

Review Paper

Girls' and women's unmet needs for menstrual hygiene management (MHM): the interactions between MHM and sanitation systems in low-income countries

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ABSTRACT

While the sanitation sector is gaining increased recognition in policy and research, its inherent inter-linkage with menstrual hygiene management remains an under-researched subject. This review explores knowledge about menstrual beliefs and behaviors, and how women and girls currently handle their monthly menses in relation to existing sanitation systems in low-income countries. It further explores how used menstrual materials are disposed of, and the consequences of different disposal practices for the functioning of sanitation systems. Conclusions point towards the inadequacy of research in the area of menstrual management. The lack of privacy and space for changing, cleaning, drying or discarding materials, as well as insufficient availability of water for personal hygiene stand out as important areas where sanitation systems often fail to cater to the needs of menstruating girls and women. Information on proper disposal of menstrual materials as well as the actual provision of disposal facilities are important for improving menstrual management and ensuring that absorption materials do not impair the functioning of sanitation systems. Training of sanitation system designers and planners with regard to menstrual management could lead to sanitation systems becoming more inclusive of the full needs of all people.

Key words | hygiene, low-income countries, menstrual beliefs, menstruation, sanitation

INTRODUCTION

The role of menstrual beliefs and practices in relation to sanitation systems in low-income countries has been long overlooked in the research, practice and policy arenas. While the taboo on sanitation to a great extent has been broken through the global push towards achieving the water and sanitation targets of the environmental Millennium Development Goals (MDGs), the unique needs of menstruating girls and women remains a taboo subject, and is consequently overlooked in sanitation system planning and design. Regardless of the reasons, there is an overdue need to draw attention and resources to the widespread unmet needs of girls and women struggling to discreetly manage monthly menses at home, and in schools, workplaces and other public spaces that frequently lack

private and convenient sanitation arrangements. There is also a need to better understand existing menstrual beliefs and practices, and the ways in which they interact and affect the sustainability of present and future sanitation systems. In an effort to better comprehend the current reality of menstrual management for girls and women in low-income settings and identify gaps in research, policy and intervention, a two-pronged review was conducted of the existing literature regarding menstrual beliefs, practices, and behaviors across low-income countries, and the interface of menstrual hygiene management (MHM) with sanitation systems in urban, peri-urban and rural environments. The reviews were part of a larger multi-institution collaborative effort aimed at understanding menstrual practices, needs

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and product demands in order to inform sanitation planning in low-income countries and spur innovation in the design and marketing of menstrual management products for low-income markets. This review article will present both a summary of the existing MHM information and an analysis of current knowledge gaps in relevant interdisciplinary fields including public health, water and sanitation, education, and urban and regional planning.

The unique contribution of the two-pronged review lies in its approach to examining both existing menstrual practices and sanitation system operations. The review explored a range of sanitation system technologies and options for materials for managing menstrual fluid absorption, and begins by defining the sanitation system and its interactions with MHM, including the implications of existing menstrual beliefs, knowledge and practices for sanitation systems in low-income countries. The article concludes by highlighting gaps in existing knowledge, implications for sanitation systems regarding the interface of present sanitation and menstrual hygiene practices, and recommendations for future research, policy and practice.

Sanitation and its interface with menstrual hygiene management (MHM)

In the broadest sense, the concept of ‘sanitation’ involves any measures for improving or protecting human health by prevention of contact with biological, physical or chemical agents of disease. More specific definitions involve lists of the types of waste matters – solid, liquid, domestic, industrial, hazardous, etc. – that would be dealt with by ‘sanitation’, but no standard definition specifically includes menstrual wastes. Rather, the disposal of human excreta stands out as the central part of standard sanitation definitions, and generally implies a whole system of physical infrastructure and social practices. Definitions of basic sanitation formulated around the United Nations International Year of Sanitation in 2008 and the movement towards defining sanitation in human rights terms have also started to more commonly include issues of privacy and dignity (COHRE *et al.* 2008; Evans *et al.* 2009). This may be understood to include the rights of women and girls at times of menstruation. However, explicit mention of the needs of menstruating women and girls is notably absent from

globally recognized definitions of sanitation. Likewise, the needs of menstruating women and girls are often overlooked in the planning and design of sanitation systems.

Historically, menstruating women and girls have used a wide variety of materials to absorb or capture their menstrual fluid with implications for disposal (and sanitation systems) both culturally and environmentally. These include sea sponges, leaves, corn cobs, wood ash, pieces of cloth, cotton wool and tissue paper (Finley 2004). The first modern disposable menstrual pads were produced in the 1890s, and menstrual tampons in the 1920s. Since their introduction, the use of modern disposable products has continued to rise, with a subsequent decrease in the use of reusable products, in both high- and low-income countries (Finley 2004). In some contexts, given limited funds for disposable materials, girls and women have been found to combine the use of different types of materials, depending on if they are managing in the household or public sphere (Sommer 2010; Crofts & Fisher 2012). They may use cloth or tissue at home, saving more expensive commercial pads for school or other public outings. As will be discussed, a range of materials were reported to be used in the articles reviewed, illustratively including tissue, toilet paper, cloth, and reusable or disposable sanitary pads.

There are various points of interaction between MHM and sanitation systems. For those girls and women who have access to some form of sanitation system, there are the physical points of interaction, when individuals are changing their menstrual fluid absorption materials – commonly at the toilet – and the ensuing interface with the sanitation system which also influences decisions around the disposal of menstrual waste. On a less tangible level, sanitation systems include more than just the physical infrastructure; they are reflections of the practices of the people who design, construct, use, maintain and govern them. The frequent secrecy surrounding menstrual hygiene practices, both girls and women hiding their menstruating status from others (particularly boys and men) and the ways in which they conceal its management, may provide some explanation for why there has been so little influence of MHM concerns in the design of existing sanitation systems (McMahon *et al.* 2011; Sommer & Ackatia-Armah 2012). The highly gendered (predominantly male) control over infrastructure investments (van Wijk-Sijbesma 1998) may also have prevented MHM-related considerations from influencing sanitation system designs and operations.

