Check for updates

Journal of
Water, Sanitation & Hygiene for Development

IWA PUBLISHING

© 2025 The Authors Journal of Water, Sanitation and Hygiene for Development Vol 15 No 3, 192 doi: 10.2166/washdev.2025.233

Research Paper

Assessing the effects of menstrual hygiene, water, and sanitation on girls' academic performances in public schools, Ethiopia

Geteneh Moges Assefa [a,*], Virginia Stulz[b], Gizachew Mengie[a], Lisan Atnafe[a], Wossen Gezahegn[a], Eefje Smet[c] and Muluken Desalegn Muluneh[a]

[a] Amref Health Africa in Ethiopia, P.O. Box 20855, Addis Ababa 1000, Ethiopia
[b] Canberra University, Sydney, Australia
[c] Amref Flying Doctors, Leiden, Netherlands
*Corresponding author. E-mail: Geteneh.Moges@amref.org, gtnhph2001@gmail.com

GMA, 0000-0002-8551-7046

ABSTRACT

This study examined relationship between menstrual hygiene management (MHM), water, sanitation, and hygiene (WASH) services, and girls' academic performance in Ethiopia. This study employed cross-sectional mixed study design with 912 public schoolgirls. Also, 22 key informants, and six focus group discussions in 37 randomly selected public schools. The median age of the schoolgirls was 16 years. Two of the five schoolgirls reported missing classes during menstruation. Out of 912 schoolgirls, 82.5% (95% CI; 81%-84%) achieved good academic performance during the academic year. Schoolgirls who attended class regularly during menstruation (AOR=14.82, 95% CI 8.652-25.391), schoolgirls who were informed about menstrual hygiene before menarche (AOR=1.81, 95% CI 1.011-3.229), schoolgirls whose mothers were educated (AOR=1.88, 95% CI 1.063-3.313), schoolgirls who had basic water services (AOR=4.72, 95% CI 2.315-9.618), schoolgirls who had basic sanitation services (AOR=6.32, 95% CI 4.643-33.670) and who had limited sanitation services (AOR=1.56, 95% CI 1.768-6.636) were significantly associated with good academic performance. Educating mothers about menstrual hygiene, increasing access to WASH, and providing safe spaces for girls can have positive ripple effect on their daughters' academic success. The findings of study provide critical evidence to inform decision makers to address MHM challenges in alignment with Sustainable Development Goals (SDGs) 2030.

Key words: academic performance, education, menstrual hygiene, sanitation, schoolgirls, water

HIGHLIGHTS

- Academic performance of girls was significantly influenced by school absenteeism, mothers' education, water service, sanitation service and pre-menarche education.
- MHM is a neglected women-specific sanitation need in its own right. The fact that this is not recognised is an important gender inequality.
- The study provides vital evidence to inform policy/decision-maker to respond to WASH and MHM in alignment with the SDGs by 2030.

1. INTRODUCTION

Menstruation is the cyclical shedding of the uterine lining, typically commencing in girls aged 10 years and older. Globally, girls strive to conceal their menstruation during school (Kuhlmann *et al.* 2017; Sommer *et al.* 2020; Rossouw & Ross 2021). Worldwide, nearly 52% of female populations are of reproductive age, and access to appropriate information and menstrual pads are often unaffordable to girls in low-income countries (Sommer *et al.* 2016; Phillips-Howard *et al.* 2016a; Cronk *et al.* 2021; Rossouw & Ross 2021). Many low-income countries lack clean water, private sanitation, and hygiene facilities in schools, and approximately 500 million women lack access to menstrual products and adequate facilities for menstrual hygiene management (MHM) (McMahon *et al.* 2011; Phillips-Howard *et al.* 2016a; Cronk *et al.* 2021; Doral Health & Wellness 2024). School-based studies indicate poor menstrual hygiene practices among girls, and only a few studies have attempted to improve menstrual hygiene practices (Sharma *et al.* 2020; Cronk *et al.* 2021; Doral Health & Wellness

This is an Open Access article distributed under the terms of the Creative Commons Attribution Licence (CC BY 4.0), which permits copying, adaptation and redistribution, provided the original work is properly cited (http://creativecommons.org/licenses/by/4.0/).

