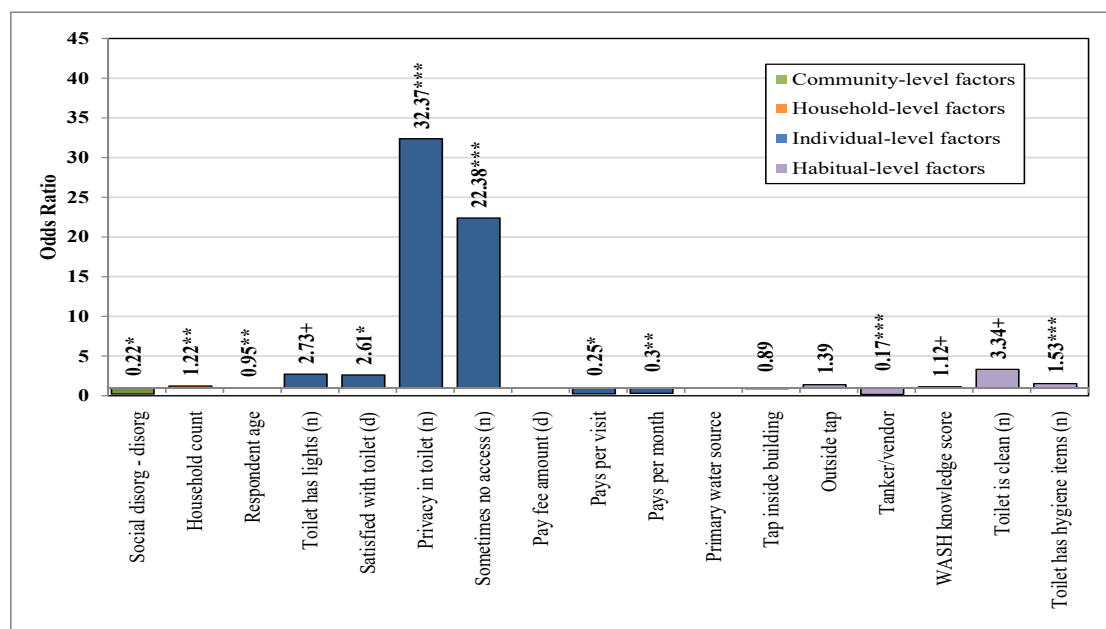


Figure 3.6. Significant factors for SP3

On a community-level, results from the logistic regression show women in SP3 had lower odds of reporting high levels of general social disorganization (e.g. drugs, public drunkenness, litter, loitering, stray dogs) than women in other SPs. Findings also show that women in SP3 have over 32 times the odds of reporting feelings of privacy when using a toilet at night than women in other SPs, and women in SP3 had over 2.5 times the odds of reporting being satisfied with their toilet than women in other SPs.

According to descriptive statistics, 89-95% (daytime and nighttime, respectively) of women in SP3 do not pay a fee to use their toilet. Results from the logistic regression

also show that women in SP3 have 75% lower odds of paying a per-use fee than paying no fee ( $p<0.05$ ) and 70% lower odds of paying a monthly fee than no fee ( $p<0.01$ ).

Women in SP3 had higher odds of having more hygiene attributes available in their toilets, i.e. for every additional hygiene attribute a woman had 1.5 times the odds of being in SP3 than in other SPs. Women in SP3, however, had about 10 times the odds of reporting that their toilets were sometimes not accessible due to temporary blockages, floods, filling, etc. than women in other SPs. Given that the majority of women in SP3 had access to plot toilets, private-shared, or private toilets, it is, perhaps, not surprising that these toilets experienced more temporary closures due to blockages, flooding, etc.

The number of members in a household, the respondent's age, and the respondent's primary drinking water source were also significantly associated with women's odds of being in SP3 compared to other SPs. First, for every additional member in the household, women had 10% greater odds of being in SP3 than other SPs. Additionally, findings suggest that younger women have lower odds of having access to a toilet for all calls and at all times of the day and night than older women, i.e. for every additional year a woman has five percent lower odds of being in SP3 compared to other SPs ( $p<0.01$ ). Finally, a woman in SP3 has significantly lower odds (83% lower,  $p<0.001$ ) of having to pay to collect her water from a tanker or vendor than being able to collect her water from inside her building or plot.

**Qualitative Analysis.** There were 8 women in the qualitative sample who fit well into SP3. Of these women, two had access to a private toilet, five had access to a toilet within their building or plot, and one had access to a public toilet. Almost all of the women (7 out of 8) in SP3 talked about the proximity of their toilet as a primary factor

for choosing to use a toilet for all calls during the day and night. For example, one woman states simply, “I am very happy the toilet is near and like, even at night, I will wake and I go to the toilet without worry” (Pur, 3A). For some women, they were even willing to pay higher rent to have access to a private toilet. For example,

I pay higher than the other houses due to the toilet... and the privacy in it...I use my own sanitation place...and I’m happy about it even if I’m paying higher, but I feel it is comfortable because it is serving the entire family (Cla, Mashimoni).

Some women also said their toilets were clean. For those who had access to their own toilets, they were able to clean the toilets regularly and maintain cleanliness, e.g. “when I am back, I need to...do thorough cleaning...after doing that thorough cleaning I will make sure that things are in order...I need to know the condition of that toilet at that moment...if it is not good I was to pick water I have it there, drain it immediately” (Cla, Mashimoni). Other women who use a plot toilet or private-shared toilet also reported that their toilet was clean, e.g. “the thing that make me happy about this toilet is that it is clean...and it is a safe place” (Mar, Number10). However, even these women reported that dirtiness of their toilet could deter them from using it, for example, “now, if it is dirty...I cannot go...you know, the toilet has illnesses...that grab [affect] women...for women, this basin for what, it comes from inside the toilet, like if the toilet is dirty, you will itch there, if you start scratching yourself” (Mar, Number 10). Some of the women in SP2 still worry about getting sick if their toilets are dirty, e.g. “I came to realize that toilet can bring problems like diarrhea from time to time. We have seen it. At least it is better to keep in mind the cleanliness of that toilet” (Dor, Kosovo). Another woman reported, “sometimes you fear cholera and diarrhea...see, there was a time when there was a cholera outbreak” (Pur, 3A).



Apart from women's fear of contracting illnesses or infection, not many of the women in SP3 talked about fear of being attacked as a prominent factor in their decision to use a toilet during the day or night. There was one woman, however, who explained why a woman might choose to use a bucket/bag at night, "for example, the toilet is far, see, I told you there is one down there, another is over there, now, you can fear a lot to go there at night, security is not good, you see, now, there are times, I have told you, it is better you go in a bucket or a paper bag than you go outside, you will be risking your life" (Pur, 3A). Another woman expressed a fear of her home being robbed, e.g. "often, if you go outside at nighttime, we say the truth...you see here behind me...there was a path that passes, you see...a person goes outside, she goes to urinate and a robber enters and takes something, he leaves with it, in just that minute" (Mar, Number 10). While fear may not always be a factor for many women in SP3, they recognized it is a serious factor for other women who do not have access to a toilet nearby.

#### **Sanitation profile 4 – Only in an emergency.**

**Boosted Regression.** Results from the boosted regression models for SP4 are summarized in Figure 3.7. According to the results, the toilet having a bad odor at night was the largest contributing factor to a woman's categorization into SP4. Privacy in the toilet at night; the respondents' age; the cleanliness of the toilet; whether or not a person had to pay to use the toilet; social cohesion, social disorganization related to serious crimes in the neighborhood; the number of people sharing the nighttime facility, and whether the toilet had a superstructure, door, etc. were all factors highly associated with being categorized into SP4.

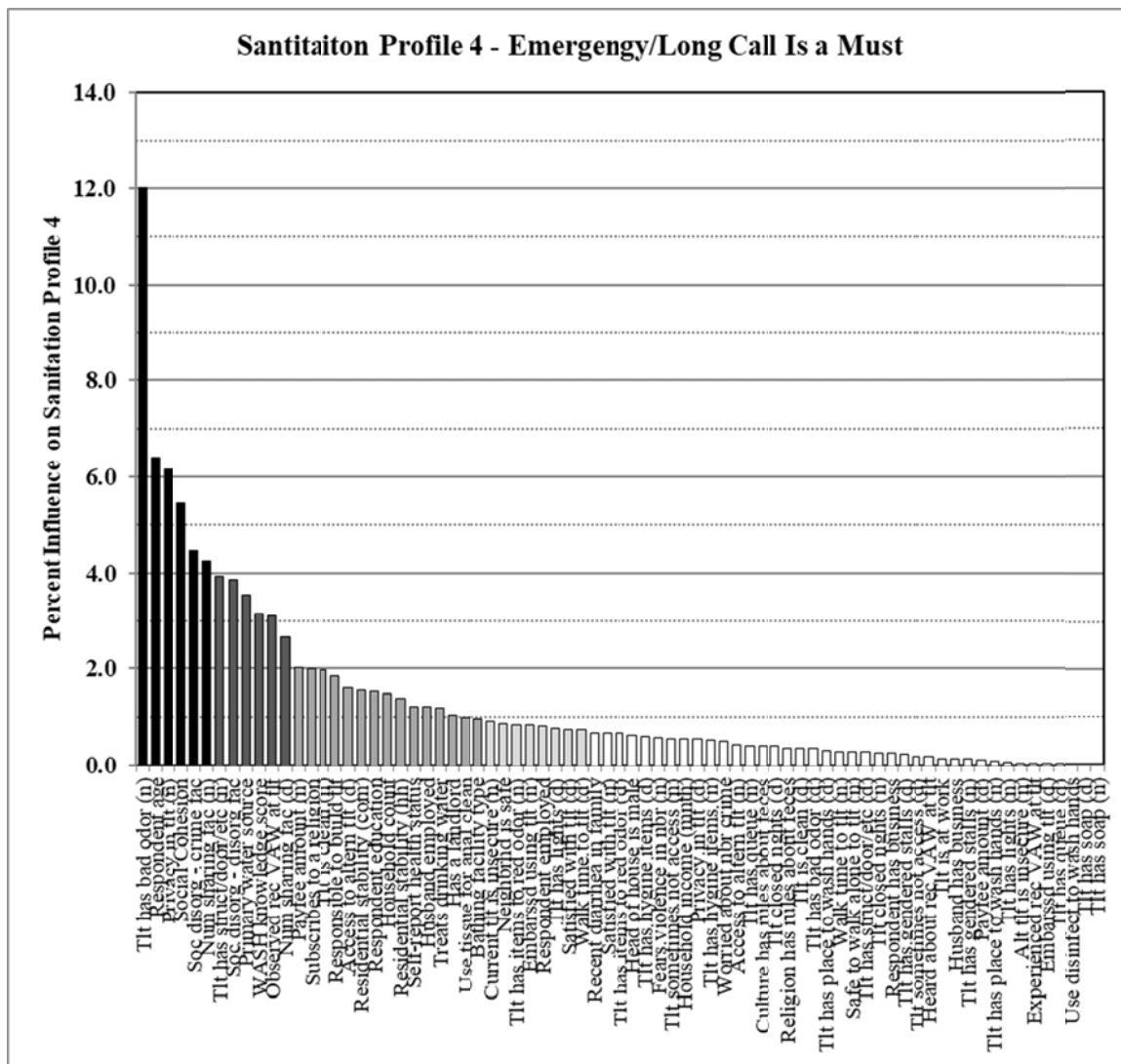


Figure 3.7. Influence of all variables on SP4

***Logistic Regression.*** Findings from the logistic regression of SP4 on a number of society- community-, household-, individual-, and habitual-level factors are summarized in Table 3.5. According to descriptive statistics (see Table 3.1), just under five percent of women in SP4 do not share their daytime toilets, 13% share their daytime toilets with under 10 people, and 37% share their toilets with fewer than 25 people. Descriptive statistics also show that just under 14% of women report not sharing their nighttime,

long-call toilet; 11% report sharing their nighttime, long-call toilet with under 10 people; and 32% of women report sharing their nighttime, long-call toilet with under 25 people.

Table 3.5  
*Factors associated with SP4*

	Odds Ratio	P-value	CI [95%]
<u>Social Factors</u>			
Has a landlord	0.50	0.184	0.182-1.387
Responsible to build toilet ( <i>ref: Other</i> )			
Landlord only	0.49	0.185	0.171-1.406
landlord and government	1.05	0.934	0.349-3.142
<u>Community Factors</u>			
Social cohesion	1.00	0.887	0.972-1.033
Social disorganization - crime	0.62	0.238	0.279-1.374
Social disorganization - disorganization	1.66	0.339	0.589-4.652
Access to alternative toilet (d)	1.04	0.897	0.605-1.773
<u>Household Factors</u>			
Household count	0.89	0.268	0.717-1.097
Husband employed	0.81	0.423	0.489-1.35
<u>Individual Factors</u>			
Respondent age	1.03	0.200	0.985-1.075
Subscribes to a religion	0.59	0.175	0.271-1.268
Respondent education			
completed primary	0.64	0.380	0.24-1.724
some secondary	0.47	0.381	0.086-2.552
completed secondary	0.69	0.463	0.262-1.837
Respondent employed	0.69	0.310	0.341-1.407
Residential stability (hh)			
5-9 years	0.85	0.633	0.432-1.666
10+ years	0.87	0.777	0.347-2.206
Residential stability (com)			
5-9 years	0.92	0.819	0.453-1.872
10+ years	1.43	0.651	0.302-6.786
Self-report health status			
fair	2.78	0.012	1.258-6.148
good	2.41	0.022	1.135-5.102
Observed recent VAW at toilet	2.96	0.002	1.508-5.823
Current toilet is insecure (n)	1.18	0.659	0.569-2.438
Neighborhood is safe	1.38	0.252	0.794-2.407
Toilet has lights (d)	0.26	0.013	0.091-0.751

Privacy in toilet (n)	0.18	0.006	0.056-0.612
Embarrassed using toilet (n)	0.51	0.404	0.102-2.507
Toilet has structure/door/etc. (n)	4.87	0.194	0.447-53.054
Toilet has bad odor (n)	3.23	0.134	0.697-14.99
Toilet has items to red odor (n)	1.40	0.651	0.33-5.905
Pay fee amount (d)			
no fee	0.62	0.478	0.161-2.354
pays per month	1.10	0.854	0.387-3.143
Number sharing facility(d)	0.99	0.012	0.985-0.998
Number sharing facility(n)	1.02	0.001	1.008-1.031
<u>Habitual Factors</u>			
Primary water source			
Tap inside building	2.21	0.003	1.3-3.769
Outside tap	3.32	0.007	1.389-7.956
Tanker/vendor	5.45	0.000	2.245-13.25
Bathing facility type	0.92	0.878	0.327-2.602
Use other than tissue for anal clean	1.41	0.372	0.661-3.028
Treats drinking water	1.05	0.953	0.239-4.578
WASH knowledge score	1.00	0.963	0.894-1.124
Toilet is clean (all)	3.13	0.076	0.887-11.042

Results from the logistic regression suggested that women in SP4 have slightly higher odds of reporting more people using their toilet at night than women in other SPs, i.e. for every additional person using the toilet a night, a woman has two percent greater odds ( $p < 0.01$ ) of being in SP4 than in other SPs. On the other hand, women in SP3 had slightly lower odds of reporting more people using their toilet during the day than women in other SPs. All significant factors associated with SP4 are shown in Figure 3.8.

