Handwashing for menstrual hygiene management among primary schoolgirls in rural western Kenya

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Good hand hygiene contributes to the health and educational attainment of schoolchildren. Poor menstrual hygiene management (MHM) is recognized to impact on girls' health, education, wellbeing and dignity, particularly in low-income countries. Identifying practical, affordable, and comfortable menstrual products to improve girls' MHM is needed. One potential cost-effective product is the menstrual cup; however, provision of this insertable MHM product, in schools in low-income countries with challenging water, sanitation and hygiene (WASH) conditions, increases the need for assurance of good hand hygiene. This paper uses data from a randomized controlled feasibility study evaluating the acceptability, use and safety of menstrual hygiene products provided to schoolgirls in rural western Kenya. Here, we explore girls' handwashing practices in school when using menstrual cups, sanitary pads or traditional items, examining the availability of WASH and the reported frequency of handwashing. Data generated from interviews with adults, girls' private surveys, narratives from focus group discussions, and observational WASH surveys are explored. Reported presence of WASH was higher than that observed during random spot-checks. Overall, 10 per cent of girls never washed before, and 7 per cent never washed after, emptying or changing their menstrual item at school. Girls in cup schools were twice as likely to wash prior to emptying, compared with girls using other items. Handwashing among girls using traditional items was low, despite the same hand hygiene training across groups and a comparable WASH presence. Data highlight the need for sustained mechanisms to support schoolgirls' handwashing practices for MHM.

Keywords: handwashing, Kenya, menstrual cup, menstrual hygiene management, schoolchildren, WASH

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http://dx.doi.org/10.3362/1756-3488.2015.027, ISSN: 0262-8104 (print) 1756-3488 (online)

Introduction

Recognition and promotion of the importance of water, sanitation and hygiene (WASH) in schools (WinS), to improve health, education, and gender equity, has gained momentum in recent years (UNICEF, 2010). Bottleneck analysis identified hygiene practices to be a key constraint in low-income countries, with a lack of promotion of handwashing. Handwashing has been shown to reduce school absenteeism (Bowen et al., 2007; Talaat et al., 2011), an important proxy for both childhood disease and educational outcomes (Bundy and Guyatt, 1996). Measures of hand hygiene behaviour thus provide important data when evaluating programme effectiveness, and for understanding the relationship between hygiene and health (Ram, 2013). In a call for action to promote WinS (UNICEF, 2012), WASH monitoring in schools has been identified as a key action point, and materials have been developed to incorporate monitoring into national education monitoring information systems (UNICEF, 2011).

Good menstrual hygiene management (MHM) has also been recognized in recent years as an important contributor to girls' health, education, wellbeing, and dignity (Sommer and Sahin, 2013). Lack of adequate water, latrines and hygiene training on school grounds may affect a girls' ability to maintain good MHM (Sommer, 2010). Use of traditional items such as cloth, pieces of mattress, and socks make girls vulnerable to leaking and odour (McMahon et al., 2011; Mason et al., 2013). Qualitative studies suggest use of such items prevents girls from concentrating in class, with some girls reporting they skip school during menstruation because of these challenges (Sommer, 2010; McMahon et al., 2011; Mason et al., 2013). Alternative menstrual solutions that are accessible, affordable, and safe in school as well as home environments are clearly needed (Sommer and Sahin, 2013). One potential product is the menstrual cup, an insertable medical-grade silicone bell, which can be used for a number of years and has been tested and used by women internationally (Stewart et al., 2009, 2010; Howard et al., 2011), including in sub-Saharan Africa (Averbach et al., 2009). While small-scale studies report schoolgirls in low-income countries can use cups (Oster and Thornton, 2012), no data are available on the hygiene implications of using insertable menstrual products in varying school environments in these countries.

Hygiene-related practices during menstruation are also reported to impact on health (Trego, 2012) and could possibly increase girls' vulnerability to reproductive tract infections (Dasgupta and Sarkar, 2008). Most MHM hygiene studies, however, have focused on cleaning menstrual items and bathing, rather than hand hygiene (Pickering et al., 2014). Measurement of girls' hand hygiene for different menstrual products has not been well documented but would be an important component of MHM nested within school WASH programmes. While observational studies on handwashing provide insights at a population level, these studies are less able to capture data at an individual level over time (Schmidt et al., 2009; Pickering et al., 2014). Self-completed surveys using computers show greater accuracy than face-to-face interviews when studying socially sensitive behaviours, such as sexual activity among adolescent girls (Hewett et al., 2004;

WaterAid, 2009), and they may play a role in understanding true hand hygiene as well.