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

2024). Despite the challenges and inadequate practices surrounding MHM, this issue has largely been overlooked in the education sector (Morgan *et al.* 2017; Ahmed Shallo *et al.* 2020; Sharma *et al.* 2020).

In low- and middle-income countries (LMICs), MHM presents significant challenges for girls, specifically their school attendance and performance (Sommer *et al.* 2020, 2021; Rossouw & Ross 2021). Moreover, stigma and social norms associated with menstruation further compound these challenges. Unhygienic and ineffective MHM has been linked to negative consequences for women and girls, impacting education, work, and psychosocial well-being (Mason *et al.* 2013; Sommer & Sahin 2013; Sommer *et al.* 2015). The number of girls enrolled in schools that have adequate and menstrual-friendly WASH services are limited (Sommer *et al.* 2015; Janoowalla *et al.* 2020; Cronk *et al.* 2021). Poor infrastructure and spaces for menstruation management affect girls in LMICs (Sommer *et al.* 2016; Korir *et al.* 2018; Nalugya *et al.* 2020). Inadequate access to clean water, insufficient facilities for changing and disposing of menstrual products, lack of privacy, social support, and the persistence of menstrual taboos contribute to psychosocial challenges such as shame, fear, anxiety, and disruptions to girls' education (Doral Health & Wellness 2024; Ahmed Shallo *et al.* 2020; World Health Organization (WHO) & the United Nations Children's Fund (UNICEF) 2022; Habtegiorgis *et al.* 2021). These factors disproportionately affect girls during menstruation and serve as additional barriers to success in schools (Korir *et al.* 2018; Habtegiorgis *et al.* 2021; Demsash *et al.* 2023).

Notably, Ethiopia faces some of the lowest levels of WASH services access globally. According to the 2,017 UNICEF and World Health Organisation (WHO) Joint Monitoring Programme (JMP) report, an estimated 41% of Ethiopians have access to at least basic drinking water, with 31% in rural and 80% in urban areas. Access to adequate sanitation was 7% for the entire country, with 4% in rural areas and 23% in urban regions, highlighting significant disparities among communities (World Health Organization (WHO) & the United Nations Children's Fund (UNICEF) 2022; Demsash *et al.* 2023; UNICEF Ethiopia 2017; Ssewanyana & Bitanihirwe 2019). This dearth of WASH services also affects menstrual health, ultimately affecting girls' school attendance, performance, and completion. A national baseline report from six regions of Ethiopia on MHM conducted by the United Nations Children's Fund (UNICEF) revealed concerning statistics: 81.4% of adolescent girls lack access to sanitary pads in their schools, 22% miss school due to menstruation, and 83.9% face inconsistent access to water for menstrual hygiene maintenance (World Health Organization (WHO) & the United Nations Children's Fund (UNICEF) 2022; Hennegan & Montgomery 2016; Phillips-Howard *et al.* 2016b). During menstruation, adolescent girls may confront harassment and social exclusion, hindering their access to necessary facilities. These factors curtail girls' mobility, autonomy, and choices, leading to decreased school attendance and participation (Mason *et al.* 2013; Sommer & Sahin 2013; Hennegan *et al.* 2016; Phillips-Howard *et al.* 2016b). These challenges are especially pronounced for girls enrolled in schools located in areas affected by humanitarian crises (Ameade & Garti 2016; Chinyama *et al.* 2019; Mohammed & Larsen-Reindorf 2020). Unfortunately, efforts to integrate gender equality and inclusion into local governance have been limited, thereby affecting access to WASH services in schools (Mason *et al.* 2013; Sumpter & Torondel 2013; Assefa *et al.* 2021; Hasan *et al.* 2021; Baird *et al.* 2022).