Our review of the existing documented menstrual beliefs, practices and knowledge was aimed at understanding the relevancy of current beliefs and practices for both the 'real' (documented to date) and 'potential' (those that should be taken into consideration for future sanitation system planning) interactions. This included particular attention to menstrual hygiene within the school environment, given the increase in co-ed formal schooling throughout low-income countries, and the need for post-pubescent girls to feel sufficiently comfortable during monthly menses to be able to concentrate and participate actively in educational activities without discomfort, embarrassment, or poor hygiene due to insufficient sanitary products or inadequate sanitation systems. As menstruation in many societies around the world is associated with unique meanings and practices (Sommer 2011a; Van de Walle & Renne 2001), the need for relatively discreet monthly self-management over decades of a girl or woman's life is a priority. In the past, and particularly in rural contexts, approaches to menstrual management may have (or may still) include seclusion, restriction of activities, or other mechanisms for inconspicuous management given menstrual fluid is often perceived as polluting or taboo (Buckley & Gottlieb 1998; WaterAid 2009). As populations have become increasingly concentrated in urban and peri-urban areas, with more girls in school, more women in co-ed work environments and more concentrated living conditions, the need for adjusting menstrual management practices has arisen. To date however, very little documentation exists on the ways in which girls and women have coped with managing menses in societies with insufficient sanitation systems, and how existing menstrual beliefs, practices, and knowledge interface with such systems.

Defining menstrual beliefs, practices and knowledge

Although girls' and women's experiences of menarche and menstrual management are relatively well documented in high-income countries (Brooks-Gunn & Petersen 1987; Burrows & Johnson 2005), there is much less information available on such topics in low-income countries. The anthropological literature includes documented aspects of puberty rites and menstrual segregation in select cultural settings around the world (Buckley & Gottlieb 1998; Van de

Walle & Renne 2001), but much of this information is dated which limits its usefulness for understanding how current menstrual beliefs and practices may interact with girls' and women's efforts to manage MHM in relation to sanitation systems. For the purposes of this review, the notion of menstrual *beliefs* refers to taboos and attitudes regarding menstruation within a given culture. The importance of exploring these beliefs, particularly given the widespread secrecy that exists on the topic, is important for projects considering the construction and maintenance of appropriate water supply and sanitation systems within a given community. In particular this includes any strongly held beliefs around menstrual blood that may have relevance for the planned disposal of used menstrual materials. The notion of menstrual *practices* refers to menstrual management-related behaviors that are of relevance for the types of water and sanitation facilities that girls and women need in their homes, schools, and communities. More specifically, these refer to requirements for privacy and safety, including physical space for bathing and washing or drying of used materials. The notion of menstrual *knowledge* refers to girls' and women's knowledge about menstrual onset, menstrual management and reproductive health. Such knowledge is important for the use and uptake of water and sanitation systems through its empowerment of girls and the development of their self-efficacy around menstrual management in new spheres (e.g. school, work, peri-slums).

In some low-income contexts today, menstrual knowledge and related menstrual practices may be influenced by national education systems and even international hygiene campaigns, although traditional sanitation and hygiene habits may be entrenched, and inter-generationally transferred within the household. Ultimately, however, sanitation system users are individuals who within the social and structural realities of their specific contexts must decide how to use an existing sanitation system and, in the case of menstruating women and girls, how to manage their menses successfully and with dignity.

The interaction between menstrual beliefs, practices and knowledge and sanitation systems

The actual physical interaction of menstrual beliefs, knowledge and practices with the sanitation system occurs at

numerous points, starting with the user interface – the toilet space itself – with secondary interaction points during waste collection, conveyance, treatment and disposal (Kjellén *et al.* 2011). Beyond the toilet/user interface, menstrual practices and beliefs affect the sanitation (excreta collection and conveyance) system itself based on the range of menstrual absorption materials used and how they are disposed of in a given context. In principle, most excreta collection technologies are not designed to handle disposed pads, tampons or discarded rags. Despite the problems caused by improper disposal, menstrual materials (such as super-absorbent materials and cloths) still frequently make their way through the sanitation system and contribute to the downstream clogging of sewers. Even further downstream, non-degradable parts of menstrual materials that are not intercepted by waste screens may go through treatment plants (where they exist) and end up along shorelines and in receiving waters.

In reviewing the interactions between menstrual management practices and sanitation systems, different methodologies were used to capture and analyze the state of knowledge on the variegated aspects of the topic.

METHODS

The two-pronged review was intended to serve as a foundation for a larger multi-institution ‘Menstruation Management and Sanitation Systems’ research study. The reviews were conducted over a period of four months in 2011 in order to understand the current knowledge on existing menstrual beliefs, practices and behaviors in low-income countries; how menstrual management practices are affected by sanitation systems; and conversely, how sanitation systems are affected by the menstrual management practices of users.

Review of menstrual beliefs, practices, knowledge and behaviors

The review of menstrual beliefs, practices, knowledge and behaviors – addressing mainly how menstrual management practices interrelate with the sanitation system – was initiated with a search of key databases covering a range

of disciplines, including those pertaining to public health, education, social science, sociology and anthropology (PubMed, CINAHL, Contemporary Women’s Issues, AnthropologyPlus, AnthroSource, International Bibliography of the Social Sciences, Proquest Dissertations and Theses, UK and Ireland Proquest Digital Dissertations, Scopus). All collated abstracts were reviewed, with a total of over 300 peer reviewed articles identified of potential interest. Select criteria were then used to narrow down the articles for inclusion in the review, including those which specifically mentioned menstrual beliefs, behaviors, practices, and other relevant issues. A parallel internet search (e.g. Google) was conducted of the gray literature to identify reports from non-governmental organizations (NGOs) and other documents referencing existing menstrual practices. Given the shortage of online information with regards to the private sector, individual electronic communications were sent to key contacts at the large private sector companies known to be involved in menstrual product distribution globally, to inquire about key summary documents that might exist. After narrowing down per the selected criteria, 62 articles were organized into the thematic content most relevant for the questions being explored around the intersection of menstrual beliefs, behaviors and sanitation, the analysis of which will be discussed in the results section (Sommer 2011a). Overall, there was found to be a dearth of quality articles on the selected topics, which limits to some degree the generalizability of the findings.

