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"There is no place to dispose them. What would you have me do?'': A qualitative study of menstruation in the unique physical and social environment in informal settlements in Nairobi, Kenya

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ABSTRACT

Menstrual Health and Hygiene (MHH) is an essential component of individual and population-level health and is inextricably linked to the environment. Few scholars have explored women's day-to-day experiences of managing their monthly period within the unique environment of informal settlements. We used data from in-depth interviews with women 18–55 years in Mathare informal settlement in Nairobi, Kenya. Findings suggest that aspects of the social environment, particularly menstrual stigma and social and gender inequities, combined with resource limitations, such as lack of water, sanitation, disposal facilities, and waste management influence menstrual management, and this, in turn, impacts the physical environment.

1. Introduction

Menstrual health and hygiene (MHH) is an essential component of individual and population-level health, and is inextricably linked to the environment (Sommer et al., 2021b; Kaur et al., 2018). Experts define MHH as "the needs experienced by people who menstruate, including having safe and easy access to the information, supplies, and infrastructure needed to manage their periods with dignity and comfort as well as the systemic factors that link menstruation with health, gender equality, empowerment, and beyond" (SOMMER et al., 2021b(p2)). Ongoing menstrual stigma, social and gender norms, and social and gender inequities influence women's practices, experiences, and perceptions of managing their menstruation (Hennegan and Montgomery, 2016; Sommer et al., 2013). Additionally, aspects of the physical environment, such as access to and affordability of products, safe and hygienic places to manage menstruation, water, and systems of disposal and waste management for menstrual products or materials, all influence the ability to manage menstruation with dignity and comfort (Hennegan and Montgomery, 2016).

In turn, menstrual management practices, including the use and disposal of menstrual products and materials, can have an effect on the environment (Vora, 2020). Lack of appropriate disposal options for menstrual products and materials, for example, may lead to disposal practices that contribute to pollution of land and waterways (Kaur et al., 2018). Research has also shown that women lacking reliable access to safe, private, and clean toilet facilities may have to use alternative sites for managing menstruation as well as urination/defecation during monthly periods (Sommer et al., 2015, 2020). This includes use of open or public spaces that heighten the risk of community exposure to human waste and contribute to contamination of local environments (Sommer et al., 2015, 2020; Kaur et al., 2018).

While a growing body of literature documents the importance of the social and physical environment to managing menstruation, there is limited literature focused on women living in informal settlements. Hence, this study sought to explore women's day-to-day experiences of managing their monthly period within such contexts in Nairobi, Kenya.

Approximately one billion people, globally, reside in informal settlements, including close to 60% of the urban population in Africa (UN-Habitat, 2015). While there is no official definition of an informal settlement beyond unplanned settlements not authorized by the State (Jones, 2017), scholars and development entities have created practical definitions to help demarcate these settlements from other urban neighborhoods and populations. The definitions stipulate a set of measurable criteria based on the spatial and material conditions in a community. The most widely-used definition defines informal settlements (slums) as areas that meet any one of five conditions: lack of clean

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water, lack of sanitation, non-durable construction, overcrowding, and insecure tenure (UN-HABITAT, 2006, p.19). In Kenya, specifically, the government has defined a slum as "a human settlement characterized by dilapidated housing structures, overcrowding, abject poverty and unemployment, high insecurity incidences, insecure land tenure, exclusion of physical development, inadequate infrastructural services and often located in an unsustainable environment" (Government of Kenya, 2016, p.iii).

The development and persistence of informal settlements in nearly every city in the world has cemented them as a universal urban phenomenon (Jones, 2017). Early theories described the emergence of informal settlements and the conditions within them as an unavoidable step in the process of economic growth and development (Frankenhoff, 1967; Turner, 1969). These settlements were portrayed as transitional spaces where low-income migrants pursing economic opportunities in cities could find cheap housing alternatives if they were unable to access or afford housing in the formal housing market (Frankenhoff, 1967; Turner, 1969). According to such theories, migrants would, over time, integrate into the economic life of cities and either move away from informal settlements into middle-income communities or invest in upgrading their current living conditions—thereby improving overall conditions in settlements or eliminating the need for them entirely (Fox, 2014). Given the permanency and scale of growth of informal settlements, however, other theories advanced over time to explain their development and persistence (Fox, 2014; Jones, 2017). For example, research on sub-Saharan Africa suggests that settlements may be a product of "disjointed modernization" (Fox, 2014) in which the population growth in cities exceeds urban economic and institutional development (Fox, 2014; Mitullah, 2003; Anyamba, 2011; Jones, 2017). According to this perspective, urban inequality and the emergence of informal settlements in sub-Saharan Africa are a legacy of colonialism, in the form of government disinvestment/underinvestment in infrastructure and exploitative governance, and linked, today, to the persistence of and inadequate living conditions within them (Fox, 2014; Mitullah, 2003; Anyamba, 2011; Jones, 2017).

