

What can existing data on water and sanitation tell us about menstrual hygiene management?

LIBBET LOUGHNAN, ROB BAIN, ROSEMARY ROP,
MARNI SOMMER, and TOM SLAYMAKER

Half of the global population menstruate as part of their life cycle. This involves water, sanitation, and hygiene (WASH) needs that are often overlooked. Experience from the Millennium Development Goals shows that states focus on targets that are measured globally. Data and indicators on menstrual hygiene management (MHM) for women and girls can have a positive impact on raising awareness, national policy making, and in finding sustainable WASH sector solutions. With this paper, we explore the possible use of Joint Monitoring Programme for Water Supply and Sanitation estimates for representing women and girls' unique WASH experience, through a focus on MHM. We reviewed definitions of MHM alongside indicators monitored by the JMP and calculated estimates for 18 case-study low- and middle-income countries. Consultation with a broad range of experts identified open defecation and handwashing indicators as the best proxy indicators for inadequate MHM. Globally around half a billion women (13 per cent) defecate in the open and likely lack privacy for MHM. Data on handwashing suggest that a lack of cleansing materials is a particular challenge for MHM. In six of 10 study countries with data, over three-quarters of women lacked handwashing facilities with water and soap. Further research is needed to establish the validity of various aspects of these proxies and to gain greater understanding of the principal WASH-related challenges and barriers faced by women. Nevertheless, it seems clear that interventions among communities with highest open defecation rates and lowest handwashing levels are needed to address barriers to MHM.

Keywords: menstrual hygiene management, menstruation, estimates, gender, hygiene, SDGs

THE WATER SUPPLY AND SANITATION COUNCIL (WSSCC) estimates that on any given day, 300 million women and girls are menstruating. In total, most women in the world

Libbet Loughnan (loughnan@worldbank.org) consults as an adviser to the World Bank, Washington, DC, on the international WASH indicators, and was formerly with the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP) and Data & Analytics Section/Division of Data, Research and Policy, UNICEF, New York. Rob Bain is statistics and monitoring specialist at the JMP and Data & Analytics Section/Division of Data, Research and Policy, UNICEF, New York. Rosemary Rop is water and sanitation specialist and a gender focal point in the Water Global Practice of the World Bank in Washington, DC, Marni Sommer is Associate Professor of Sociomedical Sciences at the Mailman School of Public Health, Columbia University, New York. Tom Slaymaker is senior statistics and monitoring specialist at the JMP and Data & Analytics Section/Division of Data, Research and Policy, UNICEF, New York.

© Practical Action Publishing, 2016, www.practicalactionpublishing.org
ISSN: 0262-8104 (print) 1756-3488 (online)

will spend 3,500 days of their lives bleeding (WSSCC, 2013). A recent study found that lack of access to private facilities with water for menstrual hygiene management (MHM) and education about safer, low-cost MHM materials may raise the risk of urogenital disease in women (Das et al., 2015). A woman who lacks adequate means to maintain menstrual hygiene is unable to manage her own body and health and faces myriad associated social impacts.

Management of menstruation in a healthy, safe, and dignified manner requires access to adequate information, materials, and support (Sommer et al., 2015). This includes females having: 1) awareness, information, and confidence to manage their menstruation; 2) safe hygienic absorptive materials; 3) safe and convenient facilities to change and dispose of these materials with privacy and dignity as often as necessary; and 4) adequate water, soap, and space for washing and bathing (WHO/UNICEF, 2015; Patkar, 2012).

According to Dr Jyoti Sanghera from the Office of the High Commissioner for Human Rights,

stigma around menstruation and menstrual hygiene is a violation of several human rights, most importantly of the right to human dignity, but also the right to non-discrimination, equality, bodily integrity, health, privacy and the right to freedom from inhumane and degrading treatment from abuse and violence. (WSSCC, 2013)

The human rights perspective has been successfully used to draw attention to MHM. For example WSSCC argues that 'ignoring the menstrual hygiene needs of a woman is a violation of her rights' (WSSCC, 2013) and Catarina de Albuquerque, former Special Rapporteur on Human Rights to Safe Drinking Water and Sanitation, advocated and campaigned for practitioners and policy makers to give high profile attention to MHM as part of the Sustainable Development Goal (SDG) agenda.

Menstruation, unless adequately managed, can pose many challenges in both the public and private domains of a woman's life: for example at school, social settings, or workplaces lacking adequate MHM facilities or materials. It can erode self-confidence, physical comfort, and peace of mind to concentrate or participate fully in everyday activities (Hennegan and Montgomery, 2016). The intrinsic relationship between MHM and progress on other women's rights further strengthens the argument for monitoring MHM, at global, national, and sub-national levels. Experts recommend tracking the ability to safely manage menstruation (or specific components of MHM) over time with a particular focus on the situation of disadvantaged groups of women, such as those living in poor, remote, or rural areas (WHO/UNICEF, 2015).