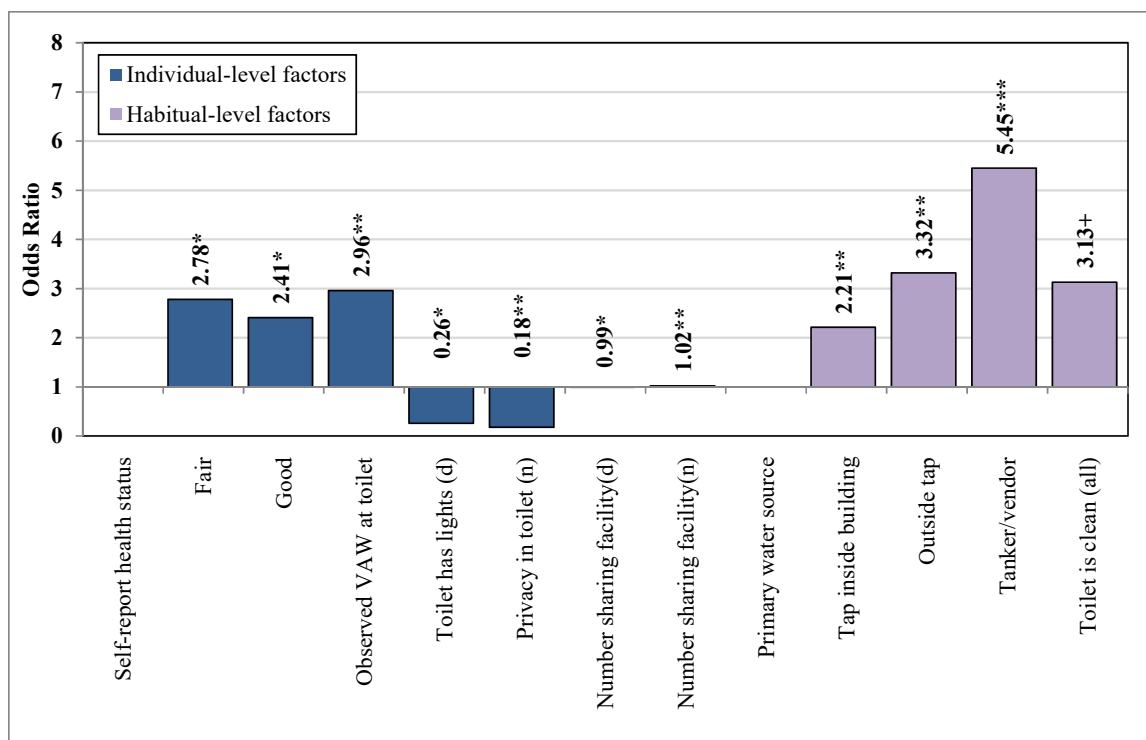


Figure 3.8. Significant factors associated with SP4

Women in SP4 had 74% lower odds of having lights in their toilets ( $p < 0.05$ ) and 82% lower odds of reporting privacy in their toilets at night ( $p < 0.01$ ) than women in other SPs. Women in SP4 also had almost five times the odds of having observed some form of recent (past 12 months) physical, sexual, or verbal violence against women at a toilet in their community than women in other SPs, although it was not specified if the violence occurred at their toilet or at another toilet elsewhere in Mathare.

Results also suggested that women in SP4 had higher odds of reporting fair ( $OR = 2.8$ ,  $p < 0.05$ ) or good ( $OR = 2.4$ ,  $p < 0.05$ ) rather than bad health. Finally, women in SP4 also had significantly higher odds of collecting water from inside their building or plot ( $OR = 2.2$ ,  $p < 0.01$ ), an outside tap ( $OR = 3.3$ ,  $p < 0.01$ ) or a tanker/vendor ( $OR = 5.5$ ,  $p < 0.001$ ) than collecting water from a public tap/well. **Qualitative Analysis.** There were ten women who could be categorized in SP4. However, only five of these women

did not overlap with another category. Women in this category had access to, and most often used, a toilet during the day for long calls and, most often, for short calls as well. At night, however, they avoided going to the toilet unless it was an emergency. For the most part, women in this category would go to a toilet at night for long calls, but only under extreme circumstances (e.g. diarrhea—“a running stomach”). Despite some variation in women’s sanitation utilization choices, women in SP4 often used open defecation or a bucket for short calls during the night. Over half of the women in SP4 talked about training yourself not to go to the toilet at night, e.g. “it is a must you constrict even if the toilet is here, there is no security” (Hel, Mabatini).

All of the women in SP4 cited fear as a factor they chose not to go outside their houses at night to urinate. All of the women expressed general fears about being attacked, e.g. “sometimes you feel something, you go to the toilet, you find a man there, he can do something bad to you” (Hel, Mabatini). Two-thirds of the women also talked about their fears of being raped, robbed, or even killed if they were to go to the toilet at night. For example,

Sometimes you can go to the toilet, you return, you get a person, he surprises you in the house, you can meet with bad people like you, you are a woman, you can be raped, you can be forced, you come to the house, they take anything they want, and sometimes they can even kill you. (Ros, 4A)

Two of the women in SP4 also expressed a different kind of fear—a fear of getting infections, e.g. “we say...you come out, you have not flushed. Me, I enter, I don’t know you were there, you know...maybe you are a sick person and that sickness maybe it can affect me” (Hel, Number 10).

Despite their fears, however, most of these women felt that they would use a toilet if it was an emergency for long calls, e.g. “it is a must you climb down [to go to the

toilet]...when it is an emergency” (Her, Number 10). But most of them said they would only go if they had a stomach issue, e.g. “for stomach problems, it is a must I just go to the toilet” (Ros, 4A). For some of the women (three out of nine), accessing a toilet at night was not possible because their daytime toilets were not open at night or their plot gate was locked—prohibiting them from leaving to access a toilet.

Since several of the women in SP4 primarily used plot or private-shared toilets, they also reported that toilet blockages were a factor that affected their daily sanitation practices. For example, one woman suggested that, “if it blocks, it usually takes a period to open it. We suffer...so me, I usually use a bucket” (Hel, Number 10). Other women reported using an alternative toilet, e.g. “when it blocks, you go to another, but it is far, down there at the end” (Ros, 4A). Whether they chose to use a different toilet in the area, the building or plot, or revert to bags/buckets, blockages affected these women’s daily sanitation practices.

#### **Sanitation profile 5 – No money or no access.**

***Boosted Regression.*** Results from the boosted regression models for SP5 are summarized in Figure 3.9. Findings suggest that a woman’s water, sanitation, and hygiene knowledge (WASH knowledge) was the most influential factor in SP5, followed by a woman’s sense of privacy when using her chosen method of disposal, particularly during the day. Some community-level factors such as social cohesion and social disorganization and some other individual-level, psychosocial factors, e.g. feelings of embarrassment and satisfaction associated with the method of disposal, were also influential.

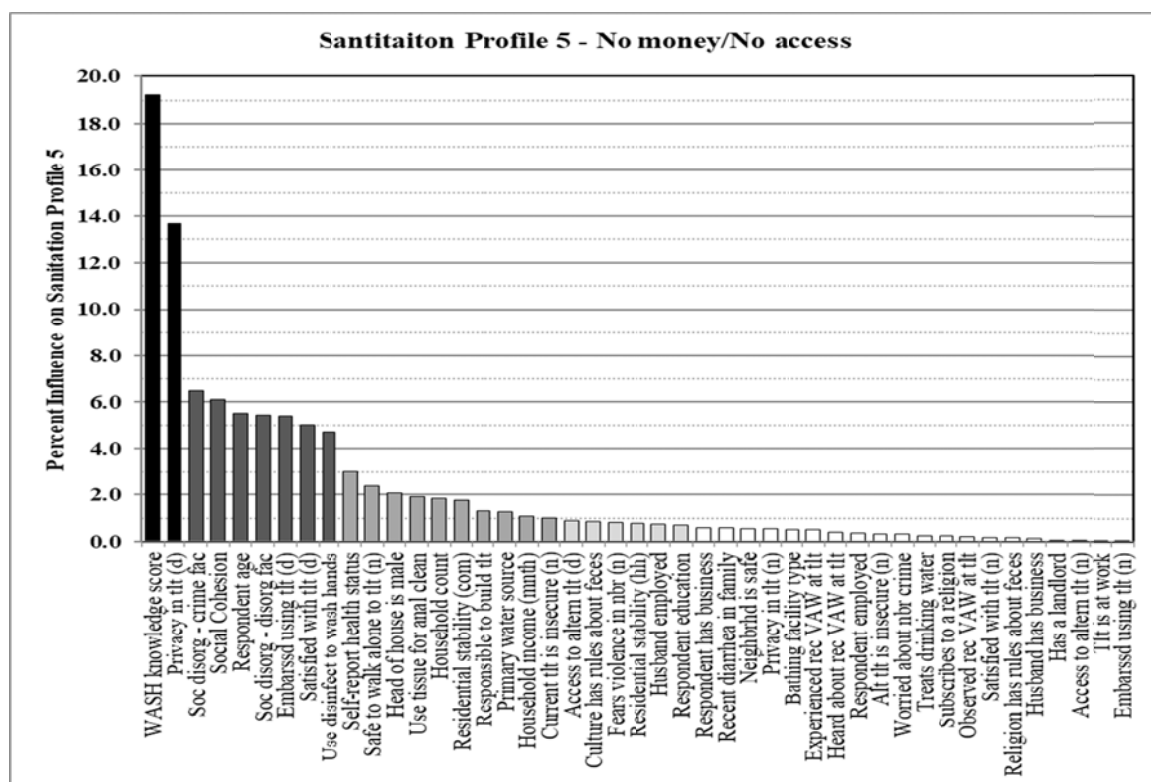


Figure 3.9. Influence of all variables on SP5

**Logistic Regression.** Findings from the logistic regression of SP5 on a number of factors are summarized in Table 3.6. Descriptive statistics (see Table 3.1) suggest that around 80% of the women in SP5 use bags or buckets to dispose of their urine and feces during the day and night and an additional 20% defecate/urinate in the open during the day and night. Perhaps that is why women in SP5 have 93% lower odds of feeling privacy when using their toilet in the daytime than women in other SPs.



Table 3.6  
*Factors associated with SP5*

	Odds Ratio	P-value	CI [95%]
<u>Social Factors</u>			
Culture has rules about feces	2.40	0.373	0.35-16.466
Responsible to build toilet			
landlord and government	0.63	0.419	0.202-1.945
Other	0.04	0.090	0.001-1.669
<u>Community Factors</u>			
Social cohesion	1.01	0.223	0.992-1.036
Social disorganization - crime	5.78	0.029	1.196-27.914
Social disorganization - disorganization	0.09	0.040	0.01-0.892
Access to alternative toilet (d)	2.58	0.037	1.057-6.284
<u>Household Factors</u>			
Household count	0.83	0.340	0.571-1.213
Head of house is male	0.31	0.002	0.146-0.649
Household income (month)			
less than 5k	2.86	0.012	1.261-6.495
more than 10k	3.20	0.150	0.656-15.631
<u>Individual Factors</u>			
Respondent age	1.03	0.305	0.975-1.083
Residential stability (com)			
1-4 years	0.53	0.202	0.195-1.412
5-9 years	0.40	0.137	0.12-1.336
10-19 years	0.12	0.000	0.056-0.248
20+ years	0.15	0.001	0.049-0.471
Self-report health status			
fair health	0.65	0.347	0.265-1.594
good health	0.25	0.027	0.072-0.853
Safe to walk alone to toilet (n)	1.13	0.917	0.109-11.782
Current toilet is insecure (n)	0.17	0.001	0.061-0.482
Fears violence in neighborhood (n)	0.40	0.268	0.076-2.044
Satisfied with toilet (d)	7.33	0.012	1.551-34.613
Privacy in toilet (d)	0.07	0.000	0.037-0.132
Embarrassed using toilet (d)	1.89	0.315	0.547-6.498
<u>Habitual Factors</u>			
Primary water source			
outside tap	0.43	0.619	0.015-12.078
public tap/well	19.59	0.000	6.03-63.64
tanker/vendor	4.39	0.077	0.85-22.681
Use disinfect to wash hands	0.04	0.000	0.013-0.12

Use other than tissue for anal clean	1.89	0.212	0.696-5.108
WASH knowledge score	0.81	0.002	0.71-0.925

In accordance with the results from the boosted regression, a woman's WASH knowledge and her sense of privacy using her toilet were both significant factors in the logistic regression. For every one-point increase in a woman's WASH knowledge score, she had 19% lower odds of being in SP5 ( $p < 0.01$ ). Also in accordance with the results from the boosted regression, a woman's WASH knowledge and her sense of privacy using her toilet were both significant factors in the logistic regression. For every one-point increase in a woman's WASH knowledge score, she had 19% lower odds of being in SP5 ( $p < 0.01$ ). See Figure 3.10 for all significant factors associated with SP5.

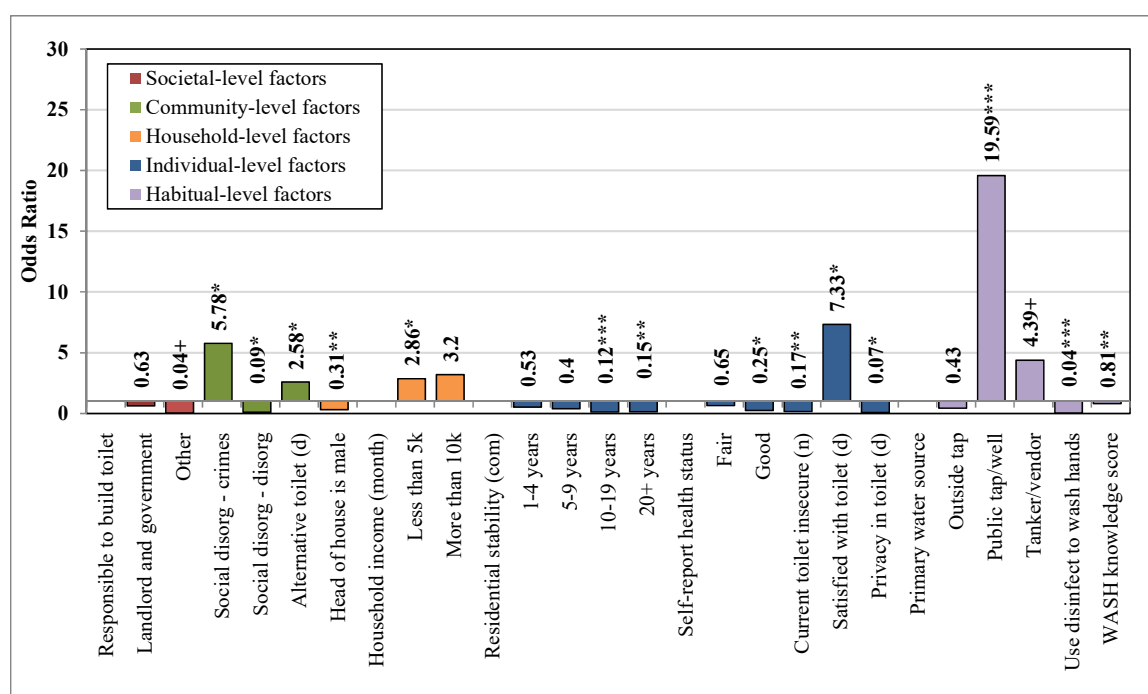


Figure 3.10. Significant factors associated with SP5

On a community-level, women in SP5 had higher odds of reporting higher levels of social disorganization related to serious crimes, but lower levels of general social

disorganization than women in other SPs. For example, for every point increase on the serious crimes-social disorganization scale, women had 5.8 times the odds of being in SP5 compared to other SPs. On the other hand, for every additional point on the general disorganization factor scale, women had 91% lower odds of being in SP5 than in other SPs. Additionally, descriptive statistics suggest that just over 41% of women in SP5 had access to an alternative toilet during the day. Of the women in SP5, 25% report they were unable to use an alternative toilet during the day because of lack of funds to pay. An additional six percent of the women in SP5 reported that they were unable to access an alternative toilet during the day because the toilets are far away. According to the findings from the logistic regression, women in SP5 had 2.6 times the odds of having access to an alternative toilet during the day than women in other SPs; yet, they choose not to utilize those toilets.

On the household-level, women in SP5 had 69% lower odds of living in a male-headed household, e.g. the majority of women in SP5 (60.8%) live in female-headed households. Perhaps, unsurprisingly, women in SP5 also had significantly higher odds of being in a lower income level than women in other SPs. According to descriptive statistics, 61% of women in SP5 had a monthly income between 5000 and 10,000 Ksh. An additional 24% had a monthly income below 5000 Ksh. Logistic regression results suggest that women in SP5 had just under three times the odds of having a monthly income of less than 5000 Ksh than a monthly income between 5000-10,000 Ksh.