In Nairobi, for example, scholars suggest that informal settlements resulted from segregation rooted in specific racist colonial migratory policies and practices developed during the British colonial period in Kenya (Wanjiru and Matsubara, 2017; Mutisya and Yarime, 2011; Ono and Kidokoro, 2020; Mitullah, 2003). Under the 1922 Vagrancy Act, for example, native African migrants who did not have work agreements in Nairobi were considered illegal city residents (Macharia, 1992; Corburn and Karanja, 2014). Thus, they were effectively forced to settle illegally outside the city and/or in ecologically sensitive areas like floodplains, geographically hazardous zones, lowlands, valleys, wetlands, or waste dumps within the city (Wanjiru and Matsubara, 2017; Darkey and Kariuki, 2013; Ono and Kidokoro, 2020). Even those with work permits were denied access to formal services like water and sanitation (Corburn and Karanja, 2014). According to scholars, the lingering effects of these policies combined with rapid urbanization, planning frameworks inherited from the colonial regime, continued government disinvestment, and political exploitation in informal settlements have sustained a legacy of social and spatial segregation (Ono and Kidokoro, 2020; Fox, 2014; Anyamba, 2011; Mitullah, 2003; Wanjiru and Matsubara, 2017; Macharia, 1992; Corburn and Karanja, 2014; Darkey and Kariuki, 2013). Consequently, residents face ongoing inequalities such as exclusion from health and social programs (Wanjiru and Matsubara, 2017; Darkey and Kariuki, 2013; Mitullah, 2003) and lack of formal water, sanitation, and waste management services (Darkey and Kariuki, 2013; Wanjiru and Matsubara, 2017; Mitullah, 2003) that we hypothesize influence MHH in these communities.

The burden of the social inequalities in informal settlements is borne disproportionately by women. Research suggests, for example, that, due to gender inequities and harmful gender norms, women in informal settlements, compared to men, bear more responsibility in childcare (Chant and McIlwaine, 2016) and domestic roles, including collecting water (Bapat and Agarwal, 2003; Chant and McIlwaine, 2016), but are disadvantaged in accessing regular employment (Izugbara et al., 2014; Otieno et al., 2020; Suda, 2002) and, relatedly, health insurance and healthcare (Otieno et al., 2020). In general, women in these settlements are also poorer in terms of income, assets, access to education and secure housing (Oxfam et al., 2015; Chant and McIlwaine, 2016). At the community level, women are often excluded from or have diminished roles in decision-making processes such as discussions of public infrastructural development projects and budgeting (Chant and McIlwaine, 2016; Izugbara et al., 2014; Simiyu et al., 2017) and are more exposed to gender-based violence at home (Izugbara et al., 2014) and in the community, e.g., in shared toilets and bathrooms (WINTER et al., 2021a, WINTER et al., 2018). All of these challenges can have an effect on women's experiences and management of menstruation in these communities.

The limited existing evidence on the experiences of menstruation in informal settlements focuses largely on adolescent girls in school environments (Girod et al., 2017; Chebii, 2018; Deshpande et al., 2018; Crichton et al., 2013), with only a few studies including experiences of adult women (McCarthy and Lahiri-Dutt, 2020; Chakravarthy et al., 2019). The research conducted in school environments does however draw important links between menstrual stigma and challenges in the built and social environment in informal settlements. Girod et al. (2017) found that fear of harassment by male students and insensitivity and incomplete information about menstruation from teachers, combined with lack of access to menstrual materials and adequate facilities for hygiene, made managing menstruation uncomfortable for girls in schools in informal settlements. Another study that focused on societal and cultural norms showed that religious practices, 'menstrual taboos,' and superstitions about menstrual blood, combined with inadequate facilities to manage menstruation at schools in settlements, may add to adolescents' perception of menstruation as a time of exclusion from activities and embarrassment (Chebii, 2018). Privacy issues related to using toilets and bathrooms have also been identified as a challenge associated with negative experiences of menstruating for adolescent girls in schools in informal settlements (Deshpande et al., 2018; Chebii, 2018) and women in non-school environments in informal settlements, more broadly (Chakravarthy et al., 2019). Unaffordability of menstrual products, lack of access to water for hygiene; and fears about safety and security are additional challenges identified as influencing both girls' and women's experiences of menstruating in informal settlement contexts (Chakravarthy et al., 2019; Chebii, 2018).

To date, little attention has been paid to women's menstrual management practices in informal settlements or how these practices influence the environment. In this paper we discuss women's day-to-day experiences with managing menstruation in environments where services for water, sanitation, and waste management and disposal are limited and social and gender inequities are prevalent. We specifically explore how these MHH practices, in turn, influence the environment.