Review of sanitation systems and interactions with menstrual management

The review of the two-way interactions between sanitation systems and menstrual management was initiated with a search of the sanitation literature and articles published in journals and reports available over the internet. The keywords of ‘blockage’ and ‘sanitation’ were searched for in Scopus and other databases. With insufficient literature found and with no references identified with mention of menstrual materials, the review was complemented with telephone interviews and email correspondence with sanitation specialists and system managers in low-income countries. A questionnaire was developed for this purpose, focusing on the type of sanitation system, the quantities

and types of menstrual material found in the sewage, and the impacts this material has on the functioning of the sanitation system. Twenty-one semi-structured interviews with sanitation specialists in low-income countries were conducted by telephone, electronic mail, or in person. The results presented in this article are based on responses from the Philippines, Cambodia, India, Yemen, Burkina Faso, Tanzania, Kenya, Zambia, Malawi, Lesotho, South Africa, Brazil, Argentina and Bolivia. The sanitation specialists interviewed worked at a range of institutions including water and sanitation utility companies, municipalities, NGOs and universities. The findings were classified according to the types of sanitation system they referred to, and then analyzed together with the findings from the interviews.

RESULTS

Numerous themes arose from the two-pronged review that identified patterns in existing menstrual practices and systems, along with gaps in research, practice and policy regarding the selected topics explored through the documentation review and interview processes.

The influence of menstrual taboos and secrecy on sanitation use

The very limited literature on menstrual beliefs in relation to sanitation systems was found to encompass dated anthropological descriptions of specific societal practices or more recent socio-cultural explorations, frequently with a broader interest in reproductive health. A number of studies from India highlighted conflicting findings in terms of existing menstrual taboos, suggesting that modernizing influences and urban migration are impacting the beliefs of selected populations. For example, Ullrich (1992) found that menstrual taboos among the Havik Brahmin in South India have significantly diminished over the prior 20 years, whereas Garg *et al.* (2001) reported that the vast majority of girls in a Delhi slum continue to experience restrictions on cooking, work activities, sexual intercourse, bathing and religious practice during menstruation. The overall perception is that menstrual fluid is dirty and polluting, which

occasions much secrecy around its management. In contrast, Dhingra *et al.* (2009) describe menstrual taboos among the Gujjar tribe of the Kashmir and Sammu regions of India, who lead a semi-nomadic existence. Their research with adolescent girls found there were restrictions on bodily washing and a taboo against burying a bloodied menstrual cloth. Cloths could only be washed and then buried or re-used. Most girls reported washing the cloths secretly and drying them in a hidden corner, not in the sun, lest they be seen by others.

Menstrual taboos and perceptions that circumscribe the activities of menstruating women and girls and the washing/handling of used menstrual cloths were also identified in other regions of the world. In northeastern Niger, Rasmussen (1990) conducted an anthropology of menstruation among the Kel Ewey Tuareg and found widespread shame and danger associated with menses. Menstrual blood was perceived as dangerous, with women observed to wash the wrapper they wore only during menses at night when others were asleep because of a belief that menstrual fluids could be misused for sorcery. Similar findings regarding the need to hide menstrual cloths for fear of being cursed were found in Tanzania, Ghana, Kenya, and Ethiopia (Sommer 2009; Fehr 2011; McMahon *et al.* 2011; Sommer & Ackatia-Armah 2012). In rural Mexico, Castaneda *et al.* (1996) found that menstrual flow was seen as dirty and shameful, with menstrual rags needing to be hidden from the sight of men in the community; and among the Igbo of southeast Nigeria, researchers explored beliefs in 12 rural communities and found women believed the management and disposal of menstrual waste was significantly tied to witchcraft and danger (Umeora & Egwuatu 2008). Although some women were found to use pads, far more were using cloth and tissue, believing that pads impede the detoxification process of menstruation. The women reported either washing their cloths and drying them in hidden corners; discarding used materials in refuse dumps and pit latrines; or burying them nearby the house. As the women explained, it was important to bury the used materials lest witches who go after human blood find the cloths and destroy the woman, causing infertility. It was equally important not to burn the cloths because that would be similar to the burning of human blood, and could cause infections, disease and infertility. All of the

beliefs documented above, while limited in generalizability to girls and women across the low-income world, highlight the range of existing menstrual hygiene-related behaviors, and point to the importance of designing culturally appropriate sanitation disposal mechanisms in a given community.

Three main aspects of importance emerged in this area, namely the need for facilities to enable privacy for girls and women given the secret and frequently taboo nature of menstruation; to consider that menstrual-related activity restrictions may hinder girls' and women's use of communal or family sanitary systems; and to adapt as needed the design of disposal mechanisms for used materials given cultural taboos around menstrual waste.