This paper utilizes data from a mixed-methods MHM feasibility study designed to examine the acceptability, use, and safety of menstrual products, including menstrual cups, among primary schoolgirls in rural Kenya. Within the study, girls' self-reports on their handwashing behaviour using private netbook computers, separate reporting to adults (nurses) during face-to-face interviews, and narratives on handwashing and school WASH during focus group discussions, are evaluated. We examine differences in hand hygiene between menstrual items used, longitudinally over the study, and explore characteristics that may have impacted on hand hygiene during the study.

Methodology

Study area and population

The study site is within the health and demographic surveillance system (HDSS) of the Kenya Medical Research Institute (KEMRI) in Siaya County, formerly part of Nyanza Province. This rural area, located a few miles north of Lake Victoria, has a population approximating 230,000 individuals spread across three districts of Asembo, Gem and Karemo (Odhiambo et al., 2012). The population is predominantly rural and culturally homogeneous; over 95 per cent of people are members of the Luo ethnic community and live through subsistence farming and local trading. Public education in Kenya is based on eight years' primary, four secondary, and four years of higher education (Omwami and Omwami, 2009). Province statistics indicate nearly all (98%) children enrol in primary school (Mugo et al., 2012), but gender disparity increases during adolescence (Mensch et al., 2001). Primary school environments in these areas of western Kenya often struggle with access to a water source, provision of sufficient or improved latrines, and adequate hygiene facilities (Migele et al., 2007; Blanton et al., 2010; Dreibelbis et al., 2013). At baseline, schools in the study catchment area had varying levels of WinS; however, just 13 per cent had water in or very near the girls' latrines, and only one school was observed to have soap (Alexander et al., 2014).

MS Study overview

The Menstrual Solutions Study (MS Study) was a cluster randomized controlled feasibility study examining the acceptability, use and safety of menstrual items, including menstrual cups, among primary schoolgirls in western Kenya. Of the 71 schools in the study area, 30 were selected based on agreement to participate and their achieving the minimum WASH criteria, discussed in detail elsewhere (Alexander et al., 2014). Randomization into the three school study groups (menstrual cups, sanitary pads, or usual-practice controls) was conducted in the community with school head teachers and district education officials. The study was discussed with parents and target-aged girls before obtaining informed written

parental consent at home and participant assent at school. Pre-intervention, girls received puberty and hygiene education, including detailed instructions on how to correctly wash their hands, and specific training on their allocated menstrual item. At baseline, participants were taught how to use netbooks (2go™ Convertible Classmate PC). Girls from these schools were eligible to participate if in classes 5 through 8, aged 14 to 16 years old, and if they had experienced three or more menstrual periods. Study nurses provided girls with the assigned menstrual items after baseline screening. Girls were followed on average twice per term through nurse screening from August 2012 to the end of the academic school year, November 2013. At each screening girls received a bar of soap. Additionally, schools received detergent monthly for making soapy water to support handwashing.

Quantitative data collection

Examination of schools' WASH, including the supply of water and soap, and the number, type and quality of latrines, was conducted at baseline and has been presented elsewhere (Alexander et al., 2014). Observational unannounced school spot-checks were made during the study (up to twice per term), providing data on the presence of handwashing water/soap per school. At each girls' individual screen, study nurses performed face-to-face personal interviews about their menstruation, menstrual item use and problems encountered, and hygiene issues including handwashing before and after changing or emptying their menstrual item. On the same day, girls separately completed a private survey answering similar questions on netbooks. Questions on hand hygiene asked, 'Did you wash your hands before changing? (or emptying, for cups)', and 'Did you wash your hands after changing? (or emptying, for cups)'. All survey instruments were piloted in the target age group as paper questionnaires prior to programming onto netbooks. Data gathered were copied weekly onto temporary hard drives before downloading at the KEMRI research station. Characteristics of girls were generated at baseline, with linkage to household socio-economic status data from the HDSS.

Qualitative data collection

As reported elsewhere (Mason et al., 2013, 2014), focus group discussions (FGDs) were conducted among girls, parents, and teachers at different stages of the study. At each stage, study schools were visited by field staff and meetings held with participating girls, describing the FGD methods and allowing time for question and answer sessions. Girls who stated their interest in participating in an FGD were documented and their parents were visited at home to request approval and written consent for their daughter to participate. Following parental consent, girls provided their written assent before the FGD commenced. Following completion of girls' FGDs, parents of participating girls were invited to join a parent FGD, and consented if

they agreed. Each FGD had a maximum of 12 participants, with groups lasting between 1 and 1.5 hours.