2. Methods

2.1. Research design

Between August 2015–July 2016, we conducted a mixed-methods study exploring women's day-to-day experiences of menstruation, urination, and defecation in informal settlements—their access to and utilization of spaces and services, especially water and sanitation; their practices and the factors that influenced those practices; and the intersection of those practices with the environment. The study included: 1) in-depth interviews with women living in a large informal settlement in Nairobi, followed by go-along interviews in the community to witness the 'lived experience' of navigating the different spaces and places women described during interviews and 2) quantitative surveys with a probability sample of women living in the same informal settlement. The qualitative and go-along interviews were conducted in parallel with the

same group of women. Findings from these interviews helped to guide the design of the quantitative surveys, which were carried out later. The findings described in this paper draw on the in-depth interviews. Findings from other parts of the study, particularly those focused on urination/defecation are published elsewhere (e.g., Winter et al., 2019a). This study was reviewed and approved by the Institutional Review Board at Rutgers, The State University of New Jersey and the National Commission for Science, Technology, and Innovation (NACOSTI) in Nairobi, Kenya.

2.2. Research setting

Data for this study were collected in Mathare Valley Informal Settlement in Nairobi. Mathare is home to over 200,000 residents and is one of Nairobi's oldest, largest, and most densely populated informal settlements. It is divided into 11 villages (Mabatini, Mashnimoni, Namba 10, 3A, 3B, 3C, Village 2, Kosovo, Githathuru, 4A, and 4B), and sits in the valleys of the Mathare and Gitathuru rivers (Corburn et al., 2012). The settlement is diverse, with 106,522 males to 100,028 females (KENYA NATIONAL BUREAU OF STATISTICS, 2019) and residents representing tribes from all over Kenya (APHRC, 2014), many with unique cultural perceptions about and practices related to menstruation (Chebii, 2018). Mathare is home to many migrants, but most residents were actually born and raised there (Celentano and Habert, 2021). Most households in Mathare rely on water from taps, wells, vendors, or other sources outside their homes and/or building or housing plots, which can be costly (Sarkar, 2020). Residents also rely mostly on shared toilets outside their homes, buildings or housing plots. Some of these toilets are open to the public, others only to specific residents (e.g., residents of certain buildings or housing plots). Some are large with separate gender blocks and many stalls, and others are smaller with one or more pit latrines or individual toilet rooms. Most of these toilets, especially public toilets, cost money to use. Those who do not have access to shared toilets or cannot pay for public toilets rely on open defecation, buckets at home, or utilize paper bags or newspaper (sometimes referred to, locally, as 'flying toilets' because they are thrown or tossed into drainages, onto rooves of houses, in waste heaps, or in open spaces) (WINTER et al., 2019a). Estimates from around the time of the study suggested that there were approximately 144 pay-to-use public toilets in Mathare each shared by an average of 85 households (Corburn and Hildebrand, 2015). While informal settlements and the residents living there are not uniform (Ono and Kidokoro, 2020), many households in these communities live at or below the universal poverty line (Oxfam et al., 2015) of US $2.15 per day (World Bank, 2022) and have regular expenses that exceed their monthly incomes (Celentano and Habert, 2021), e.g., rent; food; school fees for children; fees to visit shared toilets and showers; fees for purchasing water; and transportation costs. In Mathare, households typically face an average monthly deficit of KES 3000 (US $30) (Corburn et al., 2012).

2.2.1. Sample and recruitment

A purposive sampling technique was used to recruit women for in-depth interviews. The Chief of Mathare, village chairmen, and representatives from non-profit organizations contacted leaders of women's groups they knew from each village in Mathare (examples of groups included: microfinance, community development, single-mothers, reproductive and women's health, and self-help groups) to share the date and time for introductory meetings about the study with their members. We held introductory meetings with approximately 20–70 women in each village in Mathare. Women were provided information about the study and, if interested in participating, were asked to sign up and provide basic demographic characteristics, contact information, and sanitation and hygiene practices. From the sign-up sheet, 55 women were selected who represented a broad range of demographic characteristics and sanitation and hygiene practices. To be eligible for the study, women had to be at least 18 years old, residents of Mathare, able to speak Swahili or English, and provide consent.

Of the 55 women in the sample, 26 were married and 29 identified as the head of their household. Twenty-one women reported having a business, 12 reported being formally employed, and nine reported working odd jobs such as washing clothes or doing domestic work for households in more affluent neighborhoods. Three participants were between 18 and 24 years, 41 were between 25 and 34, 15 were between 35 and 44, and 9 were over 45. Five women reported not menstruating anymore at the time of the study. Most women (n = 53) had children. Thirty of the participants had monthly incomes less than KES 10,000 (US $100).