WASH services play a pivotal role in the lives of adolescent girls, impacting both their biological and cultural aspects. Specifically, 'SDG 6.2 acknowledges the right to menstrual health and hygiene, with the explicit aim' to achieve access to adequate and equitable sanitation and hygiene for all and paying special attention to the needs of girls and those in vulnerable situations by 2030' (Beksinska *et al.* 2015; Hennegan *et al.* 2018; Schmitt *et al.* 2021; UNICEF 2022). Lack of adequate WASH facilities and sanitary products for MHM has been linked to girls' absenteeism during their menstrual cycle (Pan *et al.* 2018; UNICEF 2022). Some also permanently dropout of school with the onset of puberty if the toilet facilities are not clean or do not provide privacy to girls while they are menstruating (Wall *et al.* 2016; Hennegan *et al.* 2017; Alexander *et al.* 2018; Belay *et al.* 2020). Social and WASH-related issues often lead many girls to stay home during their menstrual periods instead of attending school (Alexander *et al.* 2018; Aidara & Gassama Mbaye 2020). Factors such as discomfort, odour, difficulties in concentration, and family's educational status deter girls from attending school during their menstrual cycle (Tegegne & Sisay 2014; Ahmed *et al.* 2021; Shah *et al.* 2022). Menstrual hygiene products, coupled with safe, private, and gender-sensitive sanitation facilities and accessible water supplies, have increased the burden girls face at school during menstruation (World Bank 2018a; Nabwera *et al.* 2021; Shah *et al.* 2022; Asumah *et al.* 2023). Limited studies have also indicated that menstrual health is a multi-sectoral issue, necessitating collaboration between WASH, education, and the health sector (World Bank 2018a, 2018b). Hence, studying the impact of menstrual hygiene, water, and sanitation on girls' academic performance is crucial as it addresses challenges faced by adolescent girls, enables effective menstruation management, empowers girls to reach their potential, reduces missed classes, and fosters a supportive environment for better educational

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

outcomes (Morgan *et al*. 2017; Deshpande *et al*. 2018; World Bank 2018b; Sharma & Adhikari 2022). Therefore, this study explored the academic performance of girls against menstrual hygiene, water, and sanitation services.

2. MATERIALS AND METHODS

2.1. Setting, study design, and study population

The geographical scope of this study includes Addis Ababa and the Oromia region, with data collection occurred from April to June 2022. This research utilised a cross-sectional convergent parallel mixed-method approach, incorporating surveys, key informant interviews (KIIs), and focus group discussions (FGDs). Six FGDs were conducted with homogeneous groups consisting of both girls and boys from school clubs. Additionally, 22 KIIs were carried out using semi-structured questionnaires with various participants, including four health extension workers (HEWs), four education office representatives, four Women, Children, and Youth Office (WCYO) members, five schoolgirls, three schoolboys, and two school management committee members, along with health office representatives. All FGDs and KIIs were recorded and transcribed.

2.2. Sampling and sampling procedure

A total of 912 schoolgirls participated in this study and were selected through a multistage cluster sampling technique. Districts and schools served as primary and secondary sampling units. Six districts and 37 medium/high schools were randomly chosen, and the total sample size was proportionally allocated to each selected school based on the number of girls enrolled. Student attendance lists were used as a sampling frame for selecting girls in schools for the survey.

2.3. Data collection tools and procedures

Quantitative data were collected using a structured questionnaire through mobile applications, specifically ODK/KOBO. The questionnaire was pretested, featuring precoded answers, and was adapted and developed from the Ethiopian Demographic survey (EDHS) 2022 and UNICEF menstrual health and hygiene guide (Deshpande *et al*. 2018; Janoowalla *et al*. 2020). The FGD and KII qualitative tools were developed through a desk review of relevant databases and information sources. Qualified and trained data collectors were employed.

2.4. Data processing and analysis

Data were extracted, cleaned, and analysed using STATA for Windows, Version 18 software. Descriptive and regression analyses were conducted using, both dependent and independent variables. Schoolgirls self-reported their academic performance and categorised their academic performance as 'good' if they scored $\geq$68% and 'poor' if they scored $<$68% in the academic year. Independent variables (mother's education, father's education, girls living together who, are informed about menstrual hygiene before menarche, informed about menstrual hygiene after menarche, knowledge of menstrual hygiene and school absenteeism) that were significant in the bivariate analysis were included in the multivariate analysis. The results were presented using tables and figures.

Qualitative data from the KII and FGDs were anonymised and transcripts were imported for thematic analysis. Field notes taken during interviews and discussions were transcribed for synthesis, narration, and thematic presentation alongside audio-recorded data. Interview data were initially deductively coded, guided by the study's objectives and the themes covered during the interviews. Subsequent iterative rounds of analysis allowed for the inductive creation of further codes within these initial categories, reflecting issues spontaneously raised by participants. These were subsequently categorised under higher-order themes. The qualitative results were narrated and triangulated with the respective variables.