Globally, there is little comparable quantitative information on MHM. This is due to a combination of factors including: pervasive taboos; low prioritization and funding by decision makers; adult avoidance of discussion around sexual maturation; and a lack of research (Sommer et al., 2015). The evidence that does exist, however, clearly indicates that many girls start their menstruation uninformed, unprepared, and unsupported (Sommer and Sahin, 2013;

McMahon et al., 2011). A recent systematic review of studies in India illustrates some of the many challenges faced by adolescent girls: around half were informed prior to menarche and only a quarter knew the source of the bleeding (van Eijk et al., 2016). Across 64 studies, a quarter of girls reported missing school during their periods, with reasons including physical pain, fear of staining clothes, and social restrictions as well as inadequate water, sanitation, and hygiene (WASH) and a lack of suitable disposal facilities in school toilets. Despite strong qualitative evidence across multiple countries, the causal link between MHM and school absenteeism remains ambiguous (Sumpter and Torondel, 2013) with the few intervention trials focusing exclusively on the provision of materials and reproductive health information (Montgomery et al., 2012; Oster and Thornton, 2011). Provision of adequate WASH facilities at school appears to be more promising; evidence from econometric models for India found a strong and persistent effect of sex-separated sanitation on enrolment of adolescent girls (Adukia, 2014) and a cluster-randomized trial in Kenya linked availability of WASH facilities and girls' attendance (Freeman et al., 2012). There are numerous challenges posed by attempting to demonstrate the link between MHM and attendance outcomes, including the low quality of attendance records in many school systems, the irregularity of girl's menstrual periods in the first one to two years, the taboos around the topic which would prohibit most girls from articulating that their menstruation is the reason for absence, and the likelihood that girls may leave school early, missing hours of a school day rather than the entire day, making accurate attendance records more challenging to assess (Sommer, 2010).

The World Health Organization (WHO) and United Nations Children's Fund (UNICEF) Joint Monitoring Programme for Water Supply and Sanitation (JMP) is the entity designated by the United Nations to monitor global progress on WASH. The JMP produces comparable estimates for over 220 countries of progress on a number of WASH indicators between 1990 and 2015. The information has been based primarily on nationally representative household surveys and censuses.

In September 2015, the international community adopted 17 Sustainable Development Goals. SDG 6, 'Ensure access to water and sanitation for all' (United Nations, 2015), includes targets for universal access to drinking water, sanitation, and hygiene by 2030. Furthermore, these targets explicitly call for an end to open defecation and 'attention to the needs of women and girls and those in vulnerable situations'.

The JMP has developed plans for enhanced monitoring of WASH during the SDG period (Figure 1) based on recommendations from international consultations on drinking water, sanitation, hygiene, and equity and non-discrimination (WHO/UNICEF, 2015). The proposed framework includes indicators for water, sanitation, and hand hygiene at home as well as water, sanitation, hand hygiene, and MHM in institutions (schools and healthcare facilities).

An institutional MHM indicator has clear relevance for examining gender and sex-based inequities in WASH. But other indicators can also help to shed light on women's unique WASH experience. For example, there is a link between open defecation and women lacking a private place in which to manage menstruation

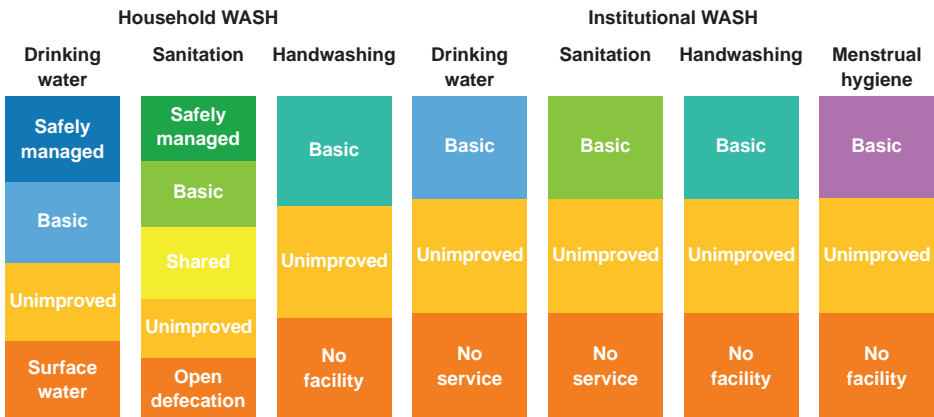


Figure 1 Main WASH indicators for SDG timeframe

(WHO/UNICEF, 2015). Our objective here is to take such ideas for proxy indicators forward and describe how existing information on WASH relates to MHM and may be used more broadly to represent the inequities women face.

Methods

Indicator selection

Staff from the JMP and from the World Bank partnered to examine how WASH monitoring related to MHM might help represent the inequities faced by women. We reviewed sector definitions and literature on MHM and developed a discussion paper based on the hypothesis that:

- Open defecation implies that women lack a private place in which to manage menstruation.
- Lacking basic sanitation that adequately separates waste from human contact implies that women lack hygiene management facilities.
- Relying on any drinking water source except piped water on the household premises is likely to make hygiene management more difficult.
- Lacking a place for handwashing where water and soap are present is likely to make menstrual hygiene management more difficult.

We calculated global estimates for each of the above, as well as national estimates for a set of case-study countries, in order to promote practical consideration of the validity and utility of such proxies.