Menstrual items

Girls in the menstrual cup group received a Mooncup®, size B for nulliparous women, or size A for those who had given birth (Stewart et al., 2010; Oster and Thornton, 2012). This brand was chosen as it had been piloted among secondary schoolgirls in Nairobi, and was approved by the Kenyan Pharmacy and Poisons Board, and internationally by the US Food and Drug Administration. Menstrual cups collect approximately 30 ml of menstrual blood and last 4–8 hours before emptying is required; cup manufacturers advise users to wash their hands before emptying the cup to minimize the risk of vaginal contamination. Girls in the sanitary pad arm were each given two packs (total 16 pads) monthly of Always®, a brand commonly available in Kenya. Girls in the usual-practice control group continued using traditional materials such as cloths, with some buying a few pads if resources were available (Mason et al., 2013, 2014).

Analysis

Quantitative. Data were analysed using Stata10. Frequency of handwashing was collapsed from 'always', 'sometimes', and 'never' into 'always' and 'not always'. Girls' responses over the study duration were separately aggregated to define which girls only responded 'never' to washing hands throughout the study. Age categories were collapsed into 'younger' (below 16 years) and 'older' (16 years and above). Duration since intervention was categorized from a continuous variable into three-month aggregates up to 12 months or more. Socio-economic status, classed at girls' household level by multiple-component analysis into quintiles, was collapsed into 'poorest' (lower two quintiles) and 'less poor' (upper three quintiles). Frequencies and percentages of handwashing questions from nurse-led and girls' private surveys were compared by menstrual item reportedly used by girls, and by study arm (where relevant), using chi-squared tests with significance level set at 5 per cent. Mantel-Haenszel (M-H) Relative Risks (RR), with Taylor Series 95% confidence intervals (CI) was used to compare handwashing rates between nurse-led and self-reports. RR analyses were stratified into handwashing before and after changing, using M-H weighted RR and Greenlands-Robins 95% CI to provide summary statistics.

Qualitative. Thematic analysis was conducted (Boyatzis, 1998) on transcripts prepared from girls' focus group discussions, as previously described (Mason et al., 2013, 2014). Transcripts were entered in NVIVO version 10 and codes assigned to relevant sections of the transcripts. Text assigned to the theme of water and sanitation, and changing of menstrual items was extracted from prior analysis of main themes (Mason et al., 2013, 2014).

Ethics

The MS Study was granted ethical approval from the scientific and ethical review boards of the Kenya Medical Research Institute (SSC No 2198), the Institutional Review Board of the U.S. Centers for Disease Control and Prevention, and the Ethics Committee of the Liverpool School of Tropical Medicine (12.11).

Results

During the course of the study, 78 per cent of participating girls reported during nurse screening that they needed to change their menstrual item while in school. By method, this represented 76 per cent of girls allocated menstrual cups, 79 per cent of those provided with pads, and 78 per cent of girls in usual-practice control schools.

Presence of WASH for handwashing

Overall, nearly all girls (96%) reported they were able to find something for cleaning their hands after changing or emptying in school, ranging from 82% to 100% of the time, by school. The majority of girls reported availability of water (83%), soap (61%) or soapy water (13%), with a small proportion reporting dry rags (3%). Girls in usual-practice control schools reported the highest frequency of water and soap present, and girls in pad schools the lowest (see Figure 1). On aggregate, girls reported that having something to clean their hands increased from 91 per cent to