2.5. Definition of terms

According to the WHO/UNICEF JMP definitions for water supply, sanitation and hygiene uses (Janoowalla *et al*. 2020).

2.5.1. Basic service levels

Water: Drinking water from an improved source, provided collection time is not more than 30-min roundtrip, including queuing.

Sanitation: Use of improved sanitation facilities not shared with other households.

Hygiene: Availability of handwashing facilities on the premises with soap and water.

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

2.5.2. Limited services level

Water: Drinking water from improved sources for which collection time exceeds 30-min roundtrip, including queuing.

Sanitation: Use of improved facilities shared between two or more households.

Hygiene: Availability of handwashing facilities on premises without soap and water.

2.5.3. No service

No water, sanitation and hygiene facilities in the premises of schools.

School absenteeism was used in this research as girls missed classes during menstruation time (starting at a minimum of 1 day).

Academic performance for girls was categorised as 'good' if they scored ≥68% and 'poor' if they scored <68% in the academic year as per the schools grading system.

2.6. Ethical considerations

A statement of informed consent was utilised at every step to ensure the willingness of participants to participate in the study. Participants were notified of their rights to confidentiality and notified of their right to withdraw at any time during the study. In addition, participants were informed of the purpose of the study, methods, estimated time of involvement, selection process, how the results will be used, and the intended impact of the study before their informed consent was collected. The confidentiality of the data was guaranteed by preserving the anonymity of the study participants. The officials were briefed on the purpose, methodologies, ethical issues, the type of activity, level of human activity, and expected duration of data collection.

3. RESULTS

3.1. Schoolgirl sociodemographic characteristics

A total of 912 schoolgirls participated in this survey, and almost two-thirds (63.3%) were from the Oromia region. The mean age of the schoolgirls was 16, ranging from 14 to 19 years. Of the 37 schools included in the survey, 23 (62.1%) were from Oromia, 30 (81.1%) were primary schools (grades 5–8) and the remaining 18.9% were secondary schools (grades 9–12). All schools were government owned with an average number of 1,727 students per school, ranging from 517 to 4,246 students. The average number of boys and girls was 871.4 and 945.7 per school, respectively. The proportion of girls to boys was 54.9 and 45.1%, respectively, while the average number of teachers was 69, ranging from 21 to 81 per school, with an average number of female teachers at 35, ranging from 11 to 60 per school (see Table 1).

3.2. Schoolgirls' attendance and academic performance

Of the 912 schoolgirls, 82.5% (95% CI 81–84%) achieved good academic performance during the academic year. A significant number of girls (377, 41.3%) missed class during their menstrual periods, with a variation in the number of days missed. Approximately half (50.7%) of the girls responded that the main reason for missing class was due to the lack of a safe

Table 1 | Schoolgirls' family characterisations in June 2022

Characteristics/Variables		Frequency ($N = 912$)	Percentage (%)
Age of schoolgirls	Below the mean	616	67.5
	Above the mean	296	32.5
Family size	One to four	342	37.5
	More than four	570	62.5
Schoolgirls live together with	Both the mother and father	444	48.7
	Only mother	303	33.2
	Others	165	18.1
Mothers' education status	Illiterate	208	22.8
	Literate	704	77.2
Fathers' education status	Illiterate	109	12.0
	Literate	801	88.0

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

space for changing stained cloths or napkins, and 30% missed class due to the lack of WASH services. The remaining 19.3% cited discrimination or teasing during menstruation, which led them to miss class (see Table 2).

The aforementioned table about the reason of absenteeism was supported by the interviews and FGD and provided contextual information and complemented the quantitative data by identifying the challenges faced by girls.

'During menstruation, I sometimes feel ashamed, fearful, lack of confidence, mood disturbance, and finally I missed a class, or I sit at the back of students (due to fear of stigma) and as a result my education was affected' [FGD, female student, age 18, Adama]'

'…. If water, toilets, and sanitary napkins are available in schools, girls will attend their education consistently without stigma and can perform with boys equally or beyond' [A 17-year female student from Adama].'