We shared the discussion paper and estimates with a broad range of experts on MHM, water and sanitation in schools, and human rights monitoring, via email, WebEx, and relevant expert meetings. This process included a dedicated session during the second meeting of ‘Menstrual Hygiene Management (MHM) in Ten’ in

New York in October 2015 (Columbia University and UNICEF, 2016). The group of experts considered the extent to which the JMP estimates may be able to represent lack of access to certain critical elements of MHM in a quantitative manner. They reviewed and provided feedback on the strengths and weaknesses of the conceptual framework and estimates from the three crucial perspectives of advocacy, monitoring, and the potential to inform the design of programmes to support women's unique WASH experience and reduce inequities. An overview of this discussion is provided in Table 3 in the Discussion section. The expert consultation guided the authors to prioritize the following JMP estimates:

- percentage of the population without an observed handwashing facility with soap and water on the premises;
- percentage of the population practising open defecation.

Estimates for each indicator

Information on populations practising open defecation were obtained from the JMP website (wssinfo.org). The JMP open defecation estimates are in general based on nationally representative household surveys, such as the Multiple Indicator Cluster Surveys (MICS) and Demographic and Health Surveys (DHS), which pose a question 'What kind of toilet facility do members of your household usually use?', and similar census data. Handwashing data are derived from the latest MICS or DHS survey in a given country and are based on enumerators requesting permission to observe handwashing facilities and then assessing whether soap and water is present at that place.

Both of the selected indicators are based on data collected at the household level and weighted by the number of people in each household to obtain population-level estimates. We assumed that approximately half of each population are female. Although menstruation occurs periodically from menarche to menopause, we chose not to adjust for the time when women and girls are or are not menstruating. Instead, the estimates reflect the number of women and girls who have unmet needs during menstruation. These simplifying assumptions will enable others to easily replicate the analysis.

We developed estimates for each aspect of MHM for 18 World Bank WASH Poverty Diagnostics countries and, where possible, global estimates. The Diagnostic is a multi-year collaborative programme which aims to identify key challenges and opportunities to improve access, quality, and sustainability of WASH services to the poorest 40 per cent of the population in selected countries. Countries were selected to represent a broad range of geographic and development settings.

Results

According to JMP estimates, in 2015 13 per cent of the global population practised open defecation – just under a billion people. Applying the concepts expressed in this paper, this suggests half a billion women and girls lack privacy and dignity for managing menstruation (Table 1). The practice of open defecation varies considerably

Table 1 Illustrative estimates: percentage and number of women lacking any privacy in which to defecate or manage menstruation

Country	Percentage (%) ¹			Number (× 1,000)		
	Urban	Rural	National	Urban	Rural	National
Bangladesh	0	2	1	0	968	968
Ecuador	0	11	4	0	316	316
Egypt	0	0	0	0	0	0
Ethiopia	6	34	29	558	13,598	14,156
Haiti	8	35	19	238	767	1,006
Honduras	0	11	5	0	201	201
Mexico	0	4	1	0	525	525
Mozambique	13	52	39	571	4,780	5,352
Niger	14	86	73	257	6,755	7,013
Nigeria	15	34	25	6,794	16,214	23,009
Palestine	0	0	0	0	0	0
Pakistan	1	21	13	224	12,326	12,550
Panama	1	9	3	10	58	68
Tajikistan	0	0	0	0	3	3
Tunisia	0	2	1	0	39	39
Uganda	2	8	7	72	1,369	1,441
United Republic of Tanzania	2	17	12	168	3,003	3,171
Yemen	–	–	–	–	–	–
Global	2	25	13	48,184	424,737	472,921

Source: Calculations based on WHO/UNICEF (2015, updated June 2015)

1 Dashes indicate missing data. Calculations are based on JMP estimates of the population practising open defecation and assume that women and girls are as likely as men and boys to practise open defecation. We further approximate that half of the population in these countries is female.

across the study countries and is particularly prevalent in rural Niger (86 per cent) and rural Mozambique (52 per cent) whereas it is uncommon in Bangladesh, Mexico, Tajikistan, and Tunisia (Figure 2).

Based on the latest MICS or DHS in each study country, between 21 per cent and 99 per cent of people face major barriers to hygiene, having no place for handwashing with soap and water at home (Figure 3). Applying the concepts expressed in this paper, this suggests that 72 million women and girls in Nigeria alone are expected to find management of menstruation an additional challenge beyond the difficulty faced by her broader household (Table 2). Lack of a place for handwashing on the household premises with soap and water affects over three-quarters of women in six out of 10 study countries with available data. In the four

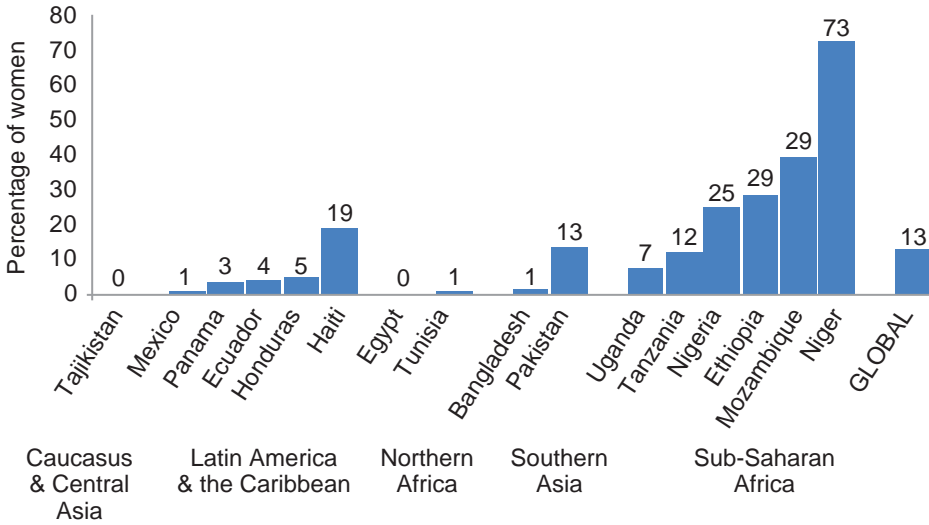


Figure 2 Percentage of women lacking any privacy in which to defecate/manage menstruation, in study countries