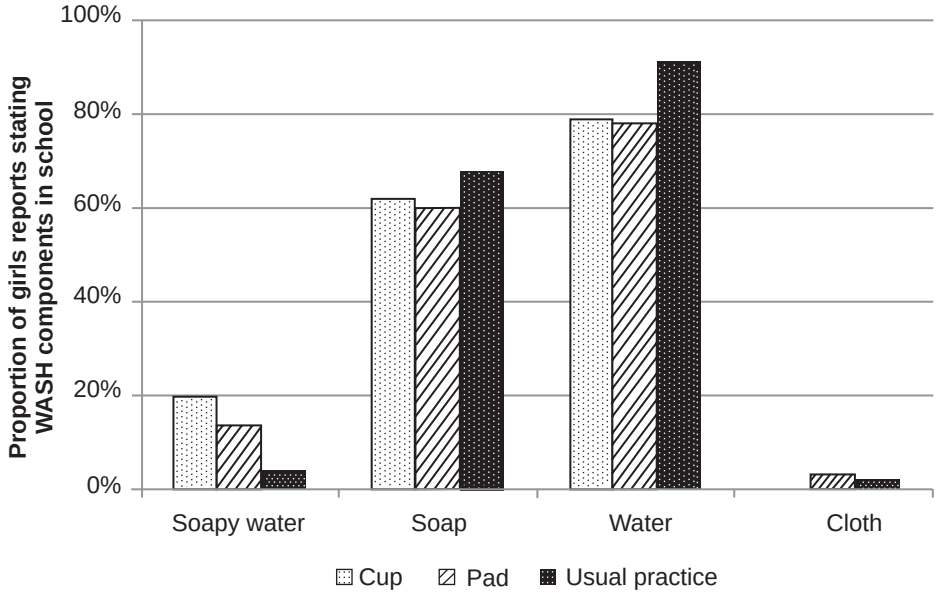

Figure 1 Reported frequency of soap, water, and cloth for washing hands aggregated by school arms

97 per cent (χ^2 linear trend 36.2, $p < 0.001$) over the study; this same increase was reported among each of the study arms.

No similar WASH question was asked in girls' private surveys, but girls' narratives from focus group discussions illustrate a range of provision, regardless of intervention. In one control school it was noted, 'Inside the latrine is clean, they are washed every morning, next to the latrines there are some water for washing hands' (P1, girl, School 2, control). A good supply of water and soap was reported in a cup school, 'Because we also have soap in the school and there is also water in the tanks' (Px, girl, School 9, cup). At the same time, a girl in a cup-allocated cup school stated girls resolved the problem of a lack of soap at school by carrying the bar soap provided to them by the MS Study: 'We carry from home' (Px, girl, School 8, cup). Girls in one cup FGD said they carried a small bottle of water for their menstrual hygiene.

The provision of the soapy water for handwashing was reported by girls across all arms, mostly through tippy-taps. Girls mentioned the 'omo foam' (detergent provided monthly to study schools by the study) and water provided through tippy-taps. Despite this provision, girls reported a lack of soap: 'They put soap but lower pupils normally steal them' (P4, girls, School 3, control). Girls in the group said they did not tell a teacher if supplies ran out.

These narratives support the findings from the unannounced observational study conducted by the WASH survey team twice each term. On average, water was observed in 4.6 of every six visits made to each of the 30 schools; 50 per cent of schools had water present on each of the six visits, and all schools except two had water on half or more visits. This contrasts with evidence of soap on the unannounced WASH survey visits, where soap was only observed in 1.7 of every six visits made to each school. No school had evidence of soap on each of the six visits, and six (20%) schools had no soap on any of the visits. Availability of water very close to girls' latrines was similarly restricted, observed in 1.5 of every six visits made to all schools. One (3%) school had provided this on all six visits, while eight (27%) never had any water provided to girls' latrines. Differences in observed WASH conditions between the intervention arms were not evident.

In contrast, parents in general seemed satisfied with facilities for girls' washing needs at school:

> 'Sincerely we have much water in Gem.' (P2, parent, School 4, pad)
>
> 'Are the girls using soap before and after changing whatever they are using?' (Moderator)
>
> 'That is a must. Even if others [other family members] do not have soap, she must have her soap to prevent the bad oduor.' (Px, parent, School 2, control)
>
> 'Yes, I wanted to add something, we as a school, we are trying to keep good hygiene in school, we have wash hands in classes, where we have mixed some soap with water for washing hands, we encourage the children to wash their hands when they are from the latrines or after changing, so that they can maintain good hygiene.' (P10, parent, School 3, pad)

Teachers' dialogue varied about WASH facilities. In some schools, facilities were considered quite adequate, and when not available, could be brought by the pupils themselves:

> 'Do you have enough water, for girls who are menstruating?' (Moderator)
>
> 'Water is there.' (P4, teacher, School 3, cup)
>
> 'When it is not adequate, sometimes we do ask the children to go and fetch.' (P7, teacher, School 3, cup)
>
> 'What about the sanitation facilities, do you have enough of them?' (Moderator)
>
> 'We have a bathroom, so [but] the basins are not available.' (P1, teacher, School 3, cup)
>
> 'What about the latrines?' (Moderator)
>
> 'The latrines are adequate.' (Px, teacher, School 3, cup)
>
> 'And the soap?' (Moderator)
>
> 'They are usually given the bar soaps, only those who are in the study, and the others (omo powder) for hand washing is for the rest, all of them.' (Px, teacher, School 3, cup)