Gaps in girls' menstrual knowledge and challenges of various menstrual materials

A similar shortage of quality articles exists on the menstrual knowledge levels of girls and women across low-income countries, although there is increasing attention being given to exploring the knowledge of schoolgirls, and the challenges girls and women face managing menses with various materials. In rural and urban Ethiopia, a survey conducted in seven regions highlighted the gap in knowledge among girls, with 70% of urban and 55% of rural schoolgirls knowing nothing prior to menarche about menses. This absence of information was perceived to contribute to disruptions in schooling as many girls reported managing menses by secluding themselves in the forest, desert or field. Studies conducted with adolescent girls in Tanzania, Kenya, Ghana, Uganda and Zimbabwe have all found confusion over the menstrual cycle, menstrual patterns, and an absence of pragmatic menstrual-related guidance provided to girls pre- and sometimes even post-menarche (McMaster *et al.* 2009; Sommer 2009; Fehr 2011; McMahan *et al.* 2011; Crofts & Fisher 2012; Sommer & Ackatia-Armah 2012). A series of articles from India also indicated insufficient knowledge about menstruation among girls, particularly pre-menarche (Gupta & Vatsayan 1996; Dhingra *et al.* 2007; Nemade *et al.* 2009).

Along with the limited existing information found on menstrual knowledge levels, there was minimal information to be found on what menstrual materials are being used in low-income countries today, and the challenges selected

materials present for successful and comfortable MHM. A series of policy briefs discuss a menstrual cup pilot intervention conducted in a peri-urban slum in Nairobi (APHRC 2010). Girls were found to have limited knowledge about menstruation; to have perceptions of menstrual blood as an unclean and harmful substance; and to primarily be using cloths and toilet tissue to manage menses, although sanitary pads were stated to be preferred (but unaffordable). In relation to the materials being used, girls also described feeling fear about the menstrual cloth smell giving away their menstruating status to peers at school or at work (and hence a desire to stay home during menses each month), and fear over potentially having a menstrual stain while in the classroom and being shamed. Augmenting the challenges around insufficient knowledge and materials were those of the facilities, such as when there was no water located within school sanitation facilities, a frequent occurrence, girls reported preferring to stay at home during menses due to the shame they would experience if they were to leave blood on the toilet, for boys and others to see who used the toilet after them. In Ethiopia, Abera (2004) conducted research on menstrual practices of girls in Addis Ababa and found a majority of girls reported absenteeism during monthly menses with 61% using cloths that were deemed to be unsanitary. Girls reported discomfort with the challenges of using rags when having to sit for long hours in poorly ventilated and crowded classrooms, which left them anxious that boys and other would smell or suspect their menstrual flow. The girls feared menstrual leaks would lead to stigmatization.

Similar findings of insufficient menstrual knowledge and challenges around using menstrual materials were found in Ghana where Scott *et al.* (2009) conducted a pilot study providing sanitary pads and education to girls in an effort to improve school attendance during menses. The initial assessment revealed that in rural areas prior to the study, girls had little menstrual knowledge, did not use sanitary pads, walked 2 hours to school to attend schools with no or inadequate toileting facilities, and if facilities did exist, no privacy or water. After the intervention, the data showed that absenteeism diminished, with girls reporting increased concentration, confidence and participation in class. Results also indicated that girls in the rural site were four times more likely to change their pads at school than before. The girls explained they

could run to the forest, change, and bury the pad much more quickly than they could a menstrual cloth. In a Kenya study, [McMahon *et al.* \(2011\)](#) found that girls struggled with shame, distraction and fear of stigma when managing menses in school. The majority of girls were found to be using cloth (as pads were unaffordable), and schools lacked sufficient water, along with adequate and private sanitation facilities. Teachers were frequently not comfortable discussing with the girls issues surrounding MHM, and girls reported struggling to hide potential menstrual accidents (embarrassing leaks).

Practices and challenges around disposal of used menstrual materials

In contrast to high-income urban areas where modern disposable menstrual hygiene products are proliferating and increasingly disposed of through centralized solid waste management systems ([Ashley *et al.* 2005](#)), in low-income areas there were found to be a range of options used for disposing of menstrual materials in the home. These included burning, burying, throwing in the waste bin, pit latrine or flushing. As indications of what materials are currently being disposed of in select regions, [Adinma & Adinma \(2008\)](#) surveyed 500 schoolgirls in southeastern Nigeria and found 41% using toilet tissue and 14% using cloths; [Abioye-Kuteyi \(2000\)](#) conducted a study with 352 girls in southwestern Nigeria and found a similar pattern, with 54% using toilet tissue and 12% using cloth; and [Lawan *et al.* \(2010\)](#) conducted a study with 400 schoolgirls in Kano, Nigeria, which showed a higher percentage using pads. From the interviews conducted with sanitary experts in a range of low-income countries, there is suggested to be a tendency to rely on re-useable and non-commercial sanitary materials (including re-usable pads, cloth or tissue paper) in rural areas, with a greater reliance on commercial disposable pads in urban areas, particularly in Africa. Thus, sanitation system problems in relation to menstrual material disposal are likely to be greater in urban areas, where more disposable menstrual waste is generated. In South Africa, [Mjoli-Mncube \(1998\)](#) suggests a perception exists that menstrual waste must be handled by women, which precludes disposal through centralized solid waste management systems as these are mostly operated by men.

The means of disposal for used menstrual materials varies depending on the type of product being used, cultural beliefs and the location where the disposal occurs. In India, [Garg *et al.* \(2001\)](#) describe the space-constraints of one densely populated urban setting, with 92% of women surveyed in a slum in Delhi not reusing cloth during menstruation but disposing of it in pit latrines. Burial or burning was reported to be more difficult where space (and privacy) is limited, with some women suggesting the disposal of used products in latrines prevents materials from being seen by men or being used in witchcraft. In Karachi, Pakistan, a study by [Ali & Rizvi \(2010\)](#) explored the menstrual practices of girls, and found that 71% of school girls threw away their used cloth without washing it, while out-of-school girls would either wash and then discard, or wash and re-use cloth. In Nepal, two studies found that many girls reported being absent from school at some time during menstruation with reasons including the lack of an available disposal system for used materials and inadequate water supply ([WaterAid 2009](#); [Mahon & Fernandes 2010](#)). Even in schools where toilets existed, improper disposal was reported to be a problem, along with a broken lock on a latrine door (impacting privacy) and the lack of a water tap or bucket to carry water for use in the latrines. Inadequate disposal systems and relevant menstrual disposal knowledge resulted in clogged toilets and pollution of streams with used materials. The study also found that 43% of girls bury their used materials, 35% throw the used materials with other waste, and 19% burn the materials ([WaterAid 2009](#)). Similar findings were reported elsewhere in Nepal ([Adhikari *et al.* 2007](#)).