Also, perhaps unsurprisingly, women in SP5 had 75% lower odds of reporting good health compared to poor health ( $p < 0.05$ ). Additionally, women in SP5 were less likely to have lived in their respective communities for a long time, i.e. compared to

women who have lived in their community for less than a year, women in SP5 had 88% lower odds of having lived in their community for 10-19 years ( $p<0.001$ ) and 85% lower odds of having lived in their community for more than 20years ( $p<0.01$ ).

***Qualitative Analysis.*** There were only two women who fit into SP5 in the qualitative sample. Although there were many women who were forced to revert to bag, buckets, and/or open defecation at different times and for different reasons, only two of the women stated that they used bags, buckets, and/or open defecation for all calls during the day and night on a regular basis. Both women suggested that this is because they could not afford to go to a public toilet. For example, “for me, if I miss [to get money], it is a must I put a paper bag there...often...it depends...if I am just missing [money] I cannot go to help myself...it is a must I just do this” (Ros, Gitathuru). The other woman reported, “I want to go [to the toilet]...you see, I don’t have money, see, I will just hold tight, I just come for that bucket...often you even fear to pour it, like people will see you, it’s a problem, often you just put it in the house, when it turns to night, you pour it outside” (Jan, Kosovo). The latter woman also stated that she is sometimes harassed at the toilets for not being able to pay, “like if you don’t have money, you beg...if they refuse, you just suffer” (Jan, Kosovo).

In addition to having no money to go to the toilet, both women expressed fears about being attacked and, more specifically, being raped if they were to go to the toilet at night. For example, “even you, a woman, you will get a man there and you don’t know his intentions...something like raping...if he takes you today, tomorrow he’ll take your child...maybe he is sick...it’s something like that I fear a lot” (Ros, Gitathuru). In

addition, one of the women also expressed a very different fear—a fear of being harassed at a toilet because of her tribe,

Most of the time you use a bucket, we are using buckets most of the time, often if you go there...we fear to go there. I told you, these days, I can't even take you there. Like it is a Kikuyu toilet...you know, they just despise us...they can ask you which government [tribe] you are with...they will fight us. (Jan, Kosovo)

## **Discussion**

The purpose of this analysis was to determine common factors associated with women's daily sanitation practices in Mathare Valley Informal Settlement in Nairobi, Kenya. Although there have been numerous studies citing factors that influence women's sanitation behaviors in a variety of settings (Jewitt, 2011; D. Joshi et al., 2011; Khanna & Das, 2016; McFarlane et al., 2014; K. O'Reilly, 2010; O'Reilly, 2012; O'Reilly & Louis, 2014; Sahoo et al., 2015), there have been limited attempts to empirically investigate the multilevel factors influencing woman's sanitation behaviors, particularly in informal settlements in East Africa. This is the first study of its kind, and, was, consequently exploratory in nature. It combined a variety of methodologies, including quantitative boosted and logistic regressions and qualitative thematic, cross-case analysis and different types of data, including qualitative and quantitative, to explore the factors associated with generalized profiles of women's daily sanitation practices.

Literature focused on economic demand for sanitation, utilization of sanitation (e.g. current practices), and acceptability of new sanitation (e.g. toilet interventions) have identified a number of factors that may influence people's perceptions, choices, and behaviors with regard to sanitation including health factors (Fewtrell et al., 2005; Freeman et al., 2015; Greene et al., 2012; Lagerkvist et al., 2014; C. O'reilly et al., 2008; Regassa, Rajan, & Ketsela, 2011; Sibiya & Gumbo, 2013; UN-HABITAT, 2010); social,

cultural, and gendered factors (Jewitt, 2011; McFarlane et al., 2014; K. O'Reilly, 2010; Sommer et al., 2014; Sommer et al., 2013), psychosocial stressors (Khanna & Das, 2016; Sahoo et al., 2015), and geographic or contextual factors (Jewitt, 2011; A. Joshi, Prasad, Kasav, Segan, & Singh, 2013a; McFarlane et al., 2014; O'Reilly, 2012; Pullan et al., 2014). This study attempted to determine which of these factors, in addition to some factors that have not yet been identified in literature, were associated with women's sanitation utilization choices in informal settlements in Nairobi, Kenya.

Factors were separated, theoretically, into ecological levels, i.e. societal/macro-, community/neighborhood-, household-, individual-, and habitual-level factors according to the IBM-WASH framework developed by Dreibelbis, Winch, et al. (2013). Although all of these factors were self-reported by individual women, many of them are likely to reflect elements of the broader social, community, political, and economic environment surrounding sanitation in informal settlements.

At the **social or cultural level**, results from this study showed that cultural rules about the disposal of urine and feces, as well as women's expectations of who is responsible for building toilets in their communities, are important factors in women's sanitation utilization decisions. Results from the boosted and logistic regressions indicated that women in SP2 (lack of funds and accessibility), in particular, were less likely to have reported cultural rules about the disposal of urine/feces compared to women in other SPs. It is impossible to make claims about the causes of this association, but it could have something to do with the fact that women in SP2 are willing to forego using a toilet for short calls during the day because they cannot, for example, prioritize cultural rules about sanitation if adhering to them is economically or physically

infeasible. Women in this category also had higher odds of believing that the construction of toilets is the responsibility of the government. This finding may be connected to the fact that almost all of the women in this category reported using public toilets—most of which are built by the local government. These findings are not only consistent with previous findings that women’s sanitation behavior is influenced by greater cultural and social norms (Jewitt, 2011; McFarlane et al., 2014; K. O'Reilly, 2010, 2016; Okurut et al., 2014), but that they have implications for potential sanitation-related interventions. For example, if we consider women’s macro-level perspectives about who is responsible for building sanitation, it hardly seems plausible to assume household-level sanitation demand interventions, such as the popular Community-Led Total Sanitation approaches (Pardeshi, 2009; Prabhakaran, Kar, Mehta, & Chowdhury, 2016), will be likely to succeed in these environments without considerable community sensitization. All or most of the demand-driven interventions require that households assume all or most of the responsibility for financing and constructing their own toilets.

Findings from this study suggest an important relationship between women’s sanitation utilization choices and several **community-level factors**. Social disorganization, in particular, showed up as an important variable in the boosted and logistic regressions as well as the qualitative findings in four of the five profiles. Women’s perceptions of serious crimes, in particular, were significantly associated with SP1, SP2, and SP5, i.e. all of the sanitation profiles in which a woman reverted to unimproved forms of sanitation (bags/buckets/OD). In other words, for women who had largely limited access to a toilet or had access only to public toilets, perceptions of crime- or violence-related social disorganization seemed to play a key role in their sanitation

decisions and choices. General disorganization (e.g. presence of litter, stray animals, idle youth, drug/alcohol use, and vandalism) was also significantly associated with certain sanitation profiles. For example, women in SP3, i.e. women who have access to toilets at all times, had lower odds of perceiving general social disorganization in their communities.

While there has yet to be an empirical study focused on the relationship between social disorganization, crime rates, neighborhood appearance, etc., and women's sanitation behaviors, there have been a number of studies that have identified the important role of "place", e.g. neighborhood and community, in women's sanitation decisions and practices (Jewitt, 2011; D. Joshi et al., 2011; McFarlane et al., 2014; K. O'Reilly, 2010). In addition, a number of studies from other disciplines (e.g. criminology, geography and urban planning) have illustrated the important role of community-level cohesion and social disorganization in women's ability to access and utilize "space" (Amnesty International, 2010; Blöbaum & Hunecke, 2005; Khanna & Das, 2016; Khosla, 2000; K. O'Reilly, 2016; O'Reilly, 2012; Sommer et al., 2014; Whitzman, 2007). While it is impossible to make causal claims about these factors given the cross-sectional nature of the data, these results are consistent with many of the findings from these other studies, i.e. that space and neighborhood conditions (e.g. crime) influence women's behaviors, specifically for women who lack access to private, safe sanitation. In addition, these findings should encourage researchers to open the door to new, interdisciplinary approaches to viewing the issue of sanitation utilization, particularly in highly disorganized communities. There is, for example, an opportunity, when exploring potential interventions that target women's sanitation behaviors, to consider integrating



criminological and urban development theories (e.g. social disorganization, social cohesion, and broken windows) to better understand the macro- and meso-level factors that influence women's sanitation behaviors. Theories from those fields, in particular, have a long history of exploring some of the social and spatial phenomena that influence women's ability to access and utilize space, e.g. sanitation in particularly violent or disorganized communities like informal settlements.

Several household-level factors were also included in these analyses; however, very few had strong associations with women's sanitation utilization practices when controlling for other factors. Results did indicate that household count, e.g. the number of members of a household, might be associated with women's categorization into SP5, i.e. the larger the household, the lower the odds of a woman having an easily-accessible toilet. This could, perhaps be a function of the cost of having children. Women with more children, particularly those who are single parents, may not be able to afford to pay additional rent for a space in a plot, building, or home with easy-access to a toilet. This finding, however, is inconsistent with other literature focused on the demographic factors influencing sanitation adoption. In particular, this finding runs contrary to Hirai, Graham, and Sandberg's (2016) recent study, which hypothesized that more children increase women's decision-making capabilities in household and, subsequently, their ability to demand or allocate funds for investing in or paying to use sanitation. For women in SP5, e.g. women who utilize bags, buckets, and or OD at all times and for all calls, household income and the gender of the head of household were also significant factors. Women in SP5 had higher odds of living in a female-headed household, and were, in most cases, the head of the household themselves. Meaning, in most of these cases, that the participant

was the head of household. When looking at the total sample (n=550), women in female-headed households have significantly higher probability of also being in a lower income bracket ( $\chi^2=30.7$ ,  $p<0.001$ ). This result is consistent with findings by Joshi and colleagues (2011) that female-headed households are often the norm in informal settlements and that these women often feel disadvantaged. Women in this study and others frequently expressed a sense of insecurity when living without a man. Many spoke specifically about the burden that this “status” places on them, i.e. women struggle, economically, with meeting basic household needs, which, in turn limits their ability to invest in sanitation that costs money.

At the **individual-level**, findings from this study showed important associations between women’s sanitation utilization behaviors and certain demographic variables, such as age, employment, residential stability, and self-reported health status. For example, findings suggested that residential stability, both in the community and in the participant’s current household, was an important factor for SP1 and SP5, in particular. Specially, women in SP5 had lower odds of having lived in their community for a long time. Women in SP1, on the other hand, had higher odds of having lived in their community for a longer time, but had lower odds of having lived in their current household for a long time. While it is impossible to know how residential stability influences women’s sanitation behaviors over time, or vice versa, it is interesting to note that residential stability may be associated with whether or not women are able to access different types of sanitation, e.g. toilets. Women’s decisions and/or ability to access sanitation may be related to a woman’s familiarity with a given environment, her social networks in a community, or her perception of the proximal physical and social

conditions. Some qualitative findings in this study suggested, for example, that tribalism and women's perceptions of the safety in an environment can influence their ability to access sanitation. Social and physical conditions that are "foreign" can also be intimidating for women who are not well-established in a community, i.e. "there are many things that people can fear if they are not used to it, if they have not lived in Mathare. If you come here and you are new, you will find going to the toilet uncomfortable" (Car, 3A). The role of residential stability could also indicate something about the nature of women's household relationships and the effect these have on her sanitation behaviors. For example, some studies suggest that newly married women, particularly in highly patriarchal societies, have an especially hard time accessing sanitation once they move into their new households compared to women who are older and more established in their homes/relationships (Khanna & Das, 2016; Sahoo et al., 2015).

While the findings for self-reported health status were not consistent nor significant across all sanitation categories, women in SP4, e.g. women who utilized a toilet for all long calls during both the day and night had higher odds of reporting good or fair health. On the other hand, women in SP5, those who utilized bags, buckets or OD for all calls during the day and night, had higher odds of reporting poor health. While self-reported self-status is by no means a consistent measure of health outcomes, particularly in disadvantaged populations (Butler, Burkhauser, Mitchell, & Pincus, 1987; Wu & Schimmele, 2005), this finding may suggest that having access to a toilet at all times is associated with better health outcomes or, at the very least, a perception of better health outcomes. This finding is consistent with a number of policies and proposed sanitation

interventions that make the claim that sanitation leads to better individual and public health outcomes (Aiello et al., 2008; Bartram & Cairncross, 2010; Bartram et al., 2005; Curtis et al., 2009; Fewtrell et al., 2005; Lenton, Wright, & Lewis, 2005; Montgomery & Elimelech, 2007; Sibiya & Gumbo, 2013) .

Sense of safety, sense of security, fear of victimization, and fears of insecurity are becoming some of the most cited factors influencing women's sanitation behaviors in literature (Amnesty International, 2010; Arnold et al., 2010; Corburn & Hildebrand, 2015; Greed, 2015; Khanna & Das, 2016; K. O'Reilly, 2016; Pearson & Mcphedran, 2008; Prabhakaran et al., 2016; Sahoo et al., 2015; Sommer et al., 2014). Findings from this study do not contradict this evidence. Fear of insecurity, being attacked, rape, and theft were commonly discussed factors in the qualitative interviews in this study. Women in all SPs discussed these factors except in SP3, i.e. women with access to and the ability to utilize a toilet at all times did not frequently cite these factors in their discussions of their sanitation behaviors. This finding suggests, perhaps, that women with access to a toilet feel, as the literature suggests, a greater sense of privacy, safety, and dignity compared to women who do not (Arnold et al., 2010; Greed, 2015; Prabhakaran et al., 2016).

Over the last decade a number of gender-related sanitation studies have provided anecdotal and empirical evidence that women may revert to unimproved forms of sanitation, e.g. buckets/bags in the home, to avoid harassment associated with walking to or using a toilet facility outside the home, particularly at night (Amnesty International, 2010; Greed, 2015; Khanna & Das, 2016; Pearson & Mcphedran, 2008). Qualitative findings from this study seemed to verify these claims—showing that women who

reported using bags/buckets/OD in or near their homes did so because they were unable to go outside at night because it would be unsafe. In addition, quantitative findings also showed significant associations between women's sense of safety/security and/or their fear of victimization/insecurity and their sanitation utilization patterns, i.e. their SPs. Women in SP1, for example, had significantly higher odds of citing insecurity as the reason for not using alternative toilet options (anything other than a bag/bucket/open defecation ) at night. Relatedly, women in SP2 and SP5 also cited security as the primary reason they chose to use their current methods of disposal (bags/buckets/open defecation) at night.

While sanitation research has provided evidence that fear of victimization (FOV) and/or women's perceived sense of safety are associated with sanitation behavior (Amnesty International, 2010; Corburn & Hildebrand, 2015), there has been limited investigation into the role of FOV or security factors in relationship to women's actual experiences of sanitation-related violence and their sanitation behaviors. Most researchers simply lump together women's *actual risk*/experiences of violence and women's *fear* of violence as a single factor influencing women's sanitation practices; however, this bundling of factors may be overly simplistic. Some studies may yield clear empirical evidence of an association between women's sanitation practices and their experiences of violence (Khanna & Das, 2016; Winter & Barchi, 2015). Yet, one can easily imagine a scenario in which women's experiences of violence are not empirically significant, but qualitative results tell us that a woman's fear of sanitation-related violence is the driving factor in her decision to adopt certain sanitation strategies. In other words, it is possible that women's fear of victimization, regardless of their personal experiences with

sanitation-related violence, could be a prominent factor in their decision to utilize or adopt certain sanitation alternatives, namely bags/buckets that keep them from having to leave their homes. Findings from this study underscore how important it is that scholars develop a more nuanced understanding of women's relationship to violence, both experienced and fears, and how this relationship influences their sanitation practices.

Privacy, or the lack thereof, was one of the most prominent factors across all sanitation profiles in both the qualitative and quantitative findings. A number of exploratory and intervention-based studies have identified privacy as one of the most critical factors related to women's ability to access and utilize sanitation (Arnold et al., 2010; Khanna & Das, 2016; K. O'Reilly, 2010; Prabhakaran et al., 2016; Sahoo et al., 2015; Sommer et al., 2013). Findings from the boosted regressions in this study showed that privacy showed up as one of the most influential factors for all of the sanitation profiles. In the logistic regressions, women in SP1 had higher odds of reporting having privacy during the day (e.g. when using a toilet) and lower odds of having privacy at night (e.g. when using a bag/bucket or OD). In a similar manner, women in SP5 (e.g. those using bags, buckets, or OD at all time) had lower odds of reporting privacy, even during the day. Finally, women in SP2 and SP4 (i.e. women who report having to use bags, buckets, or OD for at least one call during the night) had lower odds of feeling private while using these methods of disposal at night.