One of the female participants from Bishoftu also shared her experience regarding the adverse effect of poor MHM facilities on school dropout and absenteeism:

'…. I know a girl who has over bleeding and couldn't attend her school properly and was perceived as she is not clean and she also had bad odour that disturbs other students and due to all this finally she has missed all classes during her menses time' [FGD, female student, age 16, Bishoftu].'

'Poor MHM facilities result in psychological challenges and one of the schoolgirls explained that: '…Due to poor MHM facilities in our school, I always feel depressed, feeling sick and unable to attend class properly' [FGD, female student, age 14, Addis Ababa].'

'Another 17-year-old primary school student says, 'I missed three to four days per month…female students miss and even terminate their education because of poor menstruation facilities at the school.' [FGD, female student, age 17, Bishoftu].'

3.3. Attitude and knowledge towards menstrual hygiene practice in schools

Regarding the knowledge of menstruation and hygiene; of the 912 schoolgirls; 616 (67.5%) were informed about menstrual hygiene before menarche and 852 (93%) schoolgirls also knew about menstruation hygiene (see Table 3).

The qualitative findings also indicated knowledge gaps about menstruation and one of the girls enforced this as follows: 'The teachers should understand what female students feel during menstruation, since we are afraid to talk about menstruation with the teachers, we tell the teachers we are sick, but some teachers do not understand and they ask the female students to show them medical evidence when they miss class due to menstruation and even when the students ask for permission to go home the teachers didn't allow it. I know this is the girls' mistake to tell them the truth but still, we are afraid of it to talk freely about menstruation' [FGD, age 14 female student, Addis Ababa].

On the other hand, almost a third of schoolgirls (268, 29.4%) believed that menstruation should be kept secret. Almost two-thirds of the 600 students (65.8%) had a free discussion about MHM and the use of sanitary pads with their peers in the

Table 2 | Schoolgirls' self-reported absenteeism and academic performance, June 2022

Variables		Frequency ($N = 912$)	Percentage (%)
Academic performance of schoolgirls ($n = 912$)	Good (≥68% academic report)	752	82.5
	Poor (<68% academic report)	160	17.5
School absenteeism	Yes	377	41.3
	No	535	58.7
School absenteeism per mense ($n = 377$)	1 day	176	46.7
	2 days	104	27.6
	3 days	67	17.8
	More than 3 days	30	7.9
Reasons for School absenteeism ($n = 377$)	lack of a safe space for changing stained cloths or napkins	191	50.7
	Lack of WASH services	113	30.0
	Encountered discrimination or teasing during menstruation	73	19.3

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

Table 3 | Knowledge on menstruation and menstrual hygiene among schoolgirls, June 2022

Variables		Frequency ($N = 912$)	Percentage (%)
Informed about menstrual hygiene before menarche	Yes	616	67.5
	No	296	32.5
Informed about menstrual hygiene after menarche	Yes	686	75.2
	No	226	24.8
Awareness of expected age of menarche	Yes	395	43.3
	No	517	56.7
Should menstruation be kept secret	Yes	268	29.4
	No	644	70.6
Do you freely discuss menstruation in schools?	Yes	600	65.8
	No	312	34.2
Knowledge about menstruation and menstrual hygiene	Yes	852	93.4
	No	60	6.6
Sanitary pad availability in schools	Yes, girls can freely get regularly	265	29.1
	Yes, but only in an emergency	268	29.4
	Yes, but purchased	7	0.8
	No	372	40.8
Disposable pads to buy	Yes, affordable	363	39.8
	No, expensive	526	57.7
	I don't know it	23	2.5
Menstrual sanitary pads purchased	Parents/families	898	98.5
	Schools	254	27.9
	NGOs	56	6.1
	Private	56	6.1
	Friend	3	0.3
Availability of sanitary pad	Easy to obtain	447	49.0
	Difficult to obtain	328	36.0
	Don't know	137	15.0

school. This finding was also supported by key informants and a 17-year-old female student from Bishoftu reported: ' usually we believed it should be held secret as it was a taboo/culture but now I get it much better and girls had a chance to learn from school communities'. Another key informant girl also stated that the feelings during her first-time menstruation were disturbing and frightening as stated '...I was at the age of 13 when the first menstruation came. I was so afraid to talk about it to my family. I was asking for help from my friend in the neighbourhood...' [A 17-year FGD participant girl, in Bishoftu].