Similar to the findings from India, Pakistan and Nepal, findings from Africa indicate the relationship between inadequate MHM knowledge and improper disposal of used materials. [Aniebue *et al.* \(2009\)](#) conducted a study in southeastern Nigeria and found that 44% of schoolgirls had received no training prior to menarche, and that the level of training affected the ways in which girls disposed of used menstrual materials. Study recommendations included the provision of proper menstrual waste disposal facilities in schools, with toilets equipped with waste disposal containers and incinerators. In Ethiopia, the above study conducted with girls in Addis Ababa also found that for those girls who attended higher income Ethiopian schools where there were toilets, 75% reported discarding their

used materials into latrines, which the author suggests could create blockages in septic tanks (Abera 2004).

Menstrual waste management in schools in low-income countries is an especially problematic issue which may have wider effects in terms of impeding girls' and female teachers' participation in school during monthly menses. There are several examples of schools using or considering incineration as the solution for menstrual waste disposal, although issues of privacy and anonymity are often overlooked in the placement of incinerators. Crofts & Fisher (2012) provide an example from Uganda, where girls felt shy about being seen throwing used pads into incinerators, and hence refrained from using them. In Tanzania, both female teachers and girls expressed a similar hesitation to use incinerators when their placement was too exposed (Sommer 2010c). Similar problems were found at schools in Lilongwe, Malawi (personal communication (email): S. Piper, Cranfield University (MSc) and in India, where WaterAid is providing assistance for building incinerators in the girls' restrooms at selected schools (Mahon & Fernandes 2010). To address the challenge of providing discreet disposal in India, a design has been developed that includes an incinerator unit which is constructed on an outer wall of the restroom, with an inlet inside the restroom (Government of India 2007).

Along with cultural beliefs and taboos, convenience and information both appear to be key factors in a girl or woman's selection of a menstrual product and disposal method. Although based in a high-income context where modern disposable menstrual materials predominate, a survey from New Zealand is nevertheless insightful in revealing that informants who disposed of tampons via the toilet (which is bad for a sanitation system) claimed to do so because it was easy, convenient, habitual, and rid them of the waste quickly. Moreover, they stated their belief that the sewerage system could cope with tampons. Such beliefs may be critical in the choice of disposal methods (Lynch 1996).

Effects of menstrual material disposal on sanitation systems

As per the standard definitions described, sanitation systems are designed with urine and feces in mind, and not menstrual absorption materials. Even anal cleansing material is not

always meant to go into toilets, such as in small-bore sewers (i.e. effluent drains, generally with smaller diameter pipes than conventional sewers), which are unable to cope with cleansing materials other than water. In Latin America, small-bore sewerage is common, and as tissue is preferred for anal cleansing, there needs to be a waste container by the toilet. This serves as a receptacle for used tissue paper as well as menstrual pads, integrating both into the solid waste stream rather than the sewerage. However, sewers of all different sizes may clog and cause backflow in the system. There are a variety of factors that contribute to the propensity for sewer pipes to clog (Arthur *et al.* 2008). These include structural issues like the pipe gradient and the number of junctions, as well as the amount of water flowing through the system. The contents of the waste are also important. Blockages in sewers are often caused by a combination of fats and solids (Thames Water 2011). Among the solids, menstrual-related waste like super-absorptive materials and rags are serious issues for sewer maintenance. Such non-degradable materials also pose problems for pit latrines.

From the interviews conducted with sanitation experts in various countries, useful findings were identified with regard to problematic menstrual sanitation disposal practices. In terms of disposal into pit latrines, tampons, cotton wool, toilet paper and other organic materials used for menstrual management should decompose and – as long as the decomposition processes in the pit are working properly – not present a problem. According to one international specialist in on-site sanitation, sanitary napkins decompose over a period of about 1 year, except for the plastic inlay (personal communication (telephone and email): E. Huba, sanitation specialist). However, the most commonly found menstrual absorption material in pit latrines were reported to be rags. These take much longer to decompose, and if made of synthetic materials, may not decompose at all. Further, rags may bundle into balls that clog the suction hose when the pit is to be emptied, or may not be able to be removed from the pit at all (personal communication (telephone and email): E. Huba, sanitation specialist). A primary example comes from research conducted on decomposition rates of pit latrine contents in Ifakara, Tanzania, where significant quantities of rags were found (personal communication (telephone and email): B. Torondel, London School of Hygiene and Tropical

Medicine). In rural areas, once a pit latrine is full, it is normally covered with soil, a new pit is dug, and the toilet superstructure is moved or rebuilt. In urban areas, space limitations usually prevent such practices, and most pit latrines must be emptied (Bhagwan *et al.* 2008).

Pit latrines are often emptied manually, particularly in dense unplanned settlements where road access for vacuum tankers is difficult. Pit emptying is usually done by private contractors or informal service providers, though some sanitation utilities are reported to play an active role. Blockages in the suction hose were noted to be common. For example, in Zambia, Lusaka Water and Sewerage Company reports that blockages occur in 80% of pit emptying jobs, costing the company an additional 4–5 worker-hours per day. The blockages are mostly caused by excessive quantities of solid waste, the accumulation of sand and the hardening of the sludge in the pits. Menstrual products also contribute (estimated 25%) to the blocking of the suction system (personal communication (telephone and email): M. Bukali, Lusaka Water and Sewerage Company). In South Africa, the eThekweni Water and Sanitation (EWS) utility serving Durban and its environs is directly engaged in the area's on-site sanitation system. EWS reports that it is very common for the blockages of the suction hose to occur during the emptying of pit latrines, due to the presence of large amounts of menstrual materials (personal communication (email): N. Macleod, eThekweni Water and Sanitation). As suggested above, an added challenge is that all kinds of solid waste may be disposed of in pit latrines. These may include additional plastics as found in a report from Kenya, which are linked to the wrapping of menstrual waste. The *Intermediate Technology Development Group (ITDG) (2005)* reported a practice in Kenya where some women and girls wrapped used cloths in polythene bags before disposing of them in pit latrines. Such wrapping of menstrual materials prevents decomposition and poses additional problems for pit emptying.