In most schools teachers were satisfied with hygiene provision, stating for example, 'Yes enough water with enough basins, enough bathrooms' (Px, teacher, School 6, pad). Teachers from another school reiterated 'there is water' and 'soap is always there', but when asked if there were times of shortage, another noted 'In case there is drought the pupils usually carry water from home' (P9, teacher, School 5, pad). Another reported, 'The water is there but I haven't seen the soap' (P7, teacher, School 4, control).

Teachers within schools disagreed, for example, when asked if the water was sufficient for girls' needs:

> 'Actually we have two tanks, and I think they are all full [he laughs] so even around some like noon, you will see some of them going there to wash.' (P4, teacher, School 6, pads)
>
> 'Okay, this tank is leaking, and even right now as we are saying, there is no water there, so we cannot say that we have sufficient water, no, we need even more tanks.' (P7, teacher, School 6, pads)

Some teachers wanted their schools to provide more to girls, with observations about girls struggling to maintain hygiene. For example, when water was not close by the latrine, one teacher reported that handwashing after emptying menstrual cups was difficult:

> 'They also complain that when it is full, when removing it sometimes they wash themselves with blood, so they feel shy and do not come back to wash their hands.' (P1, teacher, School 1, cup)

'They do not have the taps near the latrines?'(Moderator)

'No, they are not there. Sometimes they are forced to come to these tanks near the office, and that makes them feel embarrassed ... when blood is in the hands, you know …' (P1, teacher, School 1, cup)

Another in the same school suggested: 'I think what we should at least provide in school to help the girls is that liquid soap "Dettol", then we put them near the toilet so that they use them in washing their hands after that, they could be safe' (P1, teacher, School 1, cup).

Reported handwashing

Among all girls changing their menstrual item in school, 65 per cent and 75 per cent reported they 'always washed' their hands *before* changing or cup emptying in nurse and private surveys, respectively. Girls' private reporting of 'always washed' *after* changing or cup emptying was 78 per cent and 83 per cent, respectively. Reported handwashing differed by menstrual item used, and over the duration of the study, with some variation by age and socio-economic status. Some girls throughout the study self-reported they never washed their hands; these were predominantly in usual-practice control schools (see Table 1). Overall, 10 per cent of girls never washed before and 7 per cent never washed after changing. Girls in pad and usual-practice control schools were more than twice as likely to report never washing hands prior to changing compared with girls in cup schools (RR 2.31; 95% CI 1.23-4.3; p = 0.006). There was no significant difference in the proportion of girls in cup schools reporting never washing their hands after changing/emptying compared with girls in pad or usual-practice control schools (RR 0.70; 95% CI 0.36-1.38; p = 0.3).

In FGD narratives, girls initially chorused that they always washed their hands after visiting the latrine, but girls' difficulties with handwashing surfaced with probing. When asked by the moderator to 'speak the truth', some girls stated they always did, with others in the same school admitting 'Sometimes I do wash but sometimes I don't wash' (P2, girl, School 5, pad). This was mostly blamed on a lack of water, reported in pad schools, and was dealt with in varying ways:

'At times there is no water, let's say like right now there is no water in the tanks ... so they tell pupils to carry water from home for cooking then they divide

Table 1 Proportion of study girls self-reporting they never washed their hands when managing menstruation in school, by randomized study arm

	Before	*After*	χ^2	*p value*	*RR (95% CI)*
Cup	11/215 (5.1)	13/215 (6.0)	0.18	0.67	0.85 (0.39–1.85)
Pad	16/279 (5.7)	8/279 (2.9)	2.78	0.095	2.0 (0.87–4.60)
Usual practice	44/229 (19.2)	28/229 (12.2)	4.21	0.04	1.57 (1.02–2.43)
Total	*71/723 (9.8)*	*49/723 (6.8)*	*4.14*	*0.041*	*1.45 (1.03–2.04)*

a little for washing hands but when is finished there is no water for washing hands.' (P4, girl, School 4, pad)

'Sometimes it will force you not to wash your hands even after changing the pad if at all there is no water at school.' (Px, girl, School 5, pad)

'You wipe it [hands] on the grass [girls laughing] then you go to class.' (Px, girl, School 4, pad)

Handwashing before changing menstrual items. Handwashing before changing/emptying was almost double that among girls using a cup compared to girls using pads or traditional items (see Figure 2). Self-reporting of handwashing before cup emptying was lower than that reported face-to-face with the study nurses (92% vs. 98%; χ 23; $p < 0.001$). Conversely, around half of girls reported to nurses they always washed their hands before changing pads and traditional items, with self-reported rates somewhat higher (see Figure 3).