Note: Yemen is not shown due to lack of data

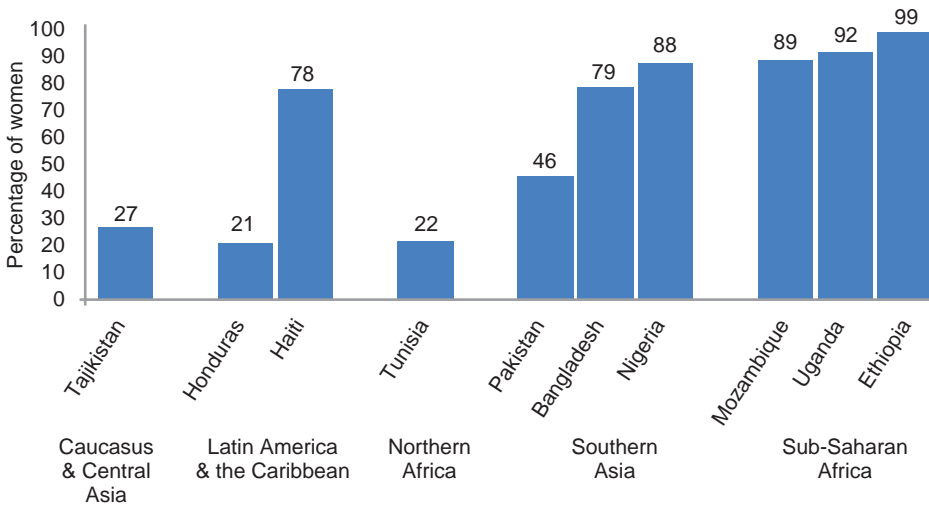


Figure 3 Percentage of women lacking a place for handwashing with soap and water at home

Note: Ecuador, Egypt, Mexico, Niger, Palestine, Panama, United Republic of Tanzania, and Yemen are not shown due to lack of data

WASH DATA AND MENSTRUAL HYGIENE MANAGEMENT

Table 2 Illustrative estimates: percentage and number of women lacking a place for handwashing with soap and water at home (HWWS)

Country	Percentage of women lacking a place for HWWS (%)			Number of women lacking a place for HWWS (× 1,000)			Source
	Urban	Rural	National	Urban	Rural	National	
Bangladesh	57	86	79	14,104	45,240	61,105	DHS 2011–12
Ecuador	–	–	–	–	–	–	–
Egypt	–	–	–	–	–	–	–
Ethiopia	96	100	99	7,610	36,769	44,250	DHS 2011
Haiti	71	84	78	1,981	1,930	3,968	DHS 2012
Honduras	20	22	21	420	411	833	DHS 2011–12
Mexico	–	–	–	–	–	–	–
Mozambique	80	93	89	3,066	7,866	10,939	DHS 2011
Niger	–	–	–	–	–	–	–
Nigeria	81	92	88	29,500	42,023	72,245	MICS 2011
Pakistan	26	56	46	8,965	31,692	41,893	DHS 2012–13
Palestine	–	–	–	–	–	–	–
Panama	–	–	–	–	–	–	–
Tajikistan	12	34	27	128	1,000	1,081	DHS 2012
Tunisia	14	38	22	505	697	1,196	MICS 2011–12
Uganda	87	93	92	2,263	13,925	16,168	DHS 2011
United Republic of Tanzania	–	–	–	–	–	–	–
Yemen	–	–	–	–	–	–	–

Source: Calculations based on handwashing data from the latest MICS/DHS in each country, as of June 2015, and the United Nations Population Division 2014 population estimate for the relevant survey year, as presented in WHO/UNICEF (2015)

Notes: Dashes indicate missing data. Calculations assume that half of the population in households lacking a place for handwashing on premises with soap and water present is female.

countries in sub-Saharan Africa, the lack of handwashing facilities is particularly common, ranging from 88 per cent to 99 per cent.

Discussion

The estimates strongly relate to a number of the critical elements defined earlier in the paper for management of menstruation at home, mainly safe and convenient facilities to change and dispose of MHM materials with privacy and dignity as often as necessary, and adequate water, soap, and space for washing and bathing. The discussion is organized around these elements.

Critical element of MHM: water

Water is a critical definitional element of MHM, and it must be available in sufficient quantities for women and girls to wash themselves at home and to also clean any reusable cloth/materials used in MHM. A number of JMP estimates relate to water: 'with piped drinking water on premises', 'with safely managed drinking water', 'with basic drinking water', or 'with a place for handwashing on premises with water present'. The first three of these are about what people drink. MHM does not require water that is safe to drink, and similarly it does not need to be piped, so data on drinking water piped onto premises may not represent all water that is available for hygiene.