2.3. Data collection

We conducted 55 in-depth interviews. Interviews were conducted by a team of two researchers—one foreign-born, white, and female-identified and one Kenyan-born, Black, and female-identified. Both researchers lived in Nairobi throughout data collection and early analysis (2015–2017) and speak Swahili and English. Each interview lasted approximately 60–90 min. To ensure confidentiality while discussing a sensitive topic, interviews were carried out in each woman's home when no one else was present. Interviews focused on participants' day-to-day practices managing menstruation during their monthly periods.

To ensure inclusion of participants regardless of literacy level, interviewers read the informed consent document aloud. Participants were asked if they wanted someone to review the document or had any questions they wanted to ask. The interviewers then engaged participants in a discussion to ensure participants understood the key elements of the consent. All participants provided a signature or personalized written mark acknowledging their consent to participate. Participants were compensated KES 200 (~US $2). Interviews were audio-recorded and transcribed.

2.4. Data analysis

Transcriptions were analyzed using NVivo qualitative analysis software (v.12) (QSR, 1999). Researchers' experience and sensitizing concepts related to perceptions and practices of menstrual management in informal settlements were used to develop a list of predefined codes. Two researchers—one who was the principal investigator and part of the original data collection team and another, a Kenyan researcher, with local ties to Mathare—used this list to carry out cross-case, thematic analysis—adding their own codes and concepts as they reviewed and analyzed transcripts. The two researchers reviewed each other's codes, concepts, and themes. Regular discussions between the two researchers took place throughout the coding process. Discrepancies in researchers' codes and interpretations were discussed until a consensus was reached according to best practices of qualitative research (Harry et al., 2005). A third researcher and author on this paper, an expert in MHH in low-income countries (LICs) then reviewed codes and thematic areas, and provided input on the organization and interpretation of findings.

2.5. Findings

Findings that emerged are organized into three overarching themes: (1) Inadequate access to water and sanitation; (2) Disposal and waste management challenges; and (3) Menstrual stigma, shame, and embarrassment interact with lack of adequate water and sanitation, disposal, and waste management options. To protect the identity of participants, participant IDs and village names are used in place of names following each quote.

2.6. Inadequate access to water and sanitation for menstruation

A common challenge that emerged from women's descriptions of their day-to-day experiences managing menstruation in informal

settlements was the lack of adequate toilet facilities with water. Only two women reported having a private toilet. The remaining participants reported having access to shared, often public, toilets outside their homes. Women described a number of barriers to regularly using these toilets (e.g., fears of victimization and crime in accessing toilets, lack of cleanliness of facilities and related fears of contracting infections or illness, prohibitive costs of pay-per-use facilities, lack of privacy, and inaccessibility of facilities due to distance, limited hours of operation, and common blockages), which are described in detail in another publication (WINTER et al., 2018).

In general, instead of going to the toilet, women described using small buckets or basins in or near their homes for urination and defecation, e.g., "I just come for that bucket … you just put it here in the house. When it turns to night, you pour it outside" (ID044, Kosovo). The buckets were emptied into nearby open drainage ditches when no one was looking (e.g., early in the morning or at night in the cover of darkness). Some participants also reported using plastic bags or newspapers for defecation at home to avoid going to the toilet, e.g., "it is a must I put a paper bag there [pointing to spot in home] … I cannot go to help myself [at the toilet]. It is a must I just do this" (ID051, Village 4A). These bags and papers were then thrown or disposed of in nearby drainages, rivers, rubbish piles, or open spaces.

Women in this study talked about the compounded challenges of using shared toilets for managing menstruation, which included: lack of water for flushing and/or cleansing oneself during menstruation, insufficient privacy, and unaffordability, specifically for changing products/materials. For these reasons, many women opted out of using toilets during menstruation—choosing, instead, to urinate/defecate and manage menstruation at home during this time—a choice with potential implications for public health and the environment.

One of the specific challenges women discussed in relation to using shared toilets during menstruation was a lack of water for flushing or hygiene. Their explanations included the potential embarrassment faced by not having water to flush away the signs of menstruation (blood or pads): "Okay we usually use the toilet, but sometimes there is no water. There is a problem with water; so, when you are on your periods it is a must you use a plastic container or bucket [at home] so that no one sees your dirtiness [blood]" (ID003, Mabatini). Some participants explained how this was especially challenging in toilets without separate gender stalls, e.g., "Maybe I have my period, you see, and I forgot to carry water. I was like going to urinate … blood comes out and I did not carry any water. A man comes, he enters, he sees that blood. He knows that it was me" (ID027, 3C). Although accessing water can also be an issue for women at home (Sarkar, 2020), participants seemed to suggest that it was still an easier place to manage menstruation: "I change [my pads] in the house, coz you have to change then you have to take a 'passport shower' [wash briefly with a basin or moist towel]" (ID015, 3A).