These data are supported by the focus group discussion narratives. Girls in schools allocated menstrual cups repeatedly chorused 'you first wash your hands' before touching the cup for emptying. In each school with cups, girls were able to describe the washing process in detail, for example:

'We were told when you are going to change it, you must wash your hands first because you are going to insert your hands inside there [vagina], and that place is not supposed to be touched with dirt. So you wash your hands first then you remove it, then you wipe it then you insert it back. Then you go and wash your hands for the second time – that is how we were told.' (P5, girl, School 9, cup)

In contrast, girls in pad and usual-practice control schools differentiated between before and after changing:

'Okay, so we wash our hands after visiting the toilet.' (Moderator)

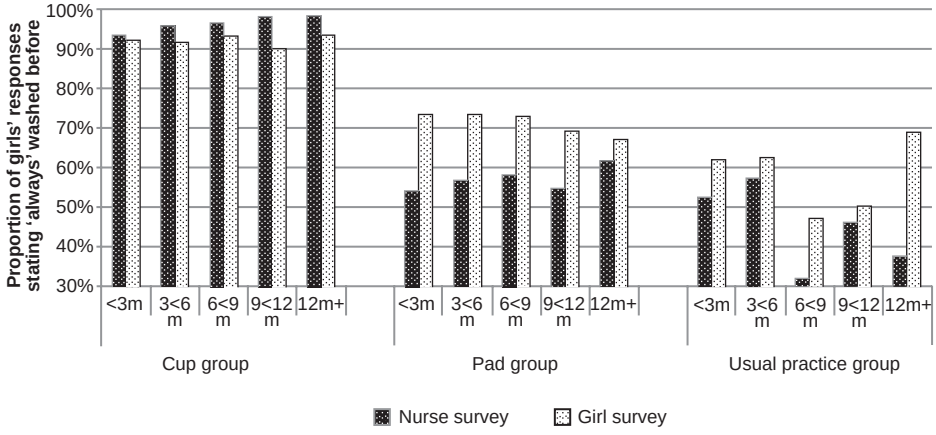

Figure 2 Reported 'always' handwash before changing or emptying by duration of study

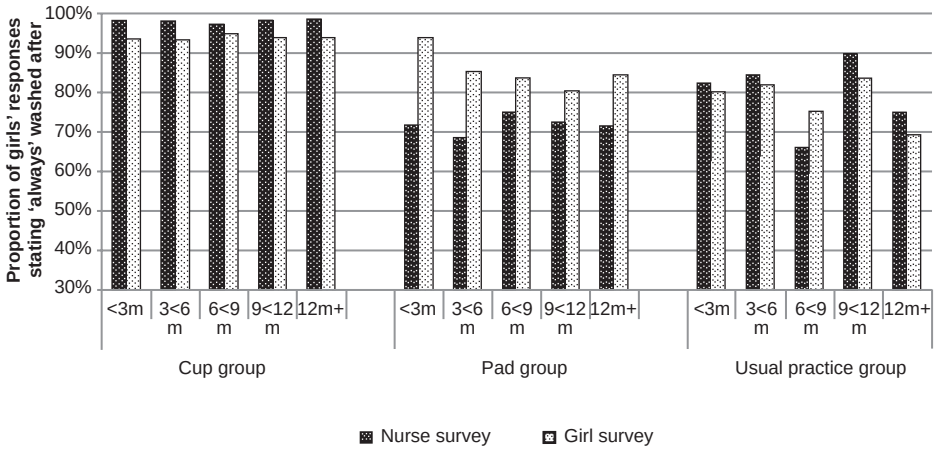

Figure 3 Reported 'always' handwash after changing or emptying by duration of study

'Yes.' (Chorus, girls, School 2, control)

'What about before changing, do we wash our hands?' (Moderator)

'Aaa. No.' (Chorus, girls, School 2, control)

Handwashing after changing menstrual items. An equally high proportion (98%) of cup users reported always washing hands after emptying, both in self-reports and in face-to-face interviews with study nurses (see Figure 3). Among girls using pads and traditional items, the frequency of handwashing after changing was about 30 per cent higher than before changing. Around 72 per cent of pad users reported to nurses they always washed their hands after changing. Around 80 per cent of girls using traditional materials reported in both surveys they washed hands after changing.