In addition, while some components of the 'basic' drinking water indicator are too constrained, the parameter that requires the drinking water source to be within a 30 minute round trip is too lenient to reflect well whether MHM needs are met. A report based on the original research behind the 30 minute cut-off does not mention any direct consideration of MHM, but suggests that other critical hygiene behaviours – such as of a caregiver washing their hands after cleaning their child's bottom – are approximately only half as likely to occur if the water source is off the household premises (Cairncross and Valdmanis, 2006: 778). A more recent review of the evidence summarizes the situation as follows: if the water is between 5 and 30 minutes, collection time, 'consumption – should be assured; hygiene – handwashing and basic food hygiene possible; laundry/bathing difficult to assure unless carried out at the source'. Beyond that, 'hygiene – not possible (unless practiced at the source)' (Kayser et al., 2013). In summary, if the source is not located on household premises, hygiene may be compromised.

Evidence shows that when drinking water is collected from outside the premises, it is more likely that a woman or girl carries the burden of collecting the water (WHO/UNICEF, 2015; Sommer and Caruso, 2015). While this may mean she is more likely to ensure that sufficient quantities are collected for MHM, there is no evidence of this in the existing literature, nor on the likely challenges, coping mechanisms, or trade-offs associated with this responsibility. Responsibility for water carrying can be understood as a further inequity women face in WASH.

Table 3 WASH sector indicators and assumptions in relating these to MHM

Indicator	Relationship with MHM	Use for MHM is valid, or involves under- or overestimate
Sanitation		
Population practising open defecation	Without any toilet everyone lacks privacy and related dignity for defecation, with menstruation posing additional challenges for women and girls among them.	Likely to underestimate the number of girls and women who do not have a private place to manage their MHM. Some women practising open defecation may manage their menstruation in a private place.
Population using unimproved sanitation	This entire group is denied the dignity of being able to adequately contain any bodily waste from human contact.	Some sanitation facility types are less conducive for separating human waste from human contact. Along this path of logic, the type of sanitation facility people report using determines whether the JMP classifies them as having unimproved sanitation, and thus whether waste is likely to be adequately contained from human contact. It is possible that there is both some under- and overestimate involved. Some people may use a type of facility classified as unimproved, but they may conscientiously manage it in a way that does effectively quarantine pathogens. Similarly, some people may soil a latrine that is classified as improved. Furthermore, although these estimates are based on the usual sanitation practices of the household, some women may be able to access better facilities away from home, for example at school or the workplace, and some may only be able to access worse facilities than their household.
Hand hygiene		
Population without an observed place for handwashing with soap and water on premises	<p>A. Without water and soap, hygiene is challenging for anyone who is menstruating.</p> <p>B. Handwashing, an important behaviour after toilet use and MHM, is impossible without a cleanser such as soap.</p> <p>C. Cleansing one's body and clothes is also likely harder in these households.</p> <p>D. Approximately half of the estimate is women, and approximately half of them are managing menstruation.</p>	<p>The concepts as phrased in points A and B are likely valid. It should be remembered that the estimates of the population without an observed place for handwashing with soap and water on premises may be an underestimate if households choose not to show the enumerator a place for handwashing.</p> <p>For C it should be remembered that it is possible that the household has water and soap at another location that they don't consider to be a place for handwashing, and that they do use it for washing their body and clothes.</p> <p>D could be an overestimate somewhat if households with a menstruating woman are more likely than other households to have an adequate place for handwashing. On the other hand, D could be an underestimate if women cannot practically use the handwashing station immediately after all critical instances for hygiene, for example if the handwashing station is located away from the space in which they manage their menstruation, or if household members discourage sharing of soap for such purposes.</p>

(continued)

Table 3 WASH sector indicators and assumptions in relating these to MHM (continued)

<i>Indicator</i>	<i>Relationship with MHM</i>	<i>Use for MHM is valid, or involves under- or overestimate</i>
Drinking water		
<i>Population without piped water on premises</i>	If hygiene relies on the same water source, any hygiene management is difficult, with MHM posing an additional challenge for anyone who is menstruating.	Likely to suffer some overestimation and some underestimation in different contexts. MHM does not require drinking water and it does not require water piped onto premises. On the other hand, water piped on premises does not necessarily mean that a woman can use it for MHM.
<i>Population using any drinking water source beyond a 30 minute round trip</i>	If hygiene relies on the same water source, any hygiene management is extremely difficult, unless practised at the source. MHM poses an additional challenge for anyone who is menstruating, and would be unlikely to be practised at the source.	Likely to suffer some overestimation and some underestimation in different contexts. In this population, MHM may still be being carried out with a source of water that is not considered drinking water, or may still be possible if water is stored on premises and readily available to a menstruating woman. On the other hand, some households that do have drinking water from more than 30 minutes' round trip away may not have any amount to be used for MHM.

The indicator ‘with a place for handwashing on premises with water present’ suffers fewer issues, as summarized in Table 3. The authors would argue that presence of water at a place for handwashing is a relevant indicator for a woman at least having that critical component of MHM.