Menstrual hygiene practice was limited due to the high cost of sanitary pads. Of the total 912 schoolgirls, 526 (57.7%) found disposable sanitary pads too expensive to buy, while only 363 (39.8%) considered them affordable. This high percentage highlights a significant barrier to MHM. The qualitative findings also complimented with this participant KII from the Oromia region emphasised the financial challenges faced by girls by saying.' sanitary pads are available at shops but not affordable for the girls. It costs about USD O.75 per pad. So, how does one young girl get USD 0.75 per pad? It is very difficult'.

3.4. WASH services

In terms of WASH services in schools; running water was available in only 48.2% ($n = 440$) of the schools at the time of the survey. Based on the WHO and UNICEF JMP measurements, the findings showed that 45.3% ($n = 413$) of schoolgirls had basic drinking water services and the remaining 54.7% ($n = 499$) had limited levels of drinking water. On the other hand, 41.4% ($n = 378$) of schoolgirls had basic sanitation service levels and 49.5% ($n = 451$) had limited sanitation services. However, 9.1% ($n = 83$) of schoolgirls had no sanitation services in schools. More than three-quarters (76.9%) of the schools have separate toilets for girls; however, in more than two-thirds of the schools (68%), the girls' toilets are not marked which can create confusion and discomfort for the students. Approximately half (48.2%), 18 of the schools do not have at least one accessible toilet for students with disabilities. This lack of accessible facilities poses a significant barrier to inclusive education, and 18.5% of schools did not have separate toilets for teachers and other staff members. Findings also showed that

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

18.6% of the schoolgirls do not have access to handwashing facilities. This can affect the overall comfort of the school environment (see Table 4).

3.5. WASH services and school absenteeism

As shown in Figure 1, girls' class absenteeism was notably higher in schools with limited water services. Also, as shown in Figure 2, girls' class absenteeism was notably higher in schools with limited or no sanitation services.

Table 4 | Water and sanitation service levels among schoolgirls, June 2022

Variables		Frequency ($N = 912$)	Percentage (%)
Water service level	Basic	413	45.3
	Limited	499	54.7
Running water available during data collection	Yes	440	48.2
	No	472	51.8
Sanitation service level	Basic	378	41.4
	Limited	451	49.5
	No services	83	9.1

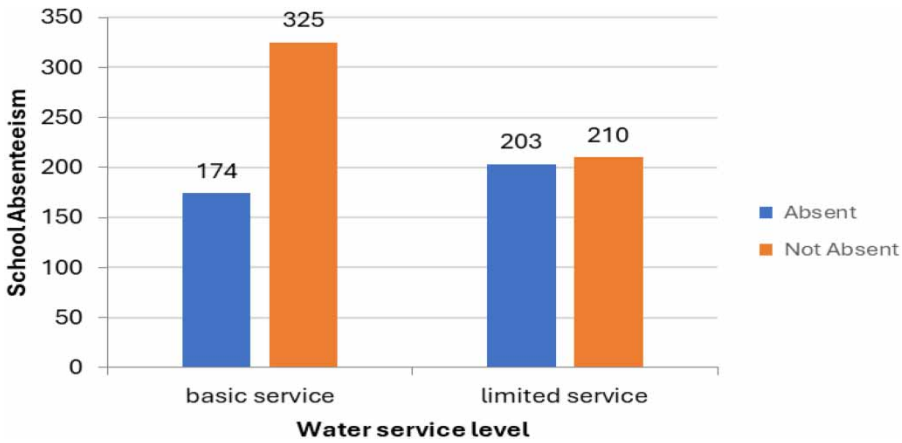

Figure 1 | School water service level against school absenteeism, June 2022.