A lack of privacy associated with water and sanitation infrastructure in available shared and public toilets also emerged as a barrier to managing menstruation. Women were concerned about a lack of doors or locks for individual toilet stalls and the pervasiveness of holes in doors or facility structures, e.g., "There are gaps in the door. Sometimes you will find I am standing here and somebody is in the toilet. You feel like he or she is seeing what I am doing inside there" (ID015, 3A). Most women described how home was their preferred place to manage menstruation because of the increased privacy it afforded. During the day, women were often alone at home when older children were at school or could be asked to go outside temporarily; and partners were at work, out looking for work, or elsewhere in the community.

The affordability of shared or public facilities was another barrier that arose in relation to menstruation. Most women described how these toilets in Mathare are pay-per-use facilities, meaning they have to pay a small fee every time they use the toilet. While there are some toilets that allow households to pay a monthly fee for unlimited use, these fees must be made in single, lump sum payments that are hard for many households to afford (WINTER et al., 2018). Thus, some women opt not to use toilets to manage menstruation. For example, "Every time you change your pad you pay. So, you can only use [the toilet] once a day." (ID001, Mabatini).

2.7. *Disposal and waste management challenges*

A related set of challenges was centered around lack of formal waste management systems and places to dispose of menstrual products in Mathare. In particular, many participants talked about a lack of rubbish bins for disposing of menstrual products in shared or public toilet facilities. For some women, the lack of bins combined with the cost of using toilets for managing menstruation was demonstrative of broader gender inequities. One participant described her frustration that pay-per-use toilet facilities often have free urinals for men, yet require women to pay to urinate, change their pads, and do not provide disposal bins for menstrual products:

> When it comes to sanitation blocks it is not gender balanced … Maybe I'm just going in there to change the pad and there is no dust bin … that is the one reason why I took my 5 bob [US $.05] there ….I paid my five shillings expecting if I enter there I will get the bin … And I've not found it. What will I do? I'll avoid going there … In men's toilets 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?.. Why don't women also be given a free urinal?..And there are no bins. (ID002, Mashimoni)

Women also complained about a general lack of formal waste management and designated places for disposal in the broader community, e.g., "There is no place to dispose them. What would you have me do?" (ID005, Mabatini). In lieu of formal systems and places for product disposal, women have adopted a variety of alternative disposal methods. Some participants reported disposing of products in waste bins or bags in the home and then dumping them in large rubbish piles scattered throughout the settlement. Others immediately dispose of products in these waste heaps. For example, "We all do it differently. I put mine in a black plastic bag and throw it where we dispose of our garbage" (ID011, 3B). Both approaches suggest the possibility of negative environmental impacts from the lack of organized disposal options.

A further impact on the community environment from menstruation practices stemmed from women disposing of menstrual products indiscriminately or "any which way" ("ovyo ovyo" in Swahili). This included throwing them on rooftops or in the open. For example, "up here on the roof of this apartment if you touch the iron sheets you'll discover that they have put pads there" (ID041, Kosovo) or "[pads] are so many here. If you walk behind our houses you will see a lot of them" (ID053, 4A). Such approaches similarly appeared to emerge from a lack of alternative and potentially more environmentally-friendly options.

The natural environment was also described as being impacted by menstrual practices in relation to women lacking waste management options. Many participants *directly* disposed of menstrual products in rivers, e.g., "I collect my pads together and dispose them at the river" (ID041, Kosovo) or "I just wrap it [the pad] with a plastic, I fold it nicely then I throw it in the river … In the nylon [plastic bag] I will put a stone so that it will be heavy" (ID015, 3A). Those who live at a distance from the river take advantage of the system of informal open drainages that flow next to homes all throughout Mathare; the latter representing a more convenient disposal site, e.g., "I throw [pads] in the open drainage with the hope that when it rains they will be washed away" (ID026, 3C). Products may also end up in rivers or open drainages *indirectly* when women dispose of products with other household rubbish and then empty the bins into the river. While others reported disposing of products in toilets that empty directly into rivers or open drainages.

Women also highlighted how the insufficient waste management options ultimately compound the problems encountered with sanitation and sewage systems in the settlement. Women described several issues that arose, such as blockages that commonly occur with disposing of

menstrual products in open drainages: "… others throw [products] in the open sewer. That blocks the whole system" (ID041, Kosovo).