Critical element of MHM: soap

Access to soap is also a critical definitional element of MHM. The main JMP estimates interfacing with this critical element are ‘with soap anywhere on premises’ and ‘with a place for handwashing on premises with soap present’. Estimates on both indicators are available for over 50 countries, as the observation-based measurement is included in all standard MICS and DHS. The former is also part of the standard MICS. The first indicator reflects total availability of this critical item, but the second indicator shows that the household has the soap ready for use in personal hygiene, and so the second option is more relevant to capturing the implications for MHM.

The JMP already has plans to monitor these two critical elements combined as a single indicator ‘with a place for handwashing on premises with soap and water present’ throughout the SDG period. The indicator is measurable and data already exists (Loughnan et al., 2015). Beyond MHM, there is ample evidence that the ability to handwash with soap and water is important for health. For example, hand hygiene interventions can reduce gastrointestinal illness such as diarrhoea by up to 42 per cent and acute respiratory infections by up to 34 per cent (Aiello et al., 2008). Handwashing with soap has also been shown to be associated with reduced neonatal mortality (Rhee et al., 2008) and skin infections (Luby et al., 2005). Therefore this current work on MHM adds even further rationale for the already critical call for monitoring the indicator.

Critical element of MHM: a private place

A private place for MHM is also a critical definitional element of MHM. The main JMP estimate with possible interface with this critical element is ‘with no toilet facility: practicing open defecation’. The glaring issue is that these women have no privacy in which to properly manage their sanitation and hygiene needs (even if they have some other private place in which to partially manage menstruation – for example for some changing of absorptive materials), and menstruation means that women tend to have more frequent demand for a private place in which to wash. There are further issues to consider, for example the vulnerability to sexual harassment and attack females are subject to when forced through necessity to expose themselves (Sommer et al., 2014). To expose oneself close to the public arena means less privacy and perhaps more ridicule, fear, and feelings of shame and embarrassment. To expose oneself further away means more privacy but more vulnerability. These considerations, along with all others explored in this article, suggest that women and girls face compounded inequities in WASH.

Critical element of MHM: a suitable place for disposal

Management of menstrual hygiene is not possible without a place in which to safely dispose of waste materials. Evidence suggests that often MHM materials are disposed directly into latrines or toilets. Two main related JMP estimates would be: 'Population practicing open defecation' and 'Population using unimproved sanitation'.

'Using unimproved sanitation' suggests that if the MHM materials are deposited into the facility, the bodily waste may not be effectively separated from human contact, and flies, other animals, or seepage may carry it back into the environment.

Those 'practicing open defecation' not only lack privacy for managing their body in menstruation, but they also likely lack any obvious place for safely disposing of waste.

Separate to the idea of improved or unimproved latrines, it is worth considering that disposal of pads/cloth can undermine the sustainability of all types of sanitation except simple open defecation. For sanitation wherein the waste stays onsite (e.g. in latrines with a simple cavity below the seat), it means pits fill more quickly and makes pit emptying more difficult. For sanitation which involves flushing the waste, materials can clog the system (Sommer et al., 2013). MHM requires an immediate receptacle to contain waste but also an effective system for final disposal.

Shortcomings of the indicators

These existing estimates cannot represent some of the critical elements of MHM, most notably: 1) awareness, information, and confidence to manage menstruation; and 2) safe hygienic absorptive materials (WHO/UNICEF, 2015; Patkar, 2012).

The assumptions and shortcomings involved in relating each existing indicator to MHM are summarized in Table 3. A number of general assumptions in addition to those mentioned in the table come into play when calculating specific percentages or numbers of women affected:

- The results are weighted by household population number to estimate overall rates, and it is assumed that approximately half of the population is women. Under natural circumstances there should be slightly more women than men, but in some countries this ratio is skewed by unnatural events, taking the ratio higher (for example if more men than women have died in a war) or sending it in the other direction (for example in countries with son-preference) (UNFPA, 2016).
- Few surveys record intra-household differences in sanitation. Evidence from some countries suggests that men may be less likely to use sanitation facilities than women (National Sample Survey Office, 2013). Therefore if the survey respondent is a man or the household has a male majority then the 'usual' practice may not reflect women's behaviour.
- In addition to this, long-standing taboos surrounding menstruation exclude women and girls from many aspects of social and cultural life as well as menstrual hygiene services. Such taboos include not being able to touch water points, and exclusion from the family home and sanitation facilities. As a result,

women and girls are often denied access to water and sanitation when they need it most (House et al., 2012).

Over time these estimates may be fine-tuned through new evidence, but it seems reasonable to assume that in general among open defecators and among those without a place for handwashing where water and soap are present, approximately half are women. Thus this paper provides the first estimates of the global magnitude of this serious but frequently overlooked obstacle to gender equity. The largest estimate provided in this paper is that at least half a billion women face privacy and dignity issues for managing menstruation. But for those countries with data also available on handwashing, at least twice as many (and often many times more) women are likely to experience a lack of water and soap while menstruating compared with those who experience a lack of privacy.

Potential new indicators on MHM

The JMP plan for post-2015 monitoring makes clear that the existing estimates in this article are not enough: the JMP will develop guidance on monitoring MHM in schools and health centres, and is also developing questions for inclusion in household surveys that record whether women have the necessary elements of MHM outlined earlier in this article. Candidate questions to measure elements in this more direct manner are being piloted under the guidance of the JMP, including in MICS and in the World Bank's WASH Poverty Diagnostics programme.