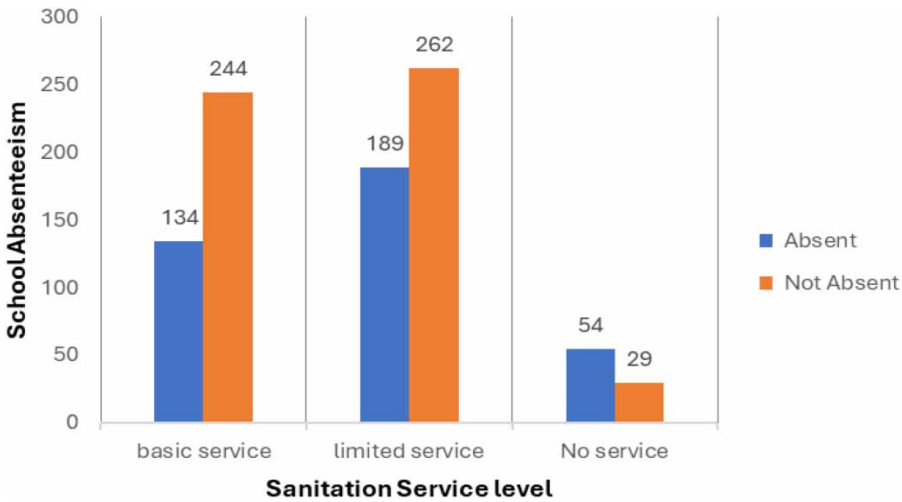

Figure 2 | School sanitation service level against school absenteeism, June 2022.

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

The qualitative findings indicate that WASH and MHM services affected girls' school attendance. When a 14-year-old student from the Oromia region was asked how she saw WASH practices at school, she said,

'Not good, mostly the water is not available; we fetch water from our home to school and many schools have insufficient water and most of them are non-functional and have little cleaning practices' [FGD female participant, age 14, Metehara].'

'Another student from an Addis Ababa school added, '...you can imagine girls with menstruation in schools where water and toilets are not available...I can imagine the feeling and psychological problems they will face, forget attending class [FGD male participant, age 16, Addis Ababa].'

'Improved WASH and MHM at school improves girls' enrolment, confidence, contributing to school performance, responsibility, and accountability' [Key Informant, Education office head, age 28, Metehara].'

'Another participant from the Adama Health Office also supplemented the idea that 'Improved WASH and MHM helps schoolgirls not only to reduce missing their class but also to develop their confidence. The schools are the critical places for girls to develop their future and perform better academic results' [Key Informant, WCY office, age 46, Adama].'

3.6. Factors associated with the academic performance of schoolgirls

The results from the multiple binary logistic regression analysis revealed several factors associated with academic performance among schoolgirls. These factors are described in the following.

Schoolgirls who attend school during menstruation demonstrated a significantly higher likelihood of academic performance, with the odds being 14.82 times higher (AOR = 14.82, 95% CI 8.652–25.391) compared to those who are absent from school during menstruation.

Menstrual hygiene education: Schoolgirls who were informed about menstrual hygiene before menarche had 1.81 times higher odds (AOR = 1.81, 95% CI 1.011–3.229) of reporting better academic performance compared to those who were not informed.

Access to water services: Schoolgirls who had access to basic water services exhibited 4.72 times higher odds (AOR = 4.72, 95% CI 2.315–9.618) of reporting better academic performance compared to those with limited water services.

Maternal education: Schoolgirls whose mothers were educated were 1.88 times more likely (AOR = 1.88, 95% CI 1.063–3.313) to demonstrate better academic performance compared to their counterparts.

Sanitation services: Schoolgirls who had access to basic sanitation services showed 6.32 times higher odds (AOR = 6.32, 95% CI 4.643–33.670) of reporting better academic performance, while those with limited sanitation services had 1.56 times higher odds (AOR = 1.56, 95% CI 1.768–6.636) compared to girls with no sanitation services (Table 5).

4. DISCUSSION

Of the 912 schoolgirls, 82.5% (95% CI 81–84%) achieved good academic performance during the academic year. This finding is also in alignment with other studies conducted in similar settings (Tegegne & Sisay 2014; Beksinska *et al.* 2015; Phillips-Howard *et al.* 2016a; Chinyama *et al.* 2019). However, this study found that being informed about menstrual hygiene before menarche, mothers' education, water service, sanitation services and school absenteeism directly impacted schoolgirls' academic performance.