Respondent satisfaction with a toilet/method of disposal, a factor cited in other literature (Tumwebaze et al., 2013), also presented as a potentially interesting factor in women's sanitation utilization choices in this study. For example, women in SP3, i.e. those who have access to a toilet at all times, had higher odds of reporting being satisfied

with their toilet. On the other hand, women in SP5, those without access to a toilet for any calls, also had higher odds of being satisfied. This finding may suggest that “satisfaction” with regard to a toilet/method of disposal is a relative and complicated concept in need of further study. Perhaps, for example, a woman, living alone and without access to a nearby, easily-accessible toilet, might find using a bucket or bag in the home to be an easy, cheap, and very satisfactory option. On the other hand, a woman with access to a toilet at all times might feel as though using a bucket, bag, or OD would be very unsatisfactory compared to her toilet option.

Interestingly, biological factors, such as a bad odor or the elimination of that odor were not significantly associated with any of the SPs in the logistic regressions and, were not often talked about as factors associated with women’s sanitation choices in the qualitative data. The boosted regression results did show an association between the presence of a bad odor and SP4, but the significance was not carried into the logistic regression findings. These results are inconsistent with sanitation-related literature that suggests “odor” is a sign of dirtiness, poor health, and socioeconomic status and, consequently, a critical factor influencing people’s desire to adopt or utilize certain sanitation alternatives (Aiello et al., 2008; Drangert, 2004; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Thilde Rheinländer et al., 2013; Whaley & Webster, 2011).

Most individual-level technological and design factors (e.g. the presence of a superstructure, doors, a slab, and a roof) also did not show up as statistically significant nor qualitatively interesting in this study. This is perhaps not surprising in light of a growing body of literature that suggest the “software” (e.g. societal, gendered and cultural) factors associated with sanitation behavior often take precedence over the

“hardware” (technical and engineering) aspects of sanitation (Dreibelbis, Winch, et al., 2013; K. O'Reilly, 2016). That being said, findings from this study did show that some technological characteristics of women's toilets, e.g. where it is located and the cost of accessing it, were significantly associated with certain SPs. For example, women in SP2 had significantly higher odds of having to pay a fee to visit their toilet for long calls during the day. Almost all of the women in this profile utilize a public toilet; so this is perhaps not a surprising finding. Most of these women in the qualitative sample in SP2 stated that they were frequently unable to pay the per-visit fee for short calls during the day. Women's descriptions of this inability/unwillingness to pay for a toilet for short calls during the day were prominent in both the data from qualitative interviews and also in women's responses to the questions in the survey. On the other hand, women in SP3, those with an easily-accessible toilet, had significantly lower odds of having to pay a fee to use their toilet, although it cannot be known from the data the extent to which the 'fees' for a toilet may already be reflected in higher rents paid for housing by women in this profile.

The burden of paying a fee to access a toilet has been previously cited in sanitation literature (D. Joshi et al., 2011; McFarlane et al., 2014), particularly in respect to demand for sanitation. There is some literature that specifically recognizes that pay-per-use sanitation is a burden shouldered disproportionately by the urban poor, i.e. those without access to toilets and piped sewerage (D. Joshi et al., 2011). Despite being a common factor in sanitation behavior literature, few researchers have looked at the gendered aspects of this disproportionate burden. Feminist WASH experts, like Greed (2015) and K. O'Reilly (2016), have drawn attention to many of the sanitation-related



inequities experienced by women as a result of persistent political, social, and historical actions that prioritize men's sanitation needs over those of women's. However, the gender inequalities related to having to pay for sanitation in these informal settlements has not been addressed adequately by these researchers. Many of the women in the qualitative phase of this study, for example, talked specifically about these issues. For example, several women in the qualitative sample stated that even though men are socially and physically able to urinate anywhere free of charge, most public toilets in Mathare provide free urinals for them. Respondents were particularly exasperated about the fact that a woman, on the other hand, is required to pay an entry fee for each and every trip to the toilet even if her intention is only to change a sanitary pad or to urinate. These findings add yet another dimension to the sanitation-related gender inequities women experience in these informal settlements—reinforcing the need for further feminist critique of current sanitation policies and procedures, not just at the national or international level, but in the day-to-day norms and rules that govern women's ability to access sanitation.

Convenience factors, such as distance to a toilet and/or site for urination/defecation, are commonly cited factors in gender-related sanitation literature. For example, researchers who focus on women's sanitation behaviors and experiences in rural settings often discuss the challenge women face in having to walk long distances to find a safe/private site for open defecation (Bosch et al., 2001; Cairncross, 2003; Jewitt, 2011; Khanna & Das, 2016; Massey, 2011; Pearson & Mcphedran, 2008; Rubin, 2004; Sommer et al., 2014; World Health Organization, 2005). Researchers who focus on sanitation issues in urban informal settlements also cite distance to the toilet as critical

challenge for women (Amnesty International, 2010; ITDG - Practical Action, 2005; Pearson & Mcphedran, 2008). Findings from this study are consistent with these claims—indicating that walking distance to a toilet plays an important role in women’s ability to access and utilize sanitation in Mathare. Perhaps because they use public toilets, women in SP2 had significantly lower odds of having to walk further to reach their daytime toilets for long calls than women in other SPs. In addition, women in the qualitative sample of SP3 frequently discussed the nearness of the toilet as a factor contributing to their choice to use a toilet for all calls during the day and night.

Finally, results from this study also showed the potential importance of some habitual-level factors. In the quantitative findings, women’s WASH knowledge seemed to play an important role in some women’s sanitation patterns. For example, WASH knowledge showed up as an important factor for SP1, SP3, SP4, and SP5 in the boosted regressions. In the logistic regressions, lower WASH scores were significantly associated with being in SP5, e.g. with using bags, buckets, or OD for all calls during the day and night. This finding is consistent with literature that argues that a lack of WASH knowledge is a primary barrier to women accessing, utilizing, and/or demanding better sanitation (Fewtrell et al., 2005; UN-HABITAT, 2010). Perhaps on a related note, women in SP5 had significantly lower odds of using a disinfectant such as soap or sanitizer to wash their hands. When these findings are examined from the perspective of literature focused on sanitation and hand-washing to prevent pathogen-related disease (Greene et al., 2012; Mattioli, Pickering, Gilsdorf, Davis, & Boehm, 2012; Pickering, Boehm, Mwanjali, & Davis, 2010; Pickering, Julian, Mamuya, Boehm, & Davis, 2011), it seems plausible that the combination of using unimproved forms of sanitation and not

washing hands with a disinfectant could be linked to women's lower odds of reporting fair or good health in SP5. On the other hand, women in SP3, those with access to a toilet at all times, had higher odds of having hygiene materials in their toilets (e.g. toilet paper, running water, bins for disposing of pads, etc.). Finally, women in all SPs in the qualitative interviews also identified the cleanliness of the toilet and/or women's fear of infections as important factors influencing their sanitation utilization choices.

While the findings from this study do not present a one-solution-fits-all model for tackling sanitation problems in informal settlements, it opens the door to conversations about the types of factors and interventions that might influence women's sanitation practices and choices in these environments. For example, while interventions aimed at improving women's WASH knowledge might very well help women who are currently practicing open defecation to change their routines, they may not be able to assist women in profiles like SP1, SP2, or SP4. Women who follow these "combination sanitation patterns" (i.e. the mixed use of toilets and bags/buckets/OD) seem to be influenced by a different constellation of factors and, consequently, in need of very different interventions. For example, community-level factors such as crime rates and violence and/or women's personal sense of safety/fear of victimization seem to be important factors associated with these women's sanitation choices. Interventions focused on community or even plot/building safety, policing, and/or availability of easily-accessible toilets seem more appropriate for women who follow these sanitation profiles.

This study had a number of limitations. First and foremost, the findings from this study do not provide causal links between factors and women's sanitation patterns. While significant and/or common associations in this study certainly highlight the need to better

understand these links, they do not help us to make causal claims about the factors that influence women's actual utilization. Women's sanitation profiles in informal settlements are complicated and the factors that influence their choices are equally complex. Without a better understanding of the factors that truly influence women's behaviors, it is likely that sanitation interventions in informal settlements will fail to meet the needs of certain groups in these environments. An additional limitation of the study was the sample size. This study utilized a two-phase process of quantitatively analyzing the association between factors and women's sanitation utilization in part because there was not a large enough sample to include all factors in one multinomial logistic regression for all 5 profiles. Instead, boosted logistic regressions were used to narrow down the factors that could then be used in individual logistic regressions for each sanitation profile. In an ideal scenario, the sample would allow for all factors to be included in one multinomial regression for all sanitation profiles. Finally, given the infancy of the sanitation behavior and feminist sanitation fields, there are very few, if any, validated measures for sanitation-related factors. Thus, many of the questions and measures used in this study are only exploratory. Furthermore, while the study certainly used numerous factors, it is unlikely that the list of factors that were tested is comprehensive.

## **Conclusion**

This study marked the first attempt to consolidate and organize all of the factors from sanitation literature that have been associated with people's (with a special emphasis on women) sanitation behaviors in "developing" countries. This study applied the IBM-WASH framework to identify the specific factors associated with women's sanitation behaviors in informal settlements in Nairobi, Kenya. Findings and methods

from this study have unique implications for sanitation researchers, policy-makers, developers, and educators. First and foremost, the systematic review and organization of factors associated with sanitation behavior is a big step in the direction of starting to consolidate sanitation-behavior literature. Sanitation behavior is a relatively new field of study and, women-focused or feminist sanitation research is an even more recent sub-genre of sanitation behavior inquiry. In addition, sanitation behavior research cuts across numerous disciplines including public health, behavioral psychology, planning and development studies, criminology, engineering, anthropology, geography, economics and sociology. This study is only a one step in the direction towards starting to clarify, consolidate, and organize sanitation behavior literature so that it is more accessible to scholars, policy-makers, and developers interested in this field. Overall this study highlights the need for sanitation-related scholars, policy-makers, and developers from across disciplines to start coming together to clarify and define this emerging field of study, particularly in the face of fast growing and changing populations without access to sanitation.

Additionally, findings from the application of the IBM-WASH framework to explore the multi-level factors associated with women's sanitation practices in Nairobi, Kenya, will have a number of implications for future research, intervention, and policy endeavors. Sanitation behavior research is still in its infancy. While there have been numerous qualitative studies and a handful of quantitative studies that have cited factors or proposed frameworks to understand the factors associated with people's sanitation behaviors, this study was unique in its comprehensive, mixed methods approach to exploring these phenomena among a specific population and context. Many researchers

have justified qualitative-only methods for studying sanitation behavior because of the complexity of the topic and the context-specific nature of the factors that arise in these studies; however, I believe there is a need to utilize a variety of approaches and methods to advance the field of sanitation behavior. This study will, hopefully, give researchers the confidence to expand their methodologies—to introduce new methodologies that show deference to the specific cultural, social, geographic, and historical context of the study site, but that also expand the knowledge and capabilities of sanitation behavior research. In doing so, I believe it will bring sanitation behavior into the center of sanitation policy and development conversations.

Finally, findings from this study are distinctly important for policymakers, developers, and researchers focused on the gendered aspects of sanitation behavior, particularly in informal settlements in Kenya. The findings from this study confirm some of the findings from previous gender-focused sanitation behavior studies carried out in India or other countries in sub-Saharan Africa, but they also add information about new factors. For example, factors such as fear of sanitation-related victimization, insecurity, privacy and social disorganization (e.g. presence of crime, violence, vandalism, drugs/alcohol, and idle youth) showed up as particularly prominent factors for women in informal settlements in Kenya. While fear of victimization is not a new factor in the literature, there has been little discussion about its role in women's adoption of the use of bags/buckets/OD in or near the home, or of its influence on women's diurnal/nocturnal patterns of sanitation practices. Additionally, the findings about social disorganization highlight a need to explore the role of proximal social context in women's ability to access sanitation in these environments. These findings could be particularly important

for policy-makers and sanitation developers because they indicate that sanitation issues are unlikely to be solved entirely until security issues are also handled or until strategies are implemented to build up community efficacy and minimize social disorganization, particularly in rapidly-growing informal settlements.

**MANUSCRIPT 3**

LOOKING TO WOMEN FOR GUIDANCE—WOMEN’S SOLUTIONS TO  
SANITATION ISSUES IN INFORMAL SETTLEMENTS IN NAIROBI, KENYA

by

SAMANTHA C. WINTER

Manuscript 3 of 3 of a dissertation entitled:

IDENTIFYING FACTORS ASSOCIATED WITH WOMEN’S SANITATION  
PRACTICES IN INFORMAL SETTLEMENTS IN SUB-SAHARAN AFRICA

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## ABSTRACT

**Introduction:** According to the United Nations, until participatory approaches to development are embraced by developers and those in charge of maintaining basic services, sanitation interventions will never meet the needs of the community or global sanitation goals. Evidence suggests that sanitation development is more effective if women are involved. Yet, women are frequently excluded from sanitation-related development and policy decisions. The purpose of this study was to bring the sanitation conversation directly to women by giving them the opportunity to share their perspectives about and solutions to sanitation issues in informal settlements.

**Methods:** Data for this study were collected from women in 11 villages in Mathare informal settlement in Nairobi, Kenya in 2016. Qualitative data from 55 semi-structured interviews were transcribed and coded using Atlas.ti software. Verbatim responses from 550 household surveys were also analyzed in Atlas.ti.

**Results:** By far the most common solution provided by women in Mathare was to build more toilets. Women had a wide variety of suggestions, however, about the type of toilets to build, who should build them, who should provide the land on which to build them, and/or what attributes toilets should have. Other women discussed strategies to renovate, add to, clean, or fix existing toilets. Still other women wished for financial stability and enhanced decision-making opportunities in the home. Finally, many women spoke specifically about solutions to gender-specific sanitation challenges, such as providing safe and private places to change and dispose of sanitary pads.

**Conclusions:** Women face a number of health and psychosocial stressors associated with trying to manage their daily sanitary needs. Findings from this study suggest that it

is imperative for sanitation policymakers, researchers, and developers strive not only to realize global sanitation coverage, but also to address the women-specific burdens associated with sanitation in informal settlements.

## Introduction

Planning, design, construction, and maintenance of sanitation and water systems, are usually carried out by technical experts and are funded and managed by government entities or private companies. In other words, it typically follows a top-down approach with very little room for stakeholder participation (Dias, Curwell, & Bichard, 2014; Wright & Mundial, 1997). It is precisely because of this top-down approach to development that the sustainability of water and sanitation projects have a history of not being satisfactory (Jung, Wafler, McConville, & Kvarnström, 2009). The plans adopted in these projects and interventions are prepared and implemented by professionals who focus mostly on what is technically feasible and little attention is paid to the users' priorities (Dias et al., 2014; Wright & Mundial, 1997). This has led to numerous interventions that have failed to meet the demands of stakeholders and, ultimately, resulted in projects that were poorly adopted, managed, and/or maintained (Dias et al., 2014). Additionally, the accumulative effect of these local-level failures is inextricably linked to larger national and international-level failures, notably the inability to meet Target 7 of the Millennium Development Goals (MDGs) to 'halve the number of people without access to sanitation by 2015

Scholars suggests that participatory and holistic approaches to sanitation planning may be the key to facilitating the sustainability of future projects and interventions (Jung et al., 2009). Participatory approaches to planning and development entail engaging with all stakeholders (Tayler, 1998). According to recent literature, these strategies can go a long way towards ensuring that there is a smooth implementation of sanitation-related interventions and that the challenges arising from implementing sanitation systems are

managed. Stakeholder participation also boosts the results and outcomes of sanitation improvement projects by generating demand for a product they helped create (J. McConville, Kain, Kvarnström, & Ulrich, 2014). According to the United Nations, until these participatory approaches to development are embraced by city planners and those in charge of maintaining sanitation and water systems, interventions will never meet the needs of the community. As a result many people will continue to suffer from a lack of basic amenities like sanitation and water despite the fact that these services are considered human rights and essential to human dignity (UN General Assembly, 2010).