Other survey networks and agencies have also been collecting relevant data, and may do so increasingly as MHM issues gain prominence. In particular, those documenting the location of water and soap relative to the toilet, anal cleansing materials, or existence of a sanitation facility on the premises might bring useful new insights.

Such data will fill some of the remaining important gaps that the estimates discussed herein leave unaddressed. They will also help validate the proxy measures listed above.

Outlook and priorities for future work

As data availability, as well as the rates in countries where data do exist, tends to be far lower for handwashing than for open defecation, special efforts to increase data on handwashing are warranted. The fact that handwashing was recently formally included as a global SDG indicator can help increase demand for data collection in this area.

In the meantime these two simple proxy indicators will help to support the existing work of experts in MHM, water and sanitation in schools, and human rights monitoring to represent the unique WASH experience of women and adolescent girls. As the country-based World Bank staff utilize the estimates and encourage uptake among stakeholders, there will be a need to develop documentation of the experience for broader readership.

Further work is needed to assess the ability of the proxies to capture key barriers to MHM in a variety of settings, to confirm or refute the assumptions inherent in using simple proxies, and identify alternative measures that address the shortcomings. Use of questionnaire validation techniques, such as behaviour coding in pilot surveys, may support the uptake of new questions, including in international household survey programmes such as MICS and DHS.

Conclusion

WASH data provide imperfect proxies for access to adequate MHM facilities but can nevertheless usefully represent women and adolescent girls on some of the particular challenges they face in relation to managing menstruation with dignity and safety. This paper has shown that a lot more can be done with existing information to highlight existing inequities in WASH and build a more sustainable WASH future. Everyone who lacks any toilet is denied privacy and associated dignity, with menstruation posing additional challenges for women among them. A lack of soap and water poses major challenges for a broad spectrum of hygiene behaviours, but is especially challenging for anyone who is menstruating. If hygiene is practised using the drinking water source, then the distance from the household of that source raises particular concerns for menstruating women. More qualitative and quantitative research is needed to establish the validity of these proxies and to gain greater understanding of the principal challenges faced by women in different countries and contexts and how these relate to other barriers faced in accessing WASH services.

References

- Adukia, A. (2014) *Sanitation and Education* [pdf], Harvard University <http://scholar.harvard.edu/files/adukia/files/adukia_sanitation_and_education.pdf> [accessed 14 May 2014].
- Aiello, A.E., Coulborn, R.M., Perez, V. and Larson, E.L. (2008) 'Effect of hand hygiene on infectious disease risk in the community setting: a meta-analysis', *American Journal of Public Health* 98(8): 1372–81 <<http://dx.doi.org/10.2105/AJPH.2007.124610>>.
- Cairncross, S. and Valdmanis, V. (2006) 'Water supply, sanitation, and hygiene promotion', in D.T. Jamison, J.G. Breman, A.R. Measham, G. Alleyne, M. Claeson, D.B. Evans, P. Jha, A. Mills, and P. Musgrove (eds), *Disease Control Priorities in Developing Countries*, Chapter 41, Washington, DC: World Bank.
- Columbia University and UNICEF (2016) 'MHM in Ten': *Advancing the MHM Agenda in WASH in Schools Second Annual Meeting*, UNICEF Programme Division.
- Das, P., Baker, K.K., Dutta, A., Swain, T., Sahoo, S., Das, B.S., Panda, B., Nayak, A., Bara, M., Bilung, B., Mishra, P.R., Panigrahi, P., Cairncross, S. and Torondel, B. (2015) 'Menstrual hygiene practices, WASH access and the risk of urogenital infection in women from Odisha, India', *PLoS ONE* 10(6): e0130777 <<http://dx.doi.org/10.1371/journal.pone.0130777>>.
- Freeman, M.C., Greene, L.E., Dreifelbis, R., Saboori, S., Muga, R., Brumback, B. and Rheingans, R. (2012) 'Assessing the impact of a school-based water treatment, hygiene and sanitation programme on pupil absence in Nyanza Province, Kenya: a cluster-randomized trial', *Tropical Medicine and International Health* 17: 380–91 <<http://dx.doi.org/10.1111/j.1365-3156.2011.02927.x>>.