2.8. Menstrual stigma, shame, and embarrassment interact with lack of adequate water and sanitation, disposal, and waste management options

Across most of the participants there was an association of menstruation with embarrassment, shame, and/or dirtiness. These emotions and perceptions of periods were exacerbated by the inadequate access to water, lack of privacy, problematic toilets fees, and insufficient places to dispose of menstrual products. In many communities across sub-Saharan Africa, there are beliefs about menstrual blood as harmful or dirty; this, in turn, often leads to behaviors to conceal it (Chebii, 2018). Many women, for example, talked about how shameful it is to leave products in shared or public toilets, bathrooms, or showers, e.g., "I don't like the way women dispose of their pads. They go to the shower when that thing [pad] has filled. They remove it and leave it on the window. It's shameful." (ID048, 4B). Yet, when faced with the potential embarrassment of having to carry used menstrual products out of these facilities, some women choose to leave their products in the stalls/facilities or dispose of them in toilets anyway as the better of two not good options, e.g., "[women] use pieces of cloth and they are ashamed to walk out of the toilets with them; therefore, they decide to throw them in the toilet and it ends up blocking" (ID027, 3C). Beyond fearing feelings of shame, some women also fear harassment if they use shared or public toilets during menstruation:

> [Women] leave pads in the toilet a lot. [If] you happen to be the next in line you will have a really tough time. People assume that you are the one that left the pad there and they insult you. That's why we prefer to urinate in a container [at home] (ID044, Kosovo).

Menstrual stigma also seems to exacerbate issues related to inadequate waste management collection and disposal in Mathare. Menstruation was commonly described as "dirty" or "unsafe," with a need to hide both blood and used products. Without formal disposal systems, women have adopted strategies that minimize their risk of embarrassment. However many of these approaches may exacerbate environmental challenges in these settlements. At a minimum, participants described wrapping used products in plastic bags to ensure no one would see them, e.g., "I put my pads in a plastic bag and tie it up. We have a bin. I put them in the bottom of the bin. I don't want anybody else to see them. It's shameful for people to see your blood. I don't even want my husband to know I am bleeding" (ID019, Namba 10). Others choose to burn used products, hoping this might be the best way to minimize embarrassment:

> *… I burn mine. The danger of mixing the pads with the rest of the garbage is that there are children who play there and they may find a bag and open it out of curiosity to see what they can find. It's not safe* (ID037, Gitathuru)

While participants seem to be doing the best they can to manage menstruation under these circumstances, many expressed an on-going fear or worry about their adopted methods of disposal—suggesting that there may be stigma attached to most, if not all of these approaches even if they are the only options available:

> *I'm afraid that where I dispose them my landlord might see me, and they don't like us to throw garbage everywhere. If they saw me, they might make me take it back to my house, unless I decide to do it by the road. So, we tie our pads in bags and dispose of them with the rest of the garbage. But the owner has complained.* (ID013, 3A)

Despite the intersecting challenges of menstrual stigma and lack of adequate water and sanitation and disposal and waste management options in this community, women do the best they can to teach their daughters how to manage menstruation in these settlements, "We sensitize them [our daughters] on the disadvantages of disposing of pads carelessly … We used to throw them at the river, but once NYS [the National Youth Service] came we changed" (ID029, 3C).

3. Discussion

The purpose of this study was to explore women's menstrual management practices within the unique physical and social environment of informal settlements in Nairobi. Across the villages of Mathare, the study's findings suggest that inadequate access to water and sanitation and insufficient disposal and waste management options interact with prevalent social and gender inequities and menstrual stigma to shape women's experiences of managing their monthly periods. And this has larger implications for the environment, which include potential negative impacts on both the natural and community environs within or bounding the settlement.

Lack of access to adequate sanitation facilities in informal settlements is a key challenge to managing menstruation. Most settlements are largely excluded from formal water, sanitation, and waste management systems, and housing density and building challenges often make shared or public toilets the only available options for residents (Goddard and Sommer, 2020). In this study, approximately 60% of women reported using public toilets during the day and another 29% reported using shared building or housing plot toilets. Additional research in Mathare (WINTER et al., 2019a, WINTER et al., 2019b) and in other informal settlements (Deshpande et al., 2018) show similar patterns of toilet use and availability. A small body of research has highlighted that limited access to private toilets and use of overcrowded shared toilets adds to negative experiences of menstruation for girls and women in such contexts (Crichton et al., 2013; Girod et al., 2017; McCarthy and Lahiri-Dutt, 2020; Chakravarthy et al., 2019; Deshpande et al., 2018). The insights from the participants in our study support this perception, with women suggesting that they may opt not to use toilets at all during menstruation to avoid negative experiences. This is particularly pronounced for those who rely on toilets with shared gender stalls, where they fear being discovered to be menstruating or harassed. Instead, women often choose to use open defecation or bags/buckets at home that are most frequently emptied into drainages outside people's homes. This contributes to pollution of waterways, e.g., by adding excess nutrients that can be detrimental to ecosystems downstream (Danquah et al., 2011).