Lack of access to sanitation is a global issue, but people living in informal settlements in “developing” countries make up the population that is most persistently burdened by this shortage (Isunju et al., 2011; UN-HABITAT, 2015). Informal settlements are not just plagued by a lack of access to services, they are often defined in terms of these deficiencies. Informal settlements frequently lie beyond administrative boundaries and are usually considered illegal by most authorities; consequently, they are neglected when it comes to provision of even the most basic infrastructure and essential services (Galli, 2013; Isunju et al., 2011). Historically, there are instances in which these services have been intentionally not planned or implemented in these communities in an effort to deter people from settling there for political and/or safety reasons. In Kenya, for example, colonial entities wanted to deter rural nationals from moving into urban centers; so, they deliberately stopped providing housing and basic services to block migrants from infiltrating into the cities (Nilsson & Nyanchaga, 2008). Their efforts were in vain, however, because migrants continued to come and settle in the lowlands of the cities—marking the foundation for today’s informal settlements (Nilsson & Nyanchaga, 2008).

Even today informal settlements continue to be excluded from the State's formal planning framework; as a result, the City Council and other utilities do not plan provision of services or utilities (water, sewerage, garbage disposal, power, etc.) to these areas (NCWSC, 2009).

Despite the harsh living conditions in informal settlements and the persistent lack of services like water and sanitation, people continue to move into these settlements at alarming rates (UN-HABITAT, 2015). Almost a third of the world's population lives in slums, with Sub-Saharan Africa having the highest proportion of its urban population living in slums (Lucci, Mansour-Ille, Easton-Calabria, & Cummings, 2016; UNDESA, 2015; Uwejamomere, 2011). In Kenya, for example, approximately 60% of Nairobi's three million people live in informal settlements (NCWSC, 2009). While over half of Nairobi's population is living in informal settlements, these settlements account for only five percent of Nairobi's residential land (NCWSC, 2009). Understandably, these settlements are very densely populated (about 130,000 people per square mile) (Kulabako, Nalubega, Woezi, & Thunvik, 2010). As a result of the high population densities, the hygiene conditions are unacceptably low and there is a strain on the few essential resources available, e.g. water and sanitation (Tayler, 1998).

Women in these settlements are particularly burdened by this lack of access to water and sanitation services (Corburn & Hildebrand, 2015). Studies suggest that they suffer not only from pathogen-related health issues, but from female-specific health issues such as increased risk of vaginal infections, violence, and indignity (Corburn & Hildebrand, 2015; Fisher, 2008). During menstruation, in particular, women need safe and hygienic sanitation alternatives (Burt et al., 2016; Khanna & Das, 2016; K. O'Reilly,

2016; Sommer et al., 2014; Sommer et al., 2013); yet, women in these settlements frequently lack private and sanitary facilities (Corburn & Karanja, 2014; Gosling et al., 2015).

Despite the burden women frequently endure from lacking access to basic services; their voices are rarely included in the development conversation. Literature has often suggested that women are frequently excluded from the design, implementation, and management of development systems, particularly water and sanitation (UN-Water, 2006). The importance of involving women in sanitation-related intervention is globally recognized (K. O'Reilly, 2016). In fact, there are a number of policies that recognize the central role women play in water and sanitation issues. For example, the recent International Decade for Action, 'Water for Life' (2005-2015), policy calls specifically for women's participation and involvement in water and sanitation-related development efforts. This resolution closely interlinks with the Sustainable Development Goal (SDGs) 5, for gender equality and women's empowerment (Sen, 2016). Yet many women continue to be excluded and their voices unheard.

A large body of literature suggests that development projects are not the only beneficiaries of women's involvement. Women, themselves, are empowered when they are involved in interventions and projects concerning issues that disproportionately affect them (Rahman, Hoque, & Makinoda, 2011). In many cases, it has been shown that projects, e.g. water and sanitation projects, work better when women are involved (K. O'Reilly, 2016; Rahman et al., 2011; UN-Water, 2006). For example, a recent study by the International Water and Sanitation Centre (IRC) of community water and sanitation projects in 88 communities in 15 countries found that projects designed and run with the

full participation of women are more sustainable and effective than those that are not (UN-Water, 2006). Another study by the World Bank found that women's participation was strongly associated with water and sanitation project effectiveness (UN-Water, 2006). Effectiveness of projects where women are involved is six to seven times higher than when they are not (Rahman et al., 2011). This evidence suggests that women's full participation in decisions that affect their lives and in projects is essential for successful project outcomes. Additionally, empowerment literature suggests women can be key agents of change if they are allowed to be involved in the planning, implementation, and operation of water and sanitation projects.

The purpose of the study was to bring the sanitation conversation to women in informal settlements in Nairobi Kenya, by giving them the opportunity to share their perspectives about and solutions to water and sanitation issues in their communities. This study is not focused on a specific water and/or sanitation intervention. Instead it highlights women's general solutions to sanitation issues in informal settlements in Nairobi. The study was guided by one question, in particular: what are the solutions women in Mathare identify to solve issues of sanitation in informal settlements?

## **Methods**

This study involved collection of data in two phases: a qualitative study involving 55 in-depth, in-person, semi-structured interviews with women in Mathare (five women from each of Mathare's eleven villages) and a quantitative phase analyzing data collected through household-level surveys with 550 women randomly selected from the same 11 villages.

The qualitative phase of the study explored (1) women's day-to-day experiences with and perceptions of sanitation in informal settlements in Nairobi; (2) the factors that influence women's ability to access and utilize sanitation, and (3) women's solutions to sanitation issues in informal settlements. This study focused on developing an in-depth description and analysis of multiple cases through qualitative inquiry and direct observation. All qualitative interviews were conducted in English and/or Swahili. Interviews lasted approximately 35-60-minutes and, with the permission of each participant, were audio-recorded on digital recorders. Audio recordings from the 55 interviews were transcribed, in full, and imported into Atlas.ti version 7. Two researchers independently reviewed and coded women's solutions to sanitation in informal settlements in all 55 transcriptions. A predefined list of codes was developed based on an initial review of the transcripts and used in subsequent analyses. Coders added to the list as they progressed. After each coder completed the coding, files were merged and assessed for inter-rater agreement. Inter-rater agreement was about 95%. New codes and/or codes which did not match were discussed one-by-one with the whole research team until a consensus was reached.

The quantitative phase of the study involved the analysis of verbatim responses to five qualitative questions from 550 household-level surveys. This second phase of the project took place after completion of data collection and preliminary analysis of findings from the first phase. Fifty women were randomly selected from each of the 11 villages in Mathare—yielding a total sample of 550 women. Surveys were conducted by a team of 11 women from Mathare selected from the pool of 55 respondents from the qualitative phase of the study to be trained as part of the quantitative research team. Surveys lasted



approximately 40-60 minutes and were conducted in English or Swahili. The survey instrument was modified based on findings from the first phase of the study and from focus-group discussions with a select group of women from the first phase of the study. As part of the surveys, women were asked to describe their solutions to the following issues in Mathare: (1) availability, accessibility, and/or conditions of toilets; (2) availability, accessibility and/or condition of water; (3) disposing of rubbish and sanitary pads; (4) hygiene; and (5) security.

Verbatim responses to these 5 questions in the quantitative survey were imported into Atlas.ti version 7. A single researcher independently reviewed and coded women's solutions to sanitation, water, hygiene, and security in informal settlements in all 550 surveys. A predefined list of codes was used based on findings from the case-studies in the first phase of the study and based on an initial review of all of the responses to the solution-related questions in the quantitative surveys. New codes were added to the list as necessary. Following coding by the first researcher, a second researcher reviewed all codes. Codes which were not intuitive to the second researcher were discussed one-by-one with the research team until a consensus was reached.

Prior to being asked to describe their solutions to issues in Mathare, women were read a number of statements about the availability, accessibility, and condition of various issues related to water, sanitation, hygiene, and security in Mathare. For each of the statements women were asked to tell the research team member whether they felt the issue was currently (1) not a problem, (2) a problem, or (3) a serious problem in Mathare. Items included issues such as the availability of toilets, the accessibility of toilets during the day and at night, the condition of open drainages, availability of police, and prevalence

of diarrhea. There was minimal missing data on the variables used in this analysis (0-3% with most variables missing less than one percent). Descriptive frequencies of responses to these questions were also analyzed in this study. The full list of the 12 sanitation-related issues and their response frequencies from both the qualitative and quantitative samples are summarized in Table 4.1.

## Results

Descriptive statistics for the qualitative and quantitative samples are summarized in Table 4.1. Results suggest that a majority of women in the quantitative sample consider accessibility of toilets during the night, availability of places to dispose of rubbish, idle youth, the condition of open drainages, and the availability of piped sewers to be serious problems in Mathare. For example, 92.4% of women in the quantitative sample consider the accessibility of toilets during the night to be a serious problem, and an additional four percent consider it to be a problem. Seventy-nine percent of women consider the availability of places to dispose of rubbish to be a serious problem and an additional 19.5% consider it to be a problem in Mathare. Finally, 75% of women consider idle youth to be a serious concern in Mathare and an additional 20.4% consider it to be a problem.

Table 4.1.  
*Women's perceptions of issues in Mathare*

	<u>Survey Sample</u> <u>(n=550)</u>			<u>Qualitative</u> <u>Sample (n=55)</u>
	Not a problem	A problem	A serious problem	Identified as problem
Availability of toilets	107	183	260	34
Accessibility of toilets (day)	256	130	164	36
Accessibility of toilets (night)	19	23	508	38
Cleanliness of toilets	63	252	235	37

Availability of piped sewers	42	226	282	1
Condition of open drainage	54	183	313	4
Availability of water	170	272	108	33
Cleanliness of water	171	299	80	9
Availability of places to dispose of rubbish	8	107	435	15
Availability of police	172	252	126	1
Idle youth	25	112	413	34
Garbage everywhere	17	90	443	20
Diarrhea	129	195	226	4

Results from the interview responses are also summarized in Table 4.1. Women were not specifically asked about the level of severity of each water, sanitation, hygiene, and/or security issue. Rather women in the qualitative interviews were simply asked to discuss common and/or serious issues related to water, sanitation, hygiene, and/or security in informal settlements in general. Therefore, the frequencies for each issue are much lower than in the quantitative surveys. A visual comparison of the problems identified by women in the qualitative interviews and the household surveys is presents in Figure 4.1.

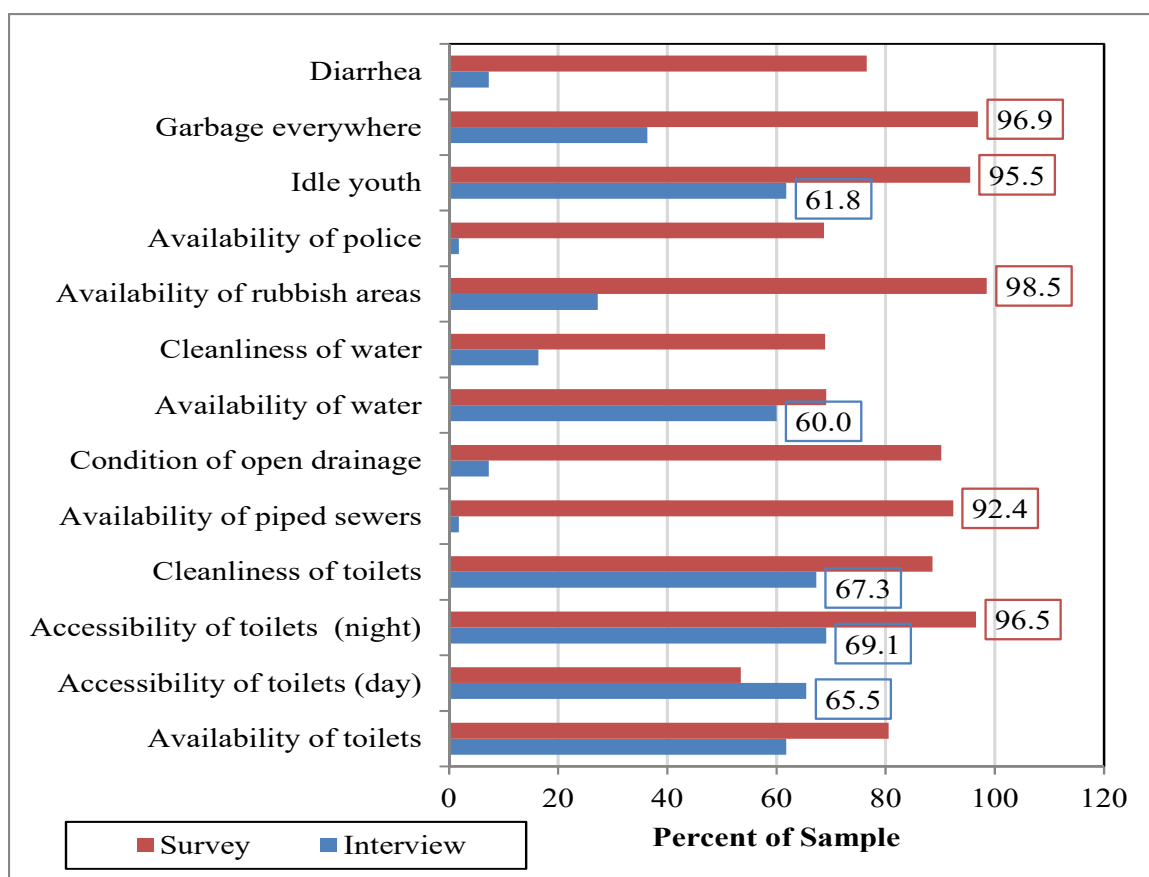


Figure 4.1. Comparison of sanitation-related issues between surveys and interviews

Results from the interview responses suggest that approximately 62% of women raised the issue of lack availability of toilets; 69% of women discussed the accessibility of toilets during the night as an issue; and 65% talked about at least one issue related to accessing a toilet during the day or in general (e.g. cost of paying to use a toilet, closures due to blockages or floods, and queues). About 67% of the women in the interviews talked about issues related to the cleanliness, or lack therefore, of toilets, including their fears of contracting infections as a result of using unclean toilets. Approximately 60% of the women in the qualitative sample identified the availability of water as another common and/or serious issue facing women in Mathare. Finally, about 62% of women identified idle youth, specifically, as a sanitation-related challenge in Mathare. **Toilet**

**Solutions.** By far the most common solution provided by women in both the qualitative and quantitative phases was to build more toilets. Approximately 42% of the women in the interviews (n = 23) and 59% of the women in the surveys (n = 325) suggested building more toilets as a solution to sanitation issues in Mathare. Women in both samples, however, had a variety of suggestions about what type of toilets to build, who should build them, who should provide the land on which to build them, and/or what attributes toilets should have. Approximately 13% (n=73) and about seven percent (n=4) of the women in the surveys and interviews, respectively, suggested building more public toilets. About 16% (n=90) and about 11% (n=6) of women in the surveys and interviews, respectively, highlighted the need to build more toilets in buildings and/or plots. Less than one percent of women in both the surveys and interviews suggested building individual toilets in people's homes.

Some women in the surveys provided simple solutions like, “we should add many toilets”, “every plot should have a toilet”, or “more public toilets are needed. We only have one public toilet in this village.” Many women also had clear suggestions about who should be responsible for providing land and/or building more toilets for Mathare residents. Many suggested that it is the responsibility of the government to build more toilets, e.g. “the government should add more toilets for us”, “the municipal council should stop favoring some areas more than others, other people should be allowed to be in charge [of the toilets]”, or “more toilets are needed. The government should identify land for toilet construction.” Other women felt it is the responsibility of the landlords to build toilets, e.g. “landlords should build toilets in every plot”, “landlords should build toilets for their tenants”, or “landlords should give land or build toilets for their tenants.”

Still other women felt that both the government and landlords had responsibilities to provide toilets for different populations, e.g. “we should talk to the landlords about adding more toilets and the government should come up with a solution for building toilets for the ones who are unable to pay.”