Other characteristics. Over time, handwashing reported to nurses among cup users increased from 93 per cent to 98 per cent, while it slightly decreased in girls' own self-reports from 92 per cent to 90 per cent over 9–12 months. Handwashing among girls using pads and traditional items remained lower than cup users throughout the study, through both surveys, with the frequency fluctuating over time.

A significantly higher proportion of younger girls (< 16 years) using menstrual cups reported always washing hands before and after emptying cups in nurse interviews compared to self-reports ($p < 0.001$). This difference was not evident among younger girls using pads ($p = 0.11$) or traditional items ($p = 0.94$). In younger girls' self-report surveys, handwashing levels among pad and cup users decreased over time, while they consistently reported higher rates to the nurses. This difference was not evident among older girls (aged 16 years and older). In terms of socio-economic status, a lower proportion of poorer girls using cups and pads reported to nurses they always washed their hands before changing compared with less poor girls ($p = 0.014$, for both menstrual items). Similar reporting occurred with handwashing

after emptying cups ($p < 0.001$). There was no difference in reported handwashing between poorer and less poor girls using traditional items.

Discussion

Our study demonstrates that girls provided with menstrual cups report very high rates of handwashing both before and after emptying of cups at school. In contrast, reported rates of handwashing among girls using pads and traditional items were significantly lower. While unannounced WASH spot-checks found most schools provided water, only a few had water close to girls' latrines, and soap was not commonly available despite its monthly provision by the study. An Indian study similarly reported that most girls using old cloth during menstruation did not wash their cloths properly before use (Khanna et al., 2005, cited in Dasgupta and Sarkar, 2008). While the study did not report on handwashing, and thus does not directly mirror handwashing behaviour, it reflects overall poor hygiene awareness among girls in low-resource settings. A small pilot study on menstrual cup use in Uganda reported 70 per cent of adult participants always washed their hands before and after menstrual cup emptying and insertion (Tellier et al., 2012), lower than that recorded by our schoolgirls. The high reporting by menstrual cup users reflects study girls' recognition of the need for cleanliness when handling cups. We provided hygiene education training and information leaflets to all girls, not just those receiving cups. Differences between study groups may, in part, reflect our study nurses' concerns about the safety of menstrual cups in the school environment, causing them to counsel girls more on hygiene issues in the cup group. Narratives from girls illustrate only those in the cup group considered handwashing before emptying/changing to be important. Lack of washing before among other groups could also be because most hand hygiene interventions stress handwashing after visiting the toilet/latrine rather than before utilization of these services. Such reminders may also have resulted in girls feeling obligated to state they maintained good hygiene practices. Similar reporting behaviour was noted in a separate study, where hygiene education led to pronounced changes in self-reported attitudes to hygiene practices (Schmidt et al., 2009).

Lack of handwashing before changing has also been reported among tampon users in adult women in California, with a lower proportion reporting washing their hands before changing their tampons compared with afterwards (Czerwinski, 2000). Following past concerns about toxic shock syndrome among tampon users (Friedrich, 1981), our study included close monitoring of girls' health through school nurses, focal point teachers, clinics, and community surveillance. An absence of any adverse events in the study provides optimism for the safe provision of different menstrual products such as cups for school-aged girls, although analyses on laboratory-confirmed reproductive tract infections (RTIs) are pending. Other studies have found no additional RTI risk among cup users (Howard et al., 2011). It is of consequence that our study selected schools reaching a considered adequate level of WASH, such as a pupil-to-latrine ratio of < 70:1, water observed on the day of visit, and separate latrines for girls (Alexander et al., 2014). However, preliminary

evidence of WASH follow-up, reported in brief here, suggests schools were unable to maintain handwashing water throughout the study year. Despite monthly soap provision, soap was witnessed in less than half of schools during impromptu visits. Narratives from teachers in school suggested they were not aware of shortages, and girls confirmed they did not report to teachers when soap had run out. Maintaining a consistency in service delivery of WASH in schools in the same study area has been shown to be difficult even after guaranteed provision of items, extra budgets, and guides to monitoring (Alexander et al., 2013). Nevertheless, our narrative and survey data illustrate girls (particularly in the menstrual cup group) resolved to ensure their good hygiene by bringing soap and water from home. We also noted the frequency of parents and teachers stating pupils could bring their own soap and water; however, clearly this is not an ideal situation for promoting the health and hygiene of all students. Outside of a research study environment, considerable effort will be needed to ensure girls have access to communal or personal soap, and have a supportive environment to facilitate continued good hygiene behaviours.