Overall, the managers of various utilities in different countries and regions rated the contribution of menstrual waste to pipe blockage differently. They all, however, reported finding large quantities of menstrual waste among the materials removed when unblocking pipes. According to EWS in South Africa, the materials removed from blocked pipes and joints include large quantities of rags, pads and

tampons. These super-absorptive materials are considered particularly problematic because they swell up when saturated with liquid. Blockages were reported to occur more frequently in areas with low water pressure, where there is insufficient water to carry the solids through the sewer system (personal communication (email): N. Macleod, eThekweni Water and Sanitation). Bordering EWS' service area is Ugu District Municipality, which also records numerous blockages on a daily basis. Each blockage takes an average of 4 hours to resolve and is a major cost to the municipality. Pipes as large as 450 mm in diameter have been found clogged by pads and tampons (personal communication (telephone and email): P. Mayeza, Ugu District Municipality). In Tanzania, the Dar es Salaam Water and Sewerage Corporation records an average of 150 blockages per month. Blockages are frequently found in pipes that had been laid at low gradient and in areas that have inadequate water supply. Menstrual pads, tampons, rags and cotton wool are also commonly found among the materials that clog sewer lines (personal communication (telephone and email): M. Mulagwanda, Dar es Salaam Water and Sewerage Company). The Mavoko Water and Sewerage Company, which operates in Eastern Kenya, reported that menstrual pads alone constitute about 40% of the material hauled from blocked sewers. As the frequency of blockages exceeds the company's ability to respond immediately, blockages are often only resolved the day after they are reported, leading to sewage backflows into homes, a serious health hazard (personal communication (email): J. Mbula, Mavoko Water and Sewerage Company).

In low- and middle- income countries outside of sub-Saharan Africa, similar challenges were reported. In Yemen, the Sana Water and Sanitation Local Corporation reported a heavy dominance of menstrual pads among the materials frequently removed from blocked pipes (personal communication (email): I. A. Al-Mahdi, Sana'a Water and Sanitation Local Corporation). In the Philippines, the Manila Water Company has a 305 km sewer network with over 144,000 connections. It receives an average of four blockage reports per day, with most caused by menstrual pads, diapers, rags, underwear, socks and condoms. Pads and rags are always among the debris hauled from clogged sewer lines. Most blockages occur at the joints between household sewers (laterals) and main sewer lines, as these connections are often

not correctly installed (personal communication (email): N. Carbon, Manila Water Company). In Bolivia, Cochabamba's municipal water and sewerage authority, SEMAPA, serves 370,000 homes and recorded 1,399 sewer blockages in 2010. The authority estimates that 30% of sewer blockages in the city are caused by menstrual pads and rags (A. Lizarazu, SEMAPA, interviewed by M. C. Arteaga, Fundacion Agua Tuya, 2011/07/14). According to the manager of a sanitation service company in the same municipality, the most frequently found materials when unblocking sewer pipes are grease, soil sediments, menstrual products and children's toys. Menstrual products, especially pads, are mostly found in sewer blockages at schools, and account for 60% of such blockages. Blockages are also common in the city's peri-urban expansion zones (V. Poclava, ServiMASTER, interviewed by M. C. Arteaga, Fundacion Agua Tuya, 2011/07/11). Similarly, a respondent from the Mar del Plata Sanitation Works in Argentina reports that menstrual products, condoms and disposable diapers frequently clog the pumps in the city's sewer pumping stations (personal Communication (telephone and email): E. Peralta, Mar del Plata Sanitation Works). All of these reported blockages and challenges to emptying latrines and sewage systems are challenges similar to those faced by high-income countries, although they differ in the types of materials being used, and the quality of the sanitation and sewage systems.

DISCUSSION

The overarching finding from the review and analysis was that far too little valid, reliable and context-specific evidence exists on the actual intersection of menstrual hygiene and sanitation systems in low-income countries. In addition, although some data exists on menstrual beliefs and behaviors that is of importance to the design and maintenance of sanitation systems, there is limited but potentially increasing information on girls' and women's present day menstrual practices, particularly in schools, work spaces and other public environments, and on what menstrual materials they are actually using or would prefer to be using, and how they are managing their menstrual hygiene (including any recommendations they may have for improving sanitation systems). Similarly, while useful reports were available from a select number of countries on the perceived

(or real) impact of menstrual hygiene and menstrual waste on sanitation systems, inadequate documentation exists or is accessible for the successful planning and maintenance of sanitation systems under construction or already in existence. This includes knowledge on cultural beliefs that may influence the types of acceptable menstrual waste disposal. Given the initial hypothesis of a trend towards increased usage of more modern sanitary products in increasingly urbanized and wealthier populations, there is an urgent need for the sanitation community to better understand present day menstrual management behaviors, patterns of disposal, and implications for sanitation systems.

Existing gaps and common findings

The review of existing menstrual beliefs and behaviors highlighted numerous gaps in the literature in terms of what is known globally and within local contexts about adolescent girls' and women's menstrual practices, beliefs, and behaviors. The gaps most relevant to sanitation systems include insufficient cultural and social evidence on adolescent girls' and women's menstrual-related beliefs in a range of local contexts, particularly those taboos that impact on menstrual-related behaviors; insufficient understanding of the challenges facing girls and women in rural versus peri-urban versus urban settings in terms of the privacy, space, facilities, and materials needed for successful menstrual management; insufficient research approaches and practices that actually engage adolescent girls and women in identifying the materials they prefer for managing menses, and the types of facilities (including water, sanitation, and disposal mechanisms) that would be most appropriate to their unique economic, social and geographic contexts.