- Hennegan, J. and Montgomery, P. (2016) 'Do menstrual hygiene management interventions improve education and psychosocial outcomes for women and girls in low and middle income countries? A systematic review', *PLoS ONE* 11(2): e0146985 <<http://dx.doi.org/10.1371/journal.pone.0146985>>.
- House, S., Mahon, T. and Cavill, S. (2012) *Menstrual Hygiene Matters: A Resource for Improving Menstrual Hygiene around the World*, London: WaterAid.
- Kayser, G.L., Moriarty, P., Fonseca, C. and Bartram, J. (2013) 'Domestic water service delivery indicators and frameworks for monitoring, evaluation, policy and planning: A review', *International Journal of Environmental Research and Public Health* 10: 4812–35 <<http://dx.doi.org/10.3390/ijerph10104812>>.
- Loughnan, L., Ram, P. and Luyendijk, R. (2015) 'Measurement of handwashing behaviour in multiple indicator cluster surveys and demographic and health surveys, 1985–2008', *Waterlines* 34(4) <<http://dx.doi.org/10.3362/1756-3488.2015.028>>.
- Luby, S.P., Agboatwalla, M., Feikin, D.R., Painter, J., Billhimer, W., Altaf, A. and Hoekstra, R.M. (2005) 'Effect of handwashing on child health: a randomised controlled trial', *The Lancet* 366(9481): 225–33 <[http://dx.doi.org/10.1016/S0140-6736\(05\)66912-7](http://dx.doi.org/10.1016/S0140-6736(05)66912-7)>.
- McMahon, S., Winch, P., Caruso, B., Obure, A., Ogutu, E., Ochari, I., McMahon, S.A., Winch, P.J., Caruso, B.A., Obure, A.O., Ogutu, E.O., Ochari, I.A. and Rheingans, R.D. (2011) "The girl with her period is the one to hang her head": reflections on menstrual management among schoolgirls in rural Kenya', *BMC International Health and Human Rights* 11: 1–10 <<http://dx.doi.org/10.1186/1472-698X-11-7>>.
- Montgomery, P., Ryus, C.R., Dolan, C.S., Dopson, S. and Scott, L.M. (2012) 'Sanitary pad interventions for girls' education in Ghana: a pilot study', *PLoS One* 7: e48274 <<http://dx.doi.org/10.1371/journal.pone.0048274>>.
- National Sample Survey Office (2013) *Housing Condition and Amenities in India – NSS 2012*, Ministry of Statistics and Programme Implementation, Government of India.
- Oster, E. and Thornton, R. (2011) 'Menstruation, sanitary products, and school attendance: evidence from a randomized evaluation', *American Economic Journal: Applied Economics* 3: 91–100 <<http://dx.doi.org/10.1257/app.3.1.91>>.
- Patkar, A. (2012) *Preparatory Input on MHM for End Group by Archana Patkar, WSSCC, JMP Equity and Non-Discrimination Working Group*.
- Rhee, V., Mullany, L.C., Khatri, S.K., Katz, J., Leclercq, S.C., Darmstadt, G.L. and Tielsch, J.M. (2008) 'Maternal and birth attendant hand washing and neonatal mortality in southern Nepal', *Archives of Pediatrics & Adolescent Medicine* 162(7): 603–8 <<http://dx.doi.org/10.1001/archpedi.162.7.603>>.
- Sommer, M. (2010) 'Putting "menstrual hygiene management" into the school water and sanitation agenda', *Waterlines* 29(4): 268–78 <<http://dx.doi.org/10.2105/AJPH.2013.301374>>.
- Sommer, M. and Caruso, B. (2015) 'Menstrual hygiene management and WASH', in J. Bartram (ed.), *Routledge Handbook of Water and Health*, pp. 522–30, Abingdon, UK: Routledge.
- Sommer, M. and Sahin, M. (2013) 'Overcoming the taboo: advancing the global agenda for menstrual hygiene management for schoolgirls', *American Journal of Public Health* 103(9): 1556–9 <<http://dx.doi.org/10.2105/AJPH.2013.301374>>.
- Sommer, M., Kjellén, M. and Pensulo, C. (2013) 'Review paper: girls' and women's unmet needs for menstrual hygiene management (MHM): the interactions between MHM and sanitation systems in low-income countries', *Journal of Water, Sanitation and Hygiene for Development* 3(3): 283–97 <<http://dx.doi.org/10.2166/washdev.2013.101>>.

Sommer, M., Cavit, S., House, S. and Ferron, S. (2014) 'Violence, gender and WASH: spurring action on a complex, under-documented and sensitive topic', *Environment and Urbanization* 27(1): 105–16 <<http://dx.doi.org/10.1177/0956247814564528>>.

Sommer, M., Sutherland, C. and Chandra-Mouli, V. (2015) 'Putting menarche and girls into the global population health agenda', *Reproductive Health Journal* 12: 24 <<http://dx.doi.org/10.1186/s12978-015-0009-8>>.

Sumpter, C. and Torondel, B. (2013) 'A systematic review of the health and social effects of menstrual hygiene management', *PLoS One* 8: e62004 <<http://dx.doi.org/10.1371/journal.pone.0062004>>.

UNFPA (2016) 'Gender-biased sex selection' [online] <www.unfpa.org/gender-biased-sex-selection> [accessed 14 May 2016].

United Nations (2015) Sustainable Development Goals <www.un.org/sustainabledevelopment/water-and-sanitation/> [accessed 14 May 2016].

Van Eijk, A.M., Sivakami, M., Thakkar, M.B., Bauman, A., Laserson, K.F., Coates, S. and Phillips-Howard, P.A. (2016) 'Menstrual hygiene management among adolescent girls in India: a systematic review and meta-analysis', *BMJ Open* 6: e010290 <<http://dx.doi.org/10.1136/bmjopen-2015-010290>>.

Water Supply and Sanitation Collaborative Council (WSSCC) (2013) 'Celebrating womanhood: how better menstrual hygiene management is the path to better health, dignity and business', Geneva: WSSCC <<http://wsscc.org/resources-feed/celebrating-womanhood-report-2013/>> [accessed 14 May 2016].

WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation (2015) *Progress on Sanitation and Drinking Water, 2015 Update and MDG Assessment*, Geneva: WHO; New York: UNICEF.