Several characteristics of shared and public toilets in informal settlements contribute to women's negative menstruation experiences and, consequently, their (un)willingness to use these facilities. Our analysis indicated that affordability, given the pay-per-use fees to access shared or public toilets, can be a usage barrier during menstruation. There was also suggested to be a prevailing gender disparity in affordability of toilets in Mathare, a reality that is exacerbated during monthly menstrual management. Women described having to pay for every use of shared or public toilets, no matter the reason for use (e.g., urination, changing menstrual products/materials); yet, many toilets provide free urinal spaces for men. Lack of adequate water for managing menstruation in toilets also acted as a barrier to use. Several women in this study chose not to use toilets during menstruation because they could more easily access water for washing at home, where they also did not have to worry about people seeing their blood when no water was available to flush toilets. Similar findings emerged from studies conducted in informal settlements in India, which also emphasized the importance of having adequate water for managing menstruation in toilets (Chakravarthy et al., 2019). Finally, dilapidated or missing safety and privacy mechanisms in shared toilets (e.g., doors on stalls, locks on doors, separate gender stalls) has been found in many low resource contexts to lead to negative experiences of menstruation; the latter range from restrictive and unsafe menstrual practices; problematic product disposal; and shame and distress (Hennegan and Montgomery, 2016). As our findings indicated, these experiences can also affect women's willingness to use toilet facilities at all during menstruation.

An overarching insight, and one that has been found in multiple studies carried out in other informal settlements, was how lack of adequate disposal mechanisms for menstrual products can contribute to restrictive menstrual practices (Deshpande et al., 2018; Chakravarthy et al., 2019; Crichton et al., 2013); environmentally-problematic products and disposal (Deshpande et al., 2018; Chakravarthy et al., 2019; Crichton et al., 2013); negative physical (Crichton et al., 2013) and mental health challenges (Girod et al., 2017; Chakravarthy et al., 2019; Crichton et al., 2013) and lost or inhibited social and educational opportunities (Hennegan and Montgomery, 2016; Girod et al., 2017; Chakravarthy et al., 2019; Crichton et al., 2013). For example, negative experiences of menstruation resulting from lack of access to adequate facilities and disposal mechanisms for managing menstruation can affect women's and girls' willingness to go school or places of employment (Hennegan and Montgomery, 2016) or to fully participate in daily activities (Crichton et al., 2013). Government disinvestment in many informal settlements has led to exclusion from most formal solid waste collection and management systems, which may contribute to poor provision of receptacles for disposal of products in shared toilets (Chakravarthy et al., 2019; Goddard and Sommer, 2020).

Research focused on menstruation has acknowledged that lack of adequate disposal mechanisms has negative consequences on community and natural environments (Vora, 2020). The insights from the Mathare study suggest that these environmental challenges may be especially prevalent in informal settlements. Most participants, for example, lacking safe, private, and environmentally-friendly alternatives, disposed of their pads and/or pieces of cloth/old clothes in rivers, open drainage ditches, toilets, or garbage heaps throughout the settlements–impacting community environments. Women talked about blockages in drainage systems and toilets resulting from disposing of menstrual products and materials in drainages, open areas, and toilets in lieu of adequate disposal alternatives, which impact the built and physical environment. Disposable sanitary products can also contain a host of dioxins, pesticides, and chemical fragrances that may be harmful for ecosystems in soils and waterways (Kaur et al., 2018), which also potentially affects the natural environment.

Both local and widespread stigma surrounding menstruation and gender inequities in access to water, sanitation, and waste management in informal settlements seemed to compound women's menstrual management challenges. Menstrual stigma and associated feelings of embarrassment and shame have been linked to women's and girls' experiences of menstruation around the world (Sommer et al., 2013). Research suggests that while perceptions of menstruation differ between tribes and cultures across Kenya, most consider menstruation to be shameful or even harmful or dangerous (Chebii, 2018). Our findings corroborate evidence from research carried out with adolescent girls in informal settlements in Kenya that suggest girls in these communities, fearing shame and embarrassment, especially from boys and men, strive to conceal their menstrual blood and products from others (Chebii, 2018). In addition to trying to conceal menstruation in shared or public toilets, particularly those without separate gender stalls, some women reported trying to conceal menstruation even from their husbands. Most women felt that, at a minimum, menstrual products needed to be wrapped in black plastic bags before being disposed of in rivers, drainages, open garbage piles, or in common areas in order to prevent anyone from seeing what was being disposed. Wrapping products in plastic, even products which are potentially biodegradable, such as cotton or cloth, exacerbates pollution of land and waterways.