Learning about hygiene during menstruation is a vital aspect of health education for girls, as patterns that are developed in adolescence are likely to persist into adult life (El-Gilany et al., 2005). In our study, some age differences were seen between older and younger girls. Handwashing before changing traditional items was notably low, particularly among younger girls. The higher proportion of younger girls reporting they always washed before and after emptying their cups to nurses suggests they are fearful to report not washing to an adult. This adds support to using self-reporting of pupil behaviours when conducting WASH monitoring in schools (UNICEF, 2011). Some differences in handwashing rates were apparent by socio-economic status, with a suggestion that poorer girls had lower rates of handwashing than less poor girls. A study looking at handwashing behaviour in Bangladesh found economic status was significantly associated with hand cleanliness among both caregivers and children (Halder et al., 2010). In India, poor literacy and low socio-economic status of females was seen to reduce their ability to understand the value of hygiene, menstrual health, and practising MHM (Ali and Rizvi, 2010). In our study, lower hygiene in poorer girls (among the cup and pad users) may also be due to a lack of conceptualization of hygiene value, since all girls received equal access to handwashing in the study schools regardless of socio-economic status. Another possible explanation is that poorer girls who now had access to a 'modern' menstrual item experienced less mess than before (with traditional items), and therefore had less urgency to wash hands. We also recognize that individual soap provision by the study would likely be required for use by the households in the poorer communities.

When comparing data generated from nurse interviews with girls' private surveys, the proportions reported for handwashing were higher in private surveys among the older girls. This differs from adults who tend to over-report in surveys as compared to observations, as seen in a study done in Zaire (Manun'Ebo et al., 1997). It is possible that pupils may be less likely than adults to exhibit reactivity to in-person observation, as they are accustomed to being watched by adults, leading them to report accurately, though this still does not explain why higher numbers were

reported in private surveys (Pickering et al., 2014). One explanation could be that some girls were uncertain 'who' would see the answers entered into the netbook and had a desire to impress outsiders. We note that 60 per cent of girls reported soap was available for handwashing and a further 15 per cent specified soapy water was available, thus a quarter of girls' reports indicated an absence of soap at the school, despite provision by the study. Girls' narratives during qualitative research reported that younger children used all the soap, requiring girls to carry their own bar soap provided by the study (Mason et al., 2014).

There is a number of limitations in this paper. Handwashing and use of soap were reported measures with no direct observation of girls performing handwashing; however, unannounced WASH observations of soap and water provision in schools revealed lower rates than that reported by the girls. It is likely girls exaggerated the frequency of their hand hygiene, since hygiene education was stressed as important and girls were questioned on this topic each time they were screened. Differences between face-to-face reports to adults (nurses) and disclosure during private surveys were not as obvious as shown in previous studies (Hewett et al., 2004; WaterAid, 2009). This may partly reflect the good relationship built with study nurses and the less sensitive topic compared with sexual behaviours. Girls did report higher levels of cup handwashing to nurses while their self-reported hygiene reduced marginally over time, raising the concern that personal hygiene may have deteriorated without the nurses' knowledge. This inclines us toward recommending the value of private surveys over face-to-face interviews when evaluating girls' MHM. When comparing handwashing we used the reported menstrual item girls mainly used in their most recent menstruation. We recognize some desirability bias may have taken place where girls reported using intervention items.

Conclusion

Girls using menstrual cups reported high standards of handwashing before as well as after emptying, despite a lack of consistent provision of soap and water in the schools. Hand hygiene among girls using other items was lower, and mostly involved washing after changing. Our data suggest a need for policymakers and programme implementers to continually sensitize girls on the importance of hand hygiene for menstrual hygiene management, assist schools in providing water and soap, and monitor that these services are provided. All pupils, and menstruating girls in particular, need and deserve consistent access to water and soap while at school.

Acknowledgements

We thank the schools, girls, staff, and stakeholders contributing to this study, funded by the Joint Global Health Trials of the UK Medical Research Council, the Department for International Development, and the Wellcome Trust; Mooncups Ltd for providing cups at a discounted price; and the Director of KEMRI for approving the manuscript. The findings and conclusions of this report are those of the authors

and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

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