In the interview sample many women also identified the need for more toilets to be built, and, similar to the women in the surveys, had different, and often more elaborate, ideas about what kinds of toilets should be built and who should be responsible for building them. For example, “every landlord should remove one of his rooms to have one toilet and one bathroom” (Mary, 3C). Some women’s solutions are much more complex and involve multiple players, e.g.

My solution is that the people of Mathare bring together all the landlords. They should be told, ‘no matter how many rooms you have, at least one room should be put aside to construct a toilet and a bathroom, or even two toilets and two bathrooms.’ According to me, that is a solution. That’s the first one. The second solution would be for all tenants to come together and designate one space for the construction of a toilet. They should also report the landlord to the area Division Officer through the Chief. The village elders are also involved in land grabbing; so if this reporting happens it will force them to give up land for a toilet. These village elders are the ones with the most houses and they keep on oppressing the villagers; so, if this report gets to the Division Officer through the chief may be they will convene a meeting with all landlords, and, if possible, it will be aired on television and the radio in all slums. All the landlords will be given maybe six months or one year with a warning: if your plot does not have a toilet within that duration of time it

will be closed. I think that solution will work because they will be afraid of losing rent money if the plot is closed (Mwa, Gitathuru).

In addition to suggesting building more toilets, several women in both the interview and survey samples also suggested renovating, adding to, cleaning, or fixing existing toilets. Approximately six percent (n=35) of the survey sample suggested renovating existing toilets in the community. Additionally, women in the survey sample also highlighted the need for toilets to (1) be open during the night (13%; n=73); (2) have security so they can be accessed at night (9%, n=50); (3) be cleaned regularly (6%, n=33); (4) be free of charge or, at least, have a reduced fee (5%, n=30); (5) have water inside (4%, n=23); (6) have electricity and lights inside (2%, n=12); and (7) have better management (1%, n=5). For example, “more toilets should be added and the ones that are there should be improved. Also, security needs to be improved for everyone to be able to use a toilet at night”; “toilets need to be repaired and water and electricity should be added”; “repair the worn out parts, such as the walls and floors. Also, add iron sheets to make a roof”; “repair the walls and cement floors so [the toilets] are easy to clean”; “toilets should be washed with other detergents that kill germs other than soap and water only”; “the people in charge of the public toilets should make sure that the toilets are always clean”, “there should be more caretakers to clean toilets two or three times a day”, “toilets should be free”.

Women in the interview sample highlighted similar solutions, such as (1) making sure toilets are clean and unblocked (11%, n = 6); (2) ensuring there is always water in the toilets (11%, n = 6); (3) having better management and security at toilets (5%, n= 3); (4) ensuring there are separate gender stalls for men and women (5%, n = 3); (5)

reducing the fees or making them free (5%,  $n = 3$ ), and (6) renovating toilets (4%,  $n = 2$ ).

Women's solutions in the interview sample tended to be much more elaborate than those in the surveys. For example,

We first have to maintain the toilets that we have. They need to be cleaned. If they need to be renovated, then renovate them first. Then maybe we can get the space to build the toilet. The problem in the slum is space to build the toilet. Like NYS came and brought the project of the toilet, but when they started running it, somebody else came with a title saying, 'this is my property.' Yeah, that is the problem. But the solution, maybe, is to talk with the owners so that you don't start building a toilet. Then you find out you have wasted all your materials and it is demolished (Nancy, 3A).

There is no space to build a lot of toilets here. So, I think we should to repairs to the toilets here. If we do repairs it [the walls and floor] will be smooth; so, they will be easy to wash. If the holes [toilet bowls] are eroded, the water won't flush. But if it is make well, it is straight and if you have put tiles, you will be able to scrub it with a brush and it will be clean quickly (Jen, 4A)

We need to have another public toilet. Not the residential toilets—a public toilet. This public toilet should have good management because when it is just there, unmanaged, we'll just misuse it. So we need good management. Also people should be sensitized. They need to know that the toilet is there to serve the whole community; so, they need to use it wisely (Car, Mashimoni).

The first thing is that there needs to be water in the toilets. You see, sometimes the water gets cut off and even the toilets, themselves, block and this brings big problems (Max, Mabatini)

Okay, for our case, let's say when the lights are there we are able to go the toilet during the night and when there is security outside [the plots and toilets] the people in the village will not fear going to the toilet at night. So it will be easy for them to go to the toilet during the night (Sha, Village 2).

Maybe we could have people who volunteer to provide security at the toilets (Dor, Kosovo).



Some women in the qualitative sample thought more financial stability and decision-making within their homes would be a viable solution to sanitation issues in Mathare. In the qualitative study approximately 56% (n=31) of the women stated that paying to use a toilet was sometimes a determining factor in their ability to access a toilet. For example, If a woman does not have money to pay, she won't go. She thinks if she goes there [to the toilet] the men [managers] will embarrass her until she feels just alone...Instead of going there and being pushed around by the men, it is better she goes home [to use a bucket/bag/OD]. Or maybe you have 50 bob or 30 bob and maybe that 30 bob has been allocated to eat because here in Mathare, food is not really expensive. Even if you have 20 bob or 30 bob you can eat. But you will get a mama who has maybe 10 bob and that money is for food. So now, she sees it is better to forego going to the toilet (Sha, 4B). In some cases, women also do not have control over where the money is spent. For example,

You see, many women are housewives. If their husband leaves only her money for the vegetables and she doesn't have an extra 5 shillings, you see, that is your problem. You will just struggle. And your children will struggle. This is a problem that constantly causing distress for women. (Elz, Gitathuru)

In relationship to these issues of money raised by women, a few women (n=3) discussed business, employment, and money as the keys to solving sanitation problems. For example, "if it is possible for every mama to not be supported by her husband alone. She has her own business. She gets even 50 bob of her own she doesn't have to beg people. Let's say a woman is just staying in the house without a business, without a job. She has no other option. If life is like that, she has to forego even using the toilet...so just that small money could make a change" (Eli, Gitathuru).

Finally, many women spoke specifically about gendered solutions to sanitation challenges in Mathare. For example, 16% of women (n=88) in the survey sample and 36% (n=20) of women in the interview sample highlighted a need for sanitary bins in the toilets for disposing of pads. For some women, particularly those in the interview sample, provision of a free and private place to change pads is also essential. For example,

It would be nice to be allowed to manage a women's toilet—for us to socialize with women and put that bin for women. In the men's toilet you will find a urinal and it is free. Why is it that men are being given so many priorities that cannot be given to women? Urinals are free. It is totally free for a short call. Why don't women also be given a free urinal? When it comes to construction of a ladies toilet it is constructed for the purpose of earning and...there are no bins (Cla, Mashimoni).

You see like for men they have these urinals and whatever, they don't pay. So I feel for the ladies we need to have like those bins, they don't need to pay because sometimes maybe you are on your periods and now you don't have the money and you need to dispose your pads so I think maybe they can set aside a room for the bins and women don't pay. Maybe you go for a long call. Maybe for that you must pay, but for the disposal me for on my side I just feel like it needs to be like for the men (Car, Mashimoni)

## Discussion

According to recent literature, gender is at the root of all sanitation issues (K. O'Reilly, 2016). Gendered solutions to sanitation are few; yet, according to some literature, gender is actually the key to solving sanitation problems around the globe (Greed, 2015; K. O'Reilly, 2016). The purpose of this study was to look, specifically, at women's perceptions of and solutions to sanitation issues in informal settlements in Nairobi, Kenya. However, beyond simply collecting information on women's solutions to sanitation, this study also served as an opportunity for women to focus not just on the problems associated with sanitation in their communities, as most previous research has done, but as a chance to visualize a different sanitation outcome—one in which they are

able to meet their daily sanitation needs with dignity, privacy, safety, and ease.

According to recent sanitation literature, engaging women and supporting them in making sanitation decisions will likely lead to better sanitation solutions and adoption and, consequently, greater health and psychosocial outcomes for women and children (Hartmann, Krishnan, Rowe, Hossain, & Elledge, 2015b)—although it is not the end-all-be-all solution to all of the gendered sanitation issues (K. O'Reilly, 2010). The solutions presented in this study are by no means conclusive or generally applicable to different women and contexts; however, they do provide a nuanced window into women's perceptions of the main sanitation issues as well as their solutions to those challenges, including who they perceive to be responsible for changing sanitation outcomes.

Demand-driven approaches to sanitation gained a lot of traction in the 1980's and 90's (Calaguas, 1999). Advocates for the demand-driven approach to sanitation, such as the popular Community-Led-Total-Sanitation (CLTS) campaigns, frequently call on women to be the drivers of change for sanitation (K. O'Reilly, 2010). There are examples of providing microfinance and subsidies to women to build toilets because studies suggested that women would prioritize household sanitation over men. Yet, in many of these instances, women lacked the decision-making power in the home to ensure money was spent on toilets (Hirai et al., 2016; Khanna & Das, 2016). Findings from this study are consistent with this literature—suggesting that women may not have the financial or decision-making power within their households to have control over even their daily sanitation needs. Some women pointed out that their sanitation access is limited by their husband's or their personal financial restrictions. As part of the solution, some women suggested that having more personal money, separate from their husbands, would, at the

very least, give them the freedom to access public toilets on a regular basis. Some research suggests, however, that even when women have more access to resources and decision-making power in the home, they may not invest in sanitation (Routray, Torondel, Clasen, & Schmidt, 2017) and/or they may prioritize other household needs, e.g. their children's health, education, and food (Hirai et al., 2016; Khanna & Das, 2016). Thus, despite some participants' suggestions to increase women's access to resources, a small shift in women's access may not lead to an increase investment in daily sanitation, e.g. an increase in use of pay-per-use public toilets. These inconsistent findings in the literature suggest there may be a need for further research into the relationship between women's access to resources and/or their decision-making power in the home and their ability to access and utilize sanitation in informal settlements.

Results from this study suggest that women do not frequently perceive sanitation to be a household-level responsibility. The majority of women in this study felt that toilet construction was the responsibility of landlords and governments. Only 14% of the women in the surveys (n=75) felt that the household had any responsibility to build toilets. Furthermore, the majority of women in the study felt that the primary solution to sanitation issues was for landlords and/or local governments to build toilets or, at the very least, to provide the land on which toilets could be constructed. These findings are consistent with other findings that suggest that demand-driven approaches to sanitation may prove to be extremely unsuccessful, particularly when 1) women are unable to access funds to build toilets and/or 2) the onus of responsibility is placed squarely on the shoulders of a socially and economically disadvantaged group (Greed, 2015; Khanna & Das, 2016; Khosla, 2000; K. O'Reilly, 2010, 2016). These findings may suggest that the

demand-driven or CLTS approaches to sanitation may not be an appropriate strategy for capturing women's needs and wants with regard to sanitation.

Findings from recent literature suggest that the politics of sanitation in informal settlements, i.e. the relationships between different stakeholders (e.g. residents, landlords, non-governmental organizations, municipal government, and public/private service providers), complicate the notion of responsibility and demand for sanitation in these settings, particularly for residents who are often very limited in their decision-making power (Isunju et al., 2011). Findings from this study corroborate this literature, suggesting that interventions that target women in informal settlements as the exclusive agents of sanitary change may not yield the best results. The results suggest, instead, that it might be worth turning attention and funding to designing initiatives that engage not only women, but landlords and local governments as well (Prabhakaran et al., 2016).

For many women in this study, solutions to the current sanitation challenges in Mathare included a number of gender-specific changes. For example, many women requested the provision of sanitary bins in toilets for the safe disposal of pads. A few women also highlighted the need for a safe, private, and free place in which to change pads. A number of studies have shown that urban governments, in particular, have, historically, provided women with less access to toilets than men (Greed, 2015; K. O'Reilly, 2010). In some cases, authorities, funders, and developers in charge of providing sanitation have neglected women's menstruation needs altogether (Greed, 2015). These studies highlight the critical need for safe, affordable, and private places for women to manage their menstruation needs (Khanna & Das, 2016; Sommer et al., 2014). Without a safe, dignified, and appropriate place, women suffer a number of

consequences, including missed days at school and higher risk of toxic shock syndrome and vaginal infections to name a few (Greed, 2015; Mahon & Fernandes, 2010; Sommer et al., 2013). Findings from past research in combination with women's solutions in this study highlight a critical need for strategies that better help women and girls to manage their sanitation and menstrual needs.

While women in this study provided some interesting solutions to sanitation challenges in informal settlements, results also suggest that there is an interesting disconnect between the factors that research from this dissertation indicate are associated with women's sanitation practices (see manuscript 2) and women's solutions to sanitation issues in Mathare. Findings from manuscript 2 of this dissertation suggest, for example, that privacy, social disorganization (presence of crimes and general disorganization), access to water, and insecurity were the most common, significant factors associated with women's access to and utilization of sanitation. Interestingly, very few women in this study identified solutions to address these factors as part of their solutions to sanitation. Instead, the majority of women identified availability (e.g. building more toilets) and access to toilets (e.g. keeping public facilities open at night); government and landlord responsibility for sanitation provision; renovation and/or better maintenance of toilets (e.g. more regular cleanings); better financial stability and decision-making for women; and some gendered improvements (e.g. adding bins for pads and private places to change pads) as the key solutions to sanitation issues in Mathare. In other words, the majority of the women's solutions seem to reflect the more common and widely publicized beliefs about the factors that influence people's sanitation behaviors, e.g. lack of availability of toilets or lack of demand (mostly willingness to pay) (Isunju et al., 2011), rather than the

context specific factors identified by women in this dissertation study (e.g. social disorganization, lack of security, lack of access to water, and lack of privacy). This disconnect seems to suggest that there is, not only a need to expand the perspectives of sanitation scholars, policies, and developers to consider a broader range of factors that might influence a woman's ability to access and utilize sanitation in informal settlements, as was suggested in manuscript 2, but to also find meaningful ways to help women, themselves to better understand and access information about the links between these other, less-commonly discussed factors, e.g. social disorganization, insecurity, and privacy, and their ability to access and utilize sanitation in these settings. For example, some women who participated in the interviews and sanitation walks, i.e. women who had more one-on-one, in-depth discussions about the sanitation challenges in Mathare, provided more in-depth solutions to the sanitation issues in informal settlements, which, in some cases, included addressing challenges of privacy and security.

One of the biggest challenges in this study stemmed from the verbatim responses in the survey. Firstly, the solutions section of the survey fell at the end of all the other questions. The questions were intentionally placed at the end in order for women to have time to think about a variety of aspects of their sanitation and water environment before talking about solutions; however, these questions were the longest and hardest to record. Thus, researcher fatigue as well as field staff fatigue may have contributed to less thorough responses from women. In addition, many of the women's responses to the solutions may have been influenced by the subject material of the preceding questions in the survey. Finally, although the field staff was instructed to write down women's responses word-for-word, there is some indication in the results that the staff may have

left out some words/abbreviated some responses. That being said, the data seems to capture women's solutions relatively well, and, when triangulated with the qualitative findings, the solutions seem consistent.

## **Conclusion**

The relationship between women and sanitation is complicated, particularly in informal settlements. Findings from this study, while not a comprehensive set of solutions to women's sanitation-related challenges and stressors, provide insight about 1) women's perceptions of the biggest sanitation issues in Mathare, 2) their notions of how to start addressing them and 3) who should be encouraged to address them. Results from this study, for example suggest that there are a number of relatively "basic" gender-specific solutions that would make small improvements in women's daily sanitation routines, e.g. provision of sanitary bins and a collection service to empty the bins on a regular basis.

Findings in the study also revealed that the majority of women in Mathare do not feel that sanitation interventions should be the responsibility of households or women alone. The burden of sanitation already falls heavily on women in these environments. These findings beg the question, should the onus of trying to improve sanitation conditions fall disproportionately on women? Or perhaps, as one woman in this study suggested, landlords and the local governments should be the primary targets of sanitation-related interventions.