Despite the many gaps identified, there were also common findings that arose, such as the frequent usage of tissue paper and cloth to manage menses (albeit cloth of varying quality); the disparate approaches to disposal (with various menstrual taboos contributing to either decisions to bury, burn, or throw by the wayside, and washing requisite for some before disposal); the aura of secrecy around menstruation that remains throughout the low-income world (not entirely dissimilar to higher-income countries) and its contribution to challenges around menstrual knowledge conveyance and successful and hygienic menstrual

management inside and outside of the house; and the growing concern that adolescent girls' and women's MHM needs are insufficiently addressed throughout numerous low-income countries. While a breadth of gaps were identified, the recommendation is to conduct targeted research around social and cultural menstrual beliefs and behaviors of relevance to the implementation and successful uptake of water and sanitation approaches, so that adolescent girls and women feel safe, secure, well-informed and comfortable managing their menses within the household, larger communities, workplaces and school settings.

Problems of menstrual waste disposal

The review of menstrual management impacts on sanitation systems highlighted a number of problems associated with the use of reusable as well as disposable materials in low-income countries. One, reusable materials such as cloth pads may not be cleaned properly due to a lack of water (and perhaps detergent) for washing materials thoroughly. In addition, because of menstrual taboos, girls and women may not be able to hang reusable materials in the sun to dry properly. Two, the most frequently reported ways of disposing used menstrual materials are flushing them down the toilet, throwing them into the latrine, or burning them. Each of these practices, as noted, creates problems for sanitation systems and the larger environment. This appears to be an issue where the potential for awareness raising and engagement with users has been under-estimated and under-utilized by utility companies. This underutilized potential of awareness-raising is suggested by the stated beliefs by women (e.g. in the referenced New Zealand study) where sanitation systems were unable to cope with menstrual materials unbeknownst to the women, and in noted examples from Latin America, where the provision of information and user engagement reduced menstrual materials clogging the small-bore sewer systems.

Three, further downstream, non-degradable parts of pads that escape through overflows or points where solid waste is washed into receiving water may affect aquatic organisms and pollute shorelines. Around the world, women who can afford disposable menstrual products are likely to use about 10,000 of such products during their reproductive years. The majority of these used products

end up in landfills (Bharadwaj & Patkar 2004), often having passed through sanitation systems as the point of disposal by the user. If the waste is not trapped and removed at the sewage treatment plant, it ends up in rivers, lakes and along seashores (Shoemaker 2008). The magnitude of such pollution is unknown and needs to be explored.

Four, the problems caused by the disposal of menstrual materials into pit latrines are costly, time-consuming and difficult, especially if there are large quantities of solid waste in the pit (Schaub-Jones 2011). As synthetic materials will not decompose within the latrine, and latrine waste is often discharged into sewage treatment plants, the same problem of menstrual materials ending up in water bodies occurs. Disposal by burning inorganic matter at relatively low temperatures can cause the release of dioxins, which are highly toxic carcinogens. Thus, incineration, although often viewed as the best way of dealing with menstrual waste, may have negative impacts on human health and the environment. Additional research is needed to better understand such potential polluting aspects of burning used menstrual material. The positives and negatives of an incineration approach must also be weighed in a particular context, noting that significant health impacts may be gained from girls feeling more comfortable and confident attending schools with adequate mechanisms of disposal.

To address the above, when disposable menstrual materials are utilized, the best disposal is through the solid waste system – assuming there is a functioning one. In a well-functioning system, 'sanitary' landfills would keep all substances contained from the surrounding environment, or if burned, incineration would occur at sufficiently high temperatures to maximize combustion and minimize the release of pollutants to the environment. Even though properly functioning solid waste systems are rare in low-income countries, communication campaigns about appropriate disposal of menstrual materials, and the dangers to system functioning of improper disposal, would still be warranted.

The need for adequate menstrual materials and relevant information

The need for effective menstrual materials, and the provision of pragmatic menstrual management guidance for girls, were also found to be of critical importance. One type of

intervention that has been suggested is the distribution of menstrual materials free of charge. There have been some attempts in low-income countries to demonstrate the benefits of providing menstrual pads free of charge to schoolgirls. The Government of India has initiated a program that distributes free menstrual pads to schoolgirls; however minimal details have been provided as to its implementation. In South Africa, the government recently initiated a program to distribute menstrual pads free of charge not only to poor schoolgirls but to all poor women listed on municipal lists of low-income households. This program, called The National Sanitary Dignity Campaign, has mobilized a number of partners including pad manufacturers for commitment to this campaign. The campaign plans to assist in kick-starting implementation while sustainable procurement and distribution mechanisms are being put in place. This raises a number of concerns. First, the campaign limits the recipients' freedom of choice by selecting a type of menstrual product for them. Second, the quality of products to be provided has yet to be specified. Third, the environmental impact of the additional waste generated has not been quantified, nor has there been consideration of the potential impact on sanitation systems that will likely be intermediate recipients of much of the waste. It is necessary for women to have access to menstrual materials of sufficient quality and quantity; however a careful investigation of the social, economic and environmental sustainability of such a broad-scale distribution campaign would be useful before implementation.

In terms of the provision of pragmatic MHM guidance to adolescent girls themselves, one example exists from the development and dissemination of a girl's puberty book in Tanzania which includes menstrual stories written by girls, and guidance on menstrual hygiene and disposal (Sommer 2011b). The book is currently being adapted for use in Ghana, Cambodia and Ethiopia, and has been adapted by water and sanitation experts and education NGOs already in Zimbabwe, Uganda and Nepal (see pdf files at: www.growandknow.org).