3.1. Limitations

There are two main limitations of this study. One, was the relatively small sample size. Mathare has a population of over 200,000 people. A larger sample would likely have captured a broader range of menstrual practices and related environmental challenges. Two, due to the timing of data collection for this study, we may also have missed some important socio-cultural factors influencing women's menstrual management in this setting. Data for this study were collected during the period leading up to the 2016 Kenyan presidential elections when political incitement of tribal/ethnic conflict was a serious concern for women (Shilaho, 2018); thus, most women expressed not feeling comfortable disclosing their own tribal identity and/or tribal factors associated with menstruation. This could be an especially important area of future study because of the diversity in informal settlements.

3.2. Implications of findings for policy and practice

At the policy-level, recent literature has drawn attention to the need to integrate menstruation into national and international efforts for sustainable development. Sommer and colleagues (2021a), for example, highlight the importance of integrating menstruation into the Sustainable Development Goals and developing MHH-related indicators and measures to track the progress of policy implementation.

Policies at the international and national levels often rely heavily on government participation, implementation, and enforcement. Because of a history of colonialism and a legacy of disinvestment and exploitation in informal settlements in Kenya (Fox, 2014; Darkey and Kariuki, 2013; Mitullah, 2003; Wanjiru and Matsubara, 2017; Ono and Kidokoro, 2020; Anyamba, 2011; Corburn and Karanja, 2014); many residents have lost trust in the state to have their best interests in mind (WINTER et al., 2021b). There is need for the government and its representatives to work to rebuild trust in these communities and co-produce solutions to critical challenges like MHH. There may, however, be ways to do this that both support safe, hygienic, and comfortable menstruation experiences and practices in informal settlements while also having positive effects on the environment. For example, one woman implied that education and waste management services provided by the National Youth Service (NYS) Slum Improvement Initiative (SII) in Mathare assisted her to change her menstruation disposal practices and those that she taught to her daughter. The NYS SII program was launched in 2014 under the Ministry of Devolution and Planning (Mitra et al., 2017). The SII was a government-run program that not only provided environmental education to residents, but also, importantly, garbage collection services, designated dumping sites, and environmental clean-up services in Mathare and other informal settlements around Nairobi. NYS seems to have provided some women an alternative to disposing of products in rivers, which may have had a positive effect on the environment in these informal settlements. Clearly more research would need to be done to assess the effectiveness of the SII program, but, the program did seem to signal an effort by the government to invest in informal settlements that have largely been excluded from formal programs and services and may have had a positive effect on MHH in these communities.

At the program level, our findings suggest that interventions to support MHH and, relatedly, help improve the environment in informal settlements need to prioritize access to adequate water, sanitation, and waste management—paying particular attention to the needs of women who are menstruating. For example, one woman in this study highlighted the need for free spaces for women within pay-per-use toilets with rubbish bins for changing pads. This highlights how important it is to meaningfully engage women in efforts to design and expand MHH-related programs and services. Evidence suggests, however, that women are often excluded from or have their roles diminished in discussions about public development projects and budgeting in their communities, with their issues frequently trivialized (Oxfam et al., 2015; Izugbara et al., 2014). Thus, it critical to ensure that women from these communities are meaningfully involved in making important decisions regarding programming and community development, particularly regarding issues like design and expansion of water, sanitation, and waste management services.

While adequate water and sanitation and waste management and sewerage systems are important, fostering a supportive social environment for women to manage menstruation with dignity is also critical.

Evidence suggests that menstruation is often experienced as a social stressor in informal settlements (Chebii, 2018) and our findings suggest that gender inequities related to menstruation seem to compound women's challenges with managing menstruation. Thus, approaches to reduce stigma need to address harmful gender norms and discrepancies as well as social taboos about menstruation.

4. Conclusion

Our findings suggest that women's experiences of managing menstruation is inextricably linked to the physical and social environment in informal settlements. Aspects of the social environment, particularly menstrual stigma and social and gender inequities, combined with resource limitations, such as lack of disposal facilities, adequate water, sanitation, and waste management, influence women's menstrual practices, which, in turn, impacts the physical environment in these communities. There is a need to integrate menstruation into sustainable development efforts and policies and for programs and interventions to address critical structural needs in informal settlements, e.g., access to water, sanitation, and waste management. While government involvement is important for achieving equitable MHH for women in informal settlements, efforts to rebuild trust in these communities is critical. It is also important that women from these communities are meaningfully involved in making important decisions regarding programming and community development. Finally, approaches to reduce menstrual stigma in informal settlements, e.g., social and educational campaigns, should address harmful gender norms and inequities as well as social taboos around menstruation.

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Data availability

Data will be made available on request.

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