Additionally, findings in this study emphasized, like the findings from other papers in this dissertation (cite papers once published), that there is a need to recognize and start correcting for the multitude of additional sanitation-related burdens placed on



women. This study, as well as others (Greed, 2015; K. O'Reilly, 2016) have uncovered serious and pervasive sanitation-related gender inequalities. At the very least, toilets should charge the same amount for men and women, which means, if men are allowed to urinate for free, so, too, should women. Women face a number of gender-specific health and psychosocial stressors associated with trying to manage their daily sanitary needs. Gender-discriminatory practices such as charging women to access a toilet to urinate or change their pad when men are admitted for free or refusing to provide sanitary bins in toilets could be considered, from a feminist perspective, unacceptable manifestations of systematic violence perpetrated against women. Again, these findings, like findings from previous papers (cite papers once published), suggest that it is imperative that sanitation policymakers, researchers, and developers to start putting women's sanitation needs at the top of the list rather than trying to include them as an afterthought, particularly if they expect to achieve the Sustainable Development Goal of universal sanitation coverage by 2030.

Finally, this study suggests that, in addition to providing information to sanitation policy makers, investors, and developers, residents, themselves, should be provided with opportunities to expand their understanding of the links between less-commonly cited factors (e.g. security) and access to and utilization of sanitation in informal settlements. Continuing to push interventions which emphasize toilet coverage, alone, may be counter-productive and limit people's potential to develop their own holistic solutions to a challenging and complicated problem.

## **DISCUSSION AND CONCLUSIONS**

The purpose of this dissertation was to explore the factors associated with women's sanitation utilization in informal settlements in Nairobi, Kenya. Sanitation access has proven to be a particularly persistent challenge to meeting international, national, and local poverty alleviation and sustainability initiatives, particularly in sub-Saharan Africa (WHO & UNICEF, 2015). Literature has shown that disadvantaged women, i.e. those living in informal settlements in these “developing” contexts, are not only more likely to be excluded from accessing basic services, such as water and sanitation, but they are also likely to suffer a broader range of consequences from lacking access (Greed, 2015; Khanna & Das, 2016; K. O'Reilly, 2016; Sahoo et al., 2015; Sommer et al., 2014). While there have been a number of studies over the last decade recognizing women's unique relationship to sanitation and the disproportionate disadvantages women face as a result of lacking access to sanitation, there have been very few studies focused exclusively on the multi-level factors associated with women's ability to access and utilize sanitation in informal settlements in East Africa, in general, and in Nairobi, in particular. Therefore, the purpose of this study was to explore these factors in a large informal settlement in Nairobi, Kenya using a multiphase, mixed methods approach.

The study design for this dissertation began in 2013 and was approved by a committee of experts in May 2015. Data collect for the project was carried out in Mathare Valley informal settlement over a period of 12 months starting in September 2015. Case studies of 55 women in Mathare were carried out between September 2015 and March, 2016. Between April 2016 and June 2017, 550 household-level surveys were collected.

The project concluded with a period of preliminary analysis and member checking carried out in Mathare between June and August 2016. Overall, the dissertation was guided by five research objectives, i.e. to explore: (1) women's sanitation utilization practices; (2) the factors that women identify as influencing their utilization practices; (3) the role that women's fear of victimization/perceived sense of safety plays in women's sanitation utilization practices; (4) the role that the proximal social context plays in women's utilization practices; and (5) women's solutions to current sanitation challenges in informal settlements of Nairobi, Kenya.

The goal of this final chapter is to summarize the key findings of the dissertation; the overall limitations, and the over-arching contributions and implications of the findings for policy-makers, developers, researchers and educators.

### **Summary of Key Findings**

**Manuscript 1: General sanitation profiles for women in Mathare.** To my knowledge, Manuscript 1 of this dissertation marked the first attempt not only to document and empirically analyze the complexity of women's sanitation practices in informal settlements in Kenya, but also to develop methodologies that could be used to generalize about those practices without sacrificing the complexity. While there have been a number of studies exploring different aspects of sanitation in informal settlements (Acharya et al., 2015; Amnesty International, 2010; Bapat & Agarwal, 2003; Gosling et al., 2015; Isunju et al., 2011; ITDG - Practical Action, 2005; A. Joshi et al., 2013a; D. Joshi et al., 2011; Kasala, Burra, & Mwankenja, 2016; Kwiringira, Atekyereza, Niwagaba, & Günther, 2014; Lagerkvist et al., 2014; Massey, 2011; McFarlane et al., 2014; Mpambije & Nuhu, 2016; Okurut et al., 2014; Penrose, De Castro, Werema, &

Ryan, 2010; Prabhakaran et al., 2016; Schouten & Mathenge, 2010; Tumwebaze & Lüthi, 2013; Tumwebaze et al., 2014; Tumwebaze et al., 2013), there have been only a few studies looking specifically at women's unique sanitation behaviors in these environments in sub-Saharan Africa. Given the infancy of this field of research, i.e. gendered-/feminist-sanitation or "Toiletology," as Greed (2015) refers to it, it is not altogether surprising that the handful of studies focused on these issues in sub-Saharan Africa are largely qualitative (e.g. Amnesty International, 2010; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014; Prabhakaran et al., 2016). As findings from this study confirm, this qualitative approach to exploring women's sanitation practices was and remains necessary for capturing the complexity of women's daily struggle to manage their daily urination and defecation needs and their monthly menstruation requirements. That being said, however, quantitative data can also play an undeniably important role in influencing international, national, and local policy, research, interventions, and practice (Dodd, 2008). Findings from this study suggest that both qualitative and quantitative data are key to understanding the complexity as well as the similarities and patterns (the sanitation profiles) in women's sanitation utilization in informal settlements in Nairobi, Kenya.

The first, and perhaps primary, finding from the exploration of women's sanitation behaviors in informal settlements in Nairobi, Kenya is that they are complex and varied. Findings from this study revealed that women's sanitation profiles are heterogeneous not just terms of how they manage urine (short calls) and feces (long calls), not to mention menstruation, but also in terms of when. Qualitative findings from the first phase of the study revealed that women in these environments often have up to

four different strategies for dealing with their basic sanitation needs in any given 24-hour period. The qualitative findings also suggested that even these daily sanitation routines could be interrupted or changed based on a number of factors such as the availability of water in their primary toilets or current social conditions around their villages (e.g. disorganization). These qualitative findings were instrumental in developing a survey instrument that could better capture some of the complexities of women's sanitation behaviors in a typical 24-hour period.

A latent-class analysis was then run on quantitative data focused on women's typical daily sanitation management strategies for: 1) long calls during the day, 2) short calls during the day, 3) long calls during the night, and 4) short calls during the night. The results of the analysis suggested that there are 5 common patterns, or sanitation profiles, representing women's typical daily sanitation practices in Mathare. These sanitation profiles included: 1) women who utilize toilets during the day for both long and short calls, but utilize bags, buckets, or OD for long and short calls during the night; 2) women who utilize a toilet for long calls during the day, but utilize bags, buckets, or OD for short calls during the day and for all calls during the night; 3) women who utilize toilets for all calls during the day and night; 4) women who utilize a toilet for all calls during the day and long call during the night, but utilize bags, buckets, or OD for short calls during the night; and 5) women who utilize bags, buckets, or OD for all calls during the day and night.

Finally, qualitative findings from the first phase of the study were subsequently used to confirm these generalized, quantitative sanitation profiles and to provide a meaningful naming structure for each profile. Final names for the 5 profiles included: 1)

No Security/Toilet Is Closed at Night, 2) Cannot or Will Not Pay/Toilet Is Far, 3) Toilet Is Easily Accessible at All Times, 4) No Security, but it is a must/emergencies, and 5) No money/No Access.

**Manuscript 2: Factors associated with women’s sanitation utilization.** Over the past decade there has been an increasing volume of studies that introduced factors related to women’s sanitation behaviors in a variety of urban and rural contexts in “developing” countries (Amnesty International, 2010; Corburn & Hildebrand, 2015; Corburn & Karanja, 2014; Hirve et al., 2015; M. W. Jenkins & Curtis, 2005; M. W. Jenkins & Scott, 2007; Khanna & Das, 2016; K. O’Reilly, 2010; Sahoo et al., 2015; Sommer et al., 2013). However, there has yet to be a mixed-methods study focused exclusively on the multi-level factors that influence women’s sanitation in informal settlements in Nairobi, Kenya. The goal of Manuscript 2, therefore, was to explore the extent to which previously cited factors from the literature were associated with women’s sanitation behaviors in Mathare.

The first part of this study involved an exhaustive literature review of sanitation utilization, adoption, demand, and behavior literature to identify potential factors influencing women’s sanitation behaviors in Nairobi informal settlements. Once factors had been identified they were organized according to Dreibelbis et. al.’s (2013) integrated behavior model for water sanitation and hygiene (IBM-WASH). Armed with the knowledge of all (or at least as many as could be identified) of the potential factors, the researchers embarked on their qualitative exploration of women’s relationship to sanitation in Mathare. To the extent possible, researchers used only general questions and probes to initiate women to talk about their daily sanitation routines and the factors that

influenced those routines without forcing women to ask specific questions about all of the factors identified in the literature. Findings from the qualitative case-studies were then used to modify the quantitative portion of the survey focused on the factors influencing women's sanitation behaviors. Women from a focus group were then provided with the opportunity to make final suggestions and modifications to the survey instrument before survey data collection commenced. Quantitative analysis soon followed.

Because of the many factors identified and measured in the surveys, boosted regressions (Matthias Schonlau, 2005) were used to narrow-down the list of factors associated with each of the 5 common sanitation profiles identified in Manuscript 1. Then logistic regressions were used to test the direct and magnitude of the associations between the most prominent sanitation factors and each of the five sanitation profiles (e.g. women's sanitation utilization). Finally, qualitative data was again analyzed to confirm and/or point out flaws/discrepancies in the results from the quantitative analyses. Findings from the qualitative and quantitative analyses were organized and discussed first in terms of each sanitation profile and then in terms of the IBM-WASH framework.

Overall, findings from both the qualitative and quantitative analyses confirmed the fact that women's sanitation behaviors in Mathare are not only complex, but that the constellation of factors that influence those behaviors compounds that complexity. At the social- or macro-level, results revealed that cultural rules about the disposal of urine and feces as well as women's expectations of who is responsible for building toilets in their communities were significant factors associated with women's sanitation utilization, particularly for women who frequently used bags/buckets/OD to deal with their sanitation needs during the day and night (SP2). At the community- or neighborhood-level,

women's perceptions of social disorganization were significantly associated with certain sanitation utilization profiles. In general, women's perception of serious crime in the neighborhood was an important factor for women who were categorized into sanitation profiles involving bags, buckets, or OD for at least one call during the day or night.

Meanwhile, for women who utilized toilets for all calls, only general social disorganization (e.g. litter, vandalism, idle youth) was a significant factor associated with their sanitation utilization. At the household-level, only household income and the number of children showed up as significant factors associated with women's sanitation practices and, mostly only for women who utilized bags/buckets/OD for all calls during the day and night.

While the individual-level factors are too many to summarize with detail, demographic variables, such as age, employment, residential stability, and self-reported health status; safety-related variables, such as fear of sanitation-related victimization; and privacy showed up as significant factors associated with women's sanitation behaviors. Privacy was a particularly important factor for women in SP3 (women who have access to and utilize toilets for all calls) and fear of victimization/perceived sense of safety were especially important factors for women who utilized bags/buckets/OD for more than one call during the day and/or night (e.g. SP2, and 5). Technological factors, such as having to pay a fee to use a toilet and the distance a woman walks to reach her toilet also showed up as being significantly associated with women's sanitation practices. These were particularly important for women who frequently relied on public toilets, e.g. those women in SP2. Finally, habitual-level factors such as WASH knowledge, attitudes, and practices and hand-washing instruments (e.g. soap) were significantly and negatively



associated with women's sanitation behaviors in SP5 (e.g. women who utilize bags/buckets/OD for all calls during the day and night), i.e. women in this SP generally had lower WASH-KAP scores and less access to hand-washing instruments, e.g. soap.

**Manuscript 3: Women's solutions to sanitation issues in Mathare.** Even though most development policies require the involvement of women in sanitation-related interventions and projects (UN General Assembly, 2010; United Nations Human Settlements Programme, 2003), women's voices and needs are still often unintentionally left out or ignored in the actual planning, implementation, and management of sanitation-related development projects (Greed, 2015; K. O'Reilly, 2016; E Tilley et al., 2013). The purpose of Manuscript 3 was to encourage women to think about solutions to sanitation issues in informal settlements in Nairobi, Kenya, and to document their thoughts to help better inform future sanitation policy and interventions. Although the solutions presented in Manuscript 3 were by no means conclusive or generally applicable to different women in different contexts, they provided a nuanced presentation of women's perceptions of the main sanitation issues and solutions in Mathare.

The data for this study were almost entirely qualitative. Cross-case and thematic analysis was carried out on the 55 qualitative interviews from phase 1 and verbatim responses to qualitative questions on the 550 household surveys from the second phase of the study. This study first explored the most pressing and/or common sanitation problems women identified in the surveys and in the qualitative interviews. Analysis was then carried out to identify women's most common and detailed solutions to sanitation issues in Mathare.

Findings from these analyses suggested, first and foremost, that most women felt landlords and local governments should be responsible for improving the sanitation conditions in Mathare. This was an important finding given the growing popularity of demand-driven approaches to sanitation development, i.e. approaches that place the primary responsibility of constructing new sanitation alternatives on households. In light of the majority of women's solutions to encourage landlords and governments to provide space for and/or build new sanitation alternatives, it seems important for future interventions to involve, if not require, these entities to take some responsibility in sanitation-related interventions. In addition, women identified a number of gender-specific solutions to sanitation, such as placing bins for pads in toilets and providing a free, safe, and private place to change pads/manage menstruation. These findings mimic several scholars' sentiments about redefining sanitation-related policies and interventions to not just "include" women in the design or management of projects, but to integrate gender into the very structure of these policies and interventions—i.e. develop rhetoric and strategies that recognize the historical and ongoing power imbalances that exist for women even, or perhaps especially, within the context of access to sanitation (Greed, 2015; K. O'Reilly, 2016; E Tilley et al., 2013). In addition, findings from the study suggest that there is also a need to provide opportunities, e.g. information sharing and trainings, for women, themselves, to better understand and explore the role of less common factors (e.g. security, social disorganization, privacy water access, and others identified in this study) in their ability to access and utilize sanitation in informal settlements. By providing better information and a broader perspective on the issue of

sanitation in informal settlements, women may be encouraged to explore more holistic and comprehensive solutions to the complex issue of sanitation in their communities.

### **Overall limitations of the dissertation**

Perhaps the most critical limitation of this dissertation is that the data used are cross-sectional. This limits the ability to make any causal claims or explore the temporal nature of the phenomenon under study. There are a number of analyses in this study that could have benefited from data collected over time. It is, for example, not possible to empirically determine the actual factors causing women's sanitation practices and behaviors. With cross-sectional data, one can only look at links between potential factors and women's sanitation behaviors—as was done in this dissertation.

In addition to the limitations associated with the data being cross-sectional, the sample size, in combination with the nature of the variables (e.g. mostly binary or categorical), limited the ability to run certain analyses without collapsing categories of the outcome variable or excluding some predictor variables all-together.

Furthermore, many of the measures used in the analyses in this dissertation are only exploratory. For example, although there has been a growing body of literature linking women's sanitation practices to (1) their experiences of violence related to sanitation (Corburn & Cohen, 2012; Fisher, 2008; Khanna & Das, 2016; Sommer et al., 2014), (2) their religious or cultural beliefs/rules about hygiene and urine/feces disposal (M. W. Jenkins & Scott, 2007), and (3) privacy and embarrassment associated with sanitation (K. O'Reilly, 2016), there were no existing quantitative measures to test these phenomena. Therefore, new questions had to be developed and piloted in this study.

Other measures used in this study such as neighborhood cohesion (Buckner,

1988), social disorganization (Gau & Pratt, 2008, 2010), biological drivers related to sanitation (Thilde Rheinländer et al., 2013), perceptions of cleanliness, user satisfaction (Tumwebaze et al., 2013), and perceptions of neighborhood crime and safety (Rader et al., 2007), had been used in other studies and, in some cases, were empirically tested (e.g. validated); however, most of them were applied in very different contexts and populations. Therefore, many of them had to be modified to fit the local context.