The need for better design and maintenance of sanitation and water facilities

The review also made evident that the degree to which a sanitation system facilitates menstrual management has an

effect on the perceptions of and the usage of the systems. In this regard, it is essential that toilets are designed and built to be 'girl and woman-friendly' (Kjellén *et al.* 2011). Toilets or stalls must offer privacy and safety, but also be well-lit and have sufficient space to washing blood from ones' hands and also ones' private bodily areas, change pads, wash reusable materials or deal with stained clothes (menstrual accidents). This requires the convenient availability of water and/or toilet paper inside the stall, a dustbin that is regularly emptied for disposable materials and, where washing is practiced, a sink or platform for washing menstrual products. Privacy includes the ability to be anonymous when taking additional time to conduct personal hygiene, and the desire to not leave traces of menstrual management in schools or institutional settings (such as used materials or spots of menstrual blood in sanitation facilities).

In order to properly dispose of used menstrual materials through the solid waste system, it is important that receptacles are placed within bathrooms. Often in public toilets, these are generic rubbish bins or, as among more up-market institutions, specific sanitary dispensers to collect menstrual waste. Where there is no lid, there is the issue of menstrual waste being seen by others, an issue which may be addressed by wrapping the waste. The most common wrapping material (in settings where it can be afforded) is toilet paper, indicating the multiple uses of this material. Covered containers have the advantage of hiding the waste but the lid must be kept clean. Generally, the proper disposal of menstrual waste may be to require the presence of covered waste bins or containers, which are emptied and cleaned on a regular basis, and located in a place that offers privacy (Tjon a Ten 2007). If emptying of dispensers is delayed, it might give rise to odors (Shoemaker 2008). Consideration of potential local taboos around who is able to handle menstrual waste, along with the provision of gloves to assigned cleaners, are both essential to incorporate into such a system.

Issues for (downstream) menstrual waste management

Used menstrual materials are, as suggested above, generally intended to be discarded of via solid waste systems (where these exist), which in some cases involves local incineration. However, if neither option is conveniently available or used,

then menstrual materials tend to end up in the excreta collection and conveyance system or discarded through other local practices, such as burying or disposal in a forested area. Pit latrines are generally perceived as convenient for discreet discarding of used menstrual materials. Nevertheless, this contributes to the filling of latrines and this way precipitates the need to empty latrines. At the same time, the presence of solid materials obstructs the emptying process. Flush systems are less convenient for discreet disposal of bulkier materials, as they are more likely to clog upstream at the user interface. Still, non-degradable parts of menstrual materials that are not intercepted at the user interface or more downstream by waste screens may even go through treatment plants (where they exist) and end up along shorelines and in receiving waters, thus impairing the quality of the environment.

The present review underlines the need for better solutions to improve sanitation systems for girls and women, but at the same time to reduce the quantities of menstrual waste that must be disposed of, given the negative impacts on sanitation systems of improper disposal. The further development and increased availability of reusable menstrual materials like menstrual cups and reusable pads may be part of the solution (although cultural taboos may exist around what types of materials are preferred for use). The further development of fully biodegradable menstrual materials is also an alternative, and would help to reduce the accumulation of non-degradable materials, and prevent the potentially harmful effects of super-absorbent materials currently used in disposable menstrual products.

The need for training and information

The inclusion of menstrual management in the training of sanitation system designers (e.g. civil and environmental engineers, municipal water and sewerage utility engineers and managers) and planners is crucial for ensuring that the needs of girls and women are addressed in the design and implementation of future sanitation systems and/or amending of existing inadequate ones. Involving girls and women in the design process would be an important step in this direction. This includes gathering their insights into the most appropriate water and sanitation facilities for enabling the private, dignified and comfortable management

of monthly menses (particularly when outside of the house in public institutions such as schools and workplaces).

In terms of improving MHM in schools, a useful example includes the construction of simple pad incinerators in girls' toilets at schools in Tamil Nadu state, India ([Government of India 2007](#)). Although this is not an ideal solution due to the health and environmental impacts of incineration, it represents a step forward towards improving conditions for menstruating schoolgirls. Another example exists in Tanzania where UNICEF collaborated with the government to integrate MHM into the new WASH in Schools strategy (including school WASH guidelines). NGOs are currently implementing MHM interventions such as providing adequate numbers of safe private latrines with doors and locks, the development of culturally appropriate disposal mechanisms, the availability of water within each toilet cubicle, and the provision of the girl's puberty books.

CONCLUSION

Menstrual management is missing from the literature, be it technical manuals on system design, simple training modules for health and sanitary workers ([Bharadwaj & Patkar 2004](#)), or even adequate documentation of how girls and women are managing their menses in low-income countries today as they participate more actively in school and work environments. This review found a lack of quality literature on these subjects and on the impact of menstrual waste on the functioning of sanitation systems, final solid waste disposal and the broader environment. Such knowledge would inform menstrual material and sanitation system designs, and contribute to better menstrual waste disposal options. Improved communication to populations about preferred disposal procedures, along with improved knowledge around how poorly sanitation systems cope with menstrual materials, is also needed to motivate appropriate disposal behavior. Lastly, water and sanitation facilities and experts across low-income countries are long overdue to take into consideration the menstrual hygiene needs of adolescent girls and women. Numerous girls across these contexts are in need of appropriate MHM-related guidance, and both girls and women require adequate and accessible latrines or toilets designed with sufficient space for changing,

washing and discarding of used menstrual materials discreetly and with dignity, and water and disposal mechanisms available *inside* of stalls and cubicles. Such sanitation system modifications, elicited from the perspectives of girls and women themselves, along with the provision of correct and complete pragmatic MHM guidance, could serve to raise the standards of sanitation systems globally, along with enabling and empowering girls and women around the world to actively and comfortably attend school and participate in the work force outside the home.

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