Furthermore, there were a number of measures that, after preliminary analyses of data collected during Phase I of this study, had to be modified because they were not, in their original format, able to capture the complexity of women's sanitation behaviors and/or the factors that influence those behaviors. For example, many of the toilet- and water-related questions used in this study were derived from the WHO's Core Questions on Drinking Water and Sanitation for Household Surveys (WHO & UNICEF, 2006); however, the original questions did not take into account the complexity of women's sanitation behaviors, including their diurnal versus nocturnal sanitation practices. Again, these questions had to be modified for this study and, consequently, should be considered exploratory. There were also some measures used in this study, for example questions related to water, sanitation, and hygiene, knowledge, attitudes, and practices (A. Joshi et al., 2013b; Pattanayak et al., 2007; Sibiya & Gumbo, 2013), which have been used to capture information in other studies, but which have seemingly never been empirically validated. Finally, there may have been factors that are, in fact, associated with women's sanitation practices that were simply not included in the interview and/or survey instruments. For example, some of the women in the qualitative interviews suggested that their husbands' control the finances for the household and, therefore, in some cases, have

control over a woman's ability to access a paid toilet. In some instances, this could be considered a form of economic control (Adams, Sullivan, Bybee, & Greeson, 2008) or intimate partner violence (IPV) associated with women's sanitation behaviors; however, measures of IPV were not included in this study. Finally, some measures, which were originally intended to be in the study, were removed at the request of participants and field staff. In particular, women asked that questions pertaining to tribal and religious affiliation be removed from the interview and survey questions in light of the planned 2017 governmental elections.

Language was also sometimes a challenge during the field work and in the interpretation and translation of interview responses. In Nairobi, and in Mathare, specifically, people use a dialect commonly referred to as "sheng." It is predominantly Swahili, but it incorporates English words as well as words from a number of local languages, such as Kikuyu, Luo, Luhya, and Kamba (to name a few). In addition to this mixing of words from a variety of languages, new words are made up, mostly by youth, and used all of the time in colloquial conversation. Because of the speed at which the "sheng" changes, it can lead to difficulties in grasping the meaning of certain phrases or words in context or in the translation of quotes from transcriptions. Therefore, the research team had to consult frequently with women in Mathare and other locals about the meaning of various words, phrases, or conjugations used during the interviews and "sanitation walks."

### **Implications of the dissertation**

The findings from this study have a number of implications for social work practice and for sanitation-related policy, development, interventions, and education.

Perhaps the most important implication is that gender needs to be at the center of policy and development focused on sanitation, not simply an after-thought in sanitation policies and interventions. According to a few feminist scholars, women have been disproportionately burdened by a multitude of gendered power imbalances that persist in sanitation (Greed, 2015; K. O'Reilly, 2016). The disproportionate sanitation-related burden born by women stems not only from their general disadvantaged position in society, and, therefore, access to services like sanitation, but in the way sanitation decisions are made, in the interventions that are carried out, and in the policies that govern sanitation development. Perhaps even more so, findings from this study confirmed a number of results and anecdotal claims from previous studies and provided new insights about the gendered-disadvantages women face when trying to deal with their sanitation needs on a daily basis. For example, findings from this study illustrated that a lack of bins for pads in toilets and gender-discriminatory fees to use a toilet for urination and/or menstruation management are just some barriers women face when trying to manage sanitation in informal settlements in Nairobi. These findings also highlight the need to explore not just the individual factors that affect women's ability to access and utilize sanitation, but also to critically analyze the intersectionality of women's position in the patriarchal sanitation hierarchy, i.e. the layers of stress that women cope with as they bear the burden of multiple strata of discrimination while trying to meet their daily sanitation needs.

Although this person-in-environment perspective is considered central to social work theory (Greenfield, 2011), it is often neglected in social work practice and research. Findings from this study suggest, however, that the person-in-environment perspective of

the daily challenges women face, even with regard to accessing and utilizing sanitation, could truly help social worker practitioners and researchers to better understand clients' ability to cope and function on a day-to-day basis. More generally, exploring the role clients' physical and social environments play in their ability to access and meet daily needs (e.g. the role of sanitation-related gender inequalities and norms in women's access to and utilization of sanitation in informal settlements) would likely help social work practitioners to better understand their clients' actions and decisions, particularly those of clients in vulnerable groups (e.g. women in informal settlements in “developing countries”).

The methods, analysis strategies, and interpretation of results in this study were guided by principles that cut across a plethora of disciplines and approaches. This study drew from theory and methodologies from public health, criminology, urban development, feminism and gender studies, sociology, anthropology, geography, and behavioral psychology. Ideally, the contributions of this study will cut across many disciplines as well. For example, findings about the complexity of women's sanitation practices should be incorporated into future studies looking at women's sanitation utilization, particularly in informal settlements. The mixed-methods, multiphase approach to data collection allowed for revisions to the quantitative tool that helped capture some of the complexity of women's profiles. At a minimum, the findings from this study make it clear that the common questions about women's “primary” and “alternative” sanitation facility—modeled after the WHO's (2006) “core questions on drinking water and sanitation for household surveys” and commonly utilized by WASH surveys—should be amended. Findings from this study suggest that these questions, at a minimum, need to

make a distinction between women's sanitation behaviors during the day versus during the night, particularly for women living in informal settlements.

The findings and limitations in this study also open the door for future research. One of the limitations in this study was that the majority of measures used were new, untested, and/or modified from previously validated measures. While the measures in this study seemed to be appropriate for this research context and produced meaningful and reasonable results, they were exploratory. There is a need for future research to validate these measures in different populations and contexts.

Additionally, according to sanitation scholars, detailed comparative studies are important when studying sanitation access and behavior because they allow for investigation into the socio-spatial differences between communities, cities, and even nations. Comparative studies draw attention to the ways technology, landscape, and politics influence people's sanitation experiences. (D. Joshi et al., 2011; McFarlane et al., 2014; T. Rheinländer, Samuelsen, Dalsgaard, & Konradsen, 2010) Yet, despite this recognition, few studies have carried out detailed comparative research on sanitation access and utilization between different informal settlements (McFarlane et al., 2014). Although this study explored the relationship between women's sanitation access and utilization and numerous factors on multiple socioecological levels, there was limited ability to explore a wide array of factors on a macro scale. For example, there seemed to be limited evidence in this research that there was a variation in sanitation-related policies or laws across different villages in Mathare. If, however, one were to expand this research—carrying out comparative studies across different informal settlement, cities, and/or countries—it would be possible to better explore the role of a variety of macro-level



factors in women's ability to access and utilized sanitation. One could, for example, better compare the role of macro-level factors such as sanitation-related policies, different cultural or social norms, governmental participation, history of non-governmental intervention, etc. on women's ability to access and utilize sanitation across different settlements, cities, and/or nations.

In addition to future research to validate the measures used in this study and to initiate cross-settlement, cross-city, and/or cross-national comparisons, findings from this study also exposed a need to start considering a broader array of sanitation-related interventions. Until now, most sanitation-related interventions have focused on health-related behavioral interventions, toilet provision, and/or demand-driven approaches (e.g. CLTS). Findings from this research revealed that insecurity, privacy, social disorganization, and access to water were the most common factors associated with women's sanitation utilization in Mathare. Several of these factors, namely insecurity and social disorganization, are largely related to a woman's social and/or physical environment. These findings suggest, perhaps, that sanitation policy-makers, researchers, and developers may need to expand their perceptions of the types of interventions that may yield the best results for access to and utilization of sanitation in informal settlements, particularly for women. Some of the proposed interventions, for example, may need to focus on social- and community-level interventions that improve security, social cohesion, sense of community, and social organization—e.g. interventions focused on space and community dynamics rather than exclusively toilet provision and/or adoption. These findings expose a need for future research that explores more social- and/or community-based intervention options.

Relatedly, findings from the third manuscript in this dissertation also reveal a potential need to not only expand the perspectives of sanitation scholars, policies, and developers, but to also find meaningful ways to help women, themselves, to better understand and access information about the links between less-commonly discussed factors, e.g. social disorganization, insecurity, and privacy, and their ability to access and utilize sanitation in these settings. Findings from manuscript 3 revealed a disconnect between women's solutions to sanitation in informal settlements and many of the less well-studied factors associated with women's ability to access and utilize sanitation. For example, very few women in the study provided solutions to sanitation that targeted insecurity, privacy, social disorganization, or access to water; yet, findings from manuscript 2 of this dissertation indicated that those factors, may, in fact, be inextricably linked to women's ability to access and utilize sanitation in these settlements. These findings open the door for future research that explores interventions and opportunities that might also help to broaden residents' perspectives on the issue of sanitation in informal settlements so that they, too, may be encouraged to consider more holistic and comprehensive solutions to the complex issue of sanitation in their own communities.

Overall, the findings of this research and the approach used to carry it out, on a more general level, highlight the critical need to expand our perspectives and approaches to researching, intervening and teaching about issues like sanitation coverage, particularly if we have any hope of trying achieve lofty international human rights goals—such as Goal 6 of the Sustainable Development Goals to ‘ensure access to water and sanitation for all by 2030.’ This is particularly true in light of findings from this study and other

literature that suggest women are truly disadvantaged when it comes to being able to access and utilize sanitation.

## GLOSSARY OF TERMS

*Sanitation* can refer to the management of a variety of materials, e.g., human excreta, storm water, grey water, solid waste, and hazardous and industrial wastes (Thuita, 2012). In this dissertation, however, sanitation is primarily concerned with the disposal of human excreta (urine and feces).

*Joint Monitoring Programme (JMP)* is the official mechanism of the United Nations dedicated to monitoring global progress on the Target 7 of the Millennium Development Goals (MDGs) and Target 6 of the Sustainable Development Goals, i.e. the use of safe drinking-water and basic sanitation.

*Improved Sanitation* has been defined by the Joint Monitoring Programme (JMP) as a facility that "hygienically separates human excreta from human contact" (WHO & UNICEF, 2015). Common improved sanitation facilities include: flush or pour-flush toilets piped to sewer systems, septic tanks, or pit latrines; ventilated improved pit latrines (VIPs), pit latrines with slabs, and composting toilets.

*Unimproved sanitation facilities* refer to facilities that do not hygienically separate human feces/urine from human contact. Common examples include: pit latrines without slabs, hanging toilets, or bucket latrines (UNICEF, 2017).

*Open Defecation* refers to defecation in fields, forests, bushes, bodies of water or other open spaces or disposal of human feces with solid waste (UNICEF, 2017).

*Shared Sanitation Facilities* are toilets of an otherwise acceptable type that is shared by two or more households and is, therefore, not considered *improved sanitation*. This category of sanitation includes public toilets (UNICEF, 2017).

*Adequate Sanitation*, as defined by UN-Habitat, refers to sanitation in which "the quality of the provision is convenient for all household members, affordable, and eliminates their (and others') contact with human excreta and other wastewater within the home and the wider neighborhood." If households do not have toilets in the home "toilets close by that are well maintained, affordable, and accessible without queues" may also be included in the definition (United Nations Human Settlements Programme, 2003)

*Informal Settlements (slums, squatter settlements, low-income areas, peri-urban settlements)* although not well-defined, have a number of common characteristics including: (1) inadequate access to basic services, particularly safe water and sanitation infrastructure; (2) overcrowding and high densities; (3) substandard housing or illegal structures built with non-durable materials, (4) unhealthy living conditions and hazardous locations, i.e. land unsuitable for settlement including floodplains or areas near industrial plants or dumping sites, (5) insecure tenure, i.e. no protection from arbitrary and/or unlawful eviction; (6) poverty and social exclusion, i.e. income or capability poverty among residents, high levels of crime or social dislocation, and often vulnerable groups such as immigrants, ethnic minorities, and internally displaced persons; and (7) minimum settlements sizes, i.e. the settlement is big enough to constitute a distinct area (Un-Habitat, 2004). Based on these common characteristics of informal settlements, UN-Habitat recently adopted an "operational" definition of informal settlements, i.e. an informal settlement is an area that combines, to varying degrees, the following characteristics: (1) inadequate access to safe water; (2) inadequate access to sanitation and other infrastructure; (3) poor structural quality of housing; (4) overcrowding, and (5) insecure residential status (Un-Habitat, 2004, 2008a). While the terms informal

settlement, low-income area, peri-urban settlement, squatter settlements, and slum are often treated as interchangeable (Heise, Ellsberg, & Gottemoeller, 1999; Mazeau, 2013), the terms "slum" and "squatter settlement" can frequently carry a negative connotation; thus, they will be avoided and the term "informal settlement" is used throughout this dissertation.

*Land Tenure* are structures and processes of delivering land access and rights (Williamson, Enemark, Wallace, & Rajabifard, 2010). These are agreed upon systems that determine land allocation, security of tenure, transactions of property and land, land use and management of land disputes, i.e. the process through which residents and developers, for example, can access land, secure their rights, control transactions and solve land related disputes (Bazoglu, Sietchiping, Mboup, & Augustinus, 2011). Land tenure systems can be formal or informal. Formal land tenure usually refers to legal ownership of land while informal land tenure is defined, instead, by the informal relationships people develop to establish their affiliation to land. Land tenure can refer not only to land ownership, but to the systems that ensure a person cannot be forced to move (UN-Habitat & Network Global Land Tools, 2008). Secure land tenure occurs when rights are underwritten by a known and accepted set of rules (Laksa & El-Mikawy, 2009).

*Demand* is defined in a number of different ways in the literature, including: demand as an assumed level of service, demand as a measure of willingness-to-pay for a new technology or service, and demand as an expression of a human right to sanitation. Although the emphasis of this research is not to assess women's "demand" for sanitation in informal settlements in Nairobi, it is none-the-less, important to have a basic

understanding of how this term is used in the sanitation literature. Therefore, for the most part, "demand" in this work will be defined as "an informed expression of desire for a particular service, measured by the contribution people are willing and able to make to receive this service" (Little & Rubin, 2014).

*Acceptability* is not well defined in the literature (Brunson, 1996); however, Mazeau (2013) suggests that acceptability is associated with the values, perceptions, and preferences of an individual or group with regard to sanitation. According to Mazeau (2013), acceptability of sanitation is frequently assessed by investigating people's values, perceptions, and preferences for sanitation and comparing these self-reported data with people's actual use of facilities (Diallo et al., 2007; Mazeau, 2013; Naranjo et al., 2010; Van der Meulen, Moe, & Breslin, 2003). According to Mazeau (2013), acceptability can change over time as characteristics of the user and technology change. This dynamic definition of acceptability will provide a guide for assessing women's perceptions, experiences, and utilization choices related to sanitation in this study.

*Acceptance* is not well-defined nor frequently used separately from 'acceptability' in the literature (Mazeau, 2013). However, Mazeau (2013) attempts to differentiate between the terms--suggesting that there is a temporal difference between 'acceptability' and 'acceptance', i.e. 'acceptability' refers to a user's "attitude towards [a] project before its implementation" and 'acceptance' is frequently understood to be a user's "attitudes after the project's implementation" (pp. 2-58).

*Utilization* refers, in this dissertation, to the actual use of specific sanitation facilities and/or methods of feces disposal. While some sanitation-related literature refers to "use" only in reference to the use of facilities/toilets, this study refers both to the use of

facilities/toilets as well as the use of open defecation, bags, buckets, etc. Acceptance, acceptability, and demand may be discussed in this study; however, the research focuses specifically on the measurement of women's sanitation utilization choices and patterns.

*Long Call* is a colloquial term used by most women in the Mathare Valley Informal Settlement in Nairobi, Kenya to refer to the process of defecation. This term will periodically be used throughout this dissertation when referring to women's methods of disposal for feces.

*Short Call*, similarly, is a colloquial term used by most women in the Mathare Valley Informal Settlement in Nairobi, Kenya to refer to the process of urination. This term will periodically be used throughout this dissertation when referring to women's methods of disposal for urine.

*Plot Toilet* is a colloquial term used by most women in the Mathare Valley Informal Settlement in Nairobi, Kenya to refer to a toilet that is either: (1) inside a multi-story building, sometimes on each floor of the building and is shared by all the tenants of that building or floor or (2) inside a gated cluster of houses (plot) and is shared by all the tenants of that plot.



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