This study revealed that schoolgirls, who were attending school during their menstrual periods were 14.82 times more likely to achieve good academic performance compared to those who were absent from school during menstruation. This finding is also supported by other studies conducted in Africa, particularly Ethiopia (Sommer *et al.* 2015; Wall *et al.* 2016; Nabwera *et al.* 2021; Shah *et al.* 2022; UNICEF 2022). Regular attendance is crucial for academic success, and absenteeism, often due to menstruation-related issues, disrupts learning continuity and negatively impacts academic performance. This might be due to schoolgirls being hard hit by poor menstrual hygiene, sanitary pads, and space to timely change their pads forcing girls to interrupt classes, fall behind on assignments, which subsequently affects their school attendance and academic performance. This finding is also consistent with other similar studies (Alexander *et al.* 2018; World Bank 2018b; Ministry of Education 2020; Ahmed *et al.* 2021; Habtegiorgis *et al.* 2021). Factors that contributed to school absenteeism during menstruation were sanitary pads cost, cultural beliefs, and fear of peers discovering their menstrual status (Mason *et al.* 2013; Sommer & Sahin 2013; Korir *et al.* 2018; Cronk *et al.* 2021). This may further contribute to a power imbalance and limit

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

Table 5 | Multivariate analysis on girls' academic performance in 2022, Ethiopia

Variables		Academic performance *N* = 912, *n* (%)		*p*-Value	COR (95%CI)	AOR (95%CI)
		Good	Poor			
Age of the schoolgirls	Age below the mean (16 years old)	504 (81.8%)	112 (18.2%)	0.121	0.87 (0.601–1.261)	0.66 (0.396–1.114)
	Age above Mean	248 (83.8%)	48 (16.2%)		1	1
Mother's education	Literate	598 (84.9%)	106 (15.1%)	0.030	1.98 (1.363–2.871)*	1.88 (1.063–3.313)*
	Illiterate	154 (74%)	54 (26%)		1	1
Father's education	Literate	670 (83.7%)	131 (16.3%)	0.864	1.77 (1.106–2.825)	1.07 (0.504–2.229)
	Illiterate	81 (74.3%)	28 (25.7%)		1	1
Girls live together with	Both mother & father	379 (85.4%)	65 (14.6%)		1	1
	Mother only	134 (81.2%)	31 (18.8%)	0.716	0.74 (0.463–1.187)	0.89 (0.470–1.680)
	Relatives	239 (78.9%)	64 (21.1%)	0.596	0.64 (0.437–0.938)	0.27 (0.597–1.670)
Informed about menstrual hygiene before menarche	Yes	534 (86.7%)	82 (13.3%)	0.046	2.33 (1.646, 3.299)*	1.81 (1.011–3.229)*
	No	218 (73.6%)	78 (26.4%)		1	1
Informed on menstrual hygiene after menarche	Yes	584 (85.1%)	102 (14.9%)	0.875	1.91 (1.372, 2.848)	1.05 (0.549–2.024)
	No	168 (74.3%)	58 (25.7%)		1	1
Knowledge of menstruation and hygiene	High	715 (83.9%)	137 (16.1%)	0.120	3.244 (1.869, 5.632)	2.09 (0.826–5.261)
	Low	37 (61.7%)	23 (38.3%)		1	1
Water services	Basic	477 (95.6%	22 (4.4%)	0.000	10.88 (6.774–17.474)	4.72 (2.315–9.618)*
	Limited	275 (66.6)	138 (33.4%)		1	1
Sanitation services	Basic	368 (97.4)	10 (2.6%)	0.000	37.69 (17.605–80.721)	6.32 (4.643–33.670)*
	Limited	343 (76%)	108 (24%)	0.000	3.25 (2.001–5.266)	1.56 (1.768–6.636)*
	No services	41 (49.4%)	42 (50.6%)		1	1
School Absenteeism	Not Absent	515 (96.3%)	20 (3.7%)	0.000	15 (9.289–24.907)*	14.82 (8.652–25.391)*
	Absent	237 (62.9%)	140 (37.1%)		1	1

*p-Value < 0.05.

the opportunities including gender equality, economic, reproductive health choices of girls in the future. This finding also supported by other studies (Sumpter & Torondel 2013; Tegegne & Sisay 2014; World Bank 2018a; Ahmed Shallo *et al.* 2020; Janoowalla *et al.* 2020; Sharma *et al.* 2020; Baird *et al.* 2022; Demsash *et al.* 2023).

Schoolgirls who had access to basic water services exhibited 4.72 times higher odds of reporting better academic performance compared to those with limited water services. This might be due to the additional water needs for MHM. This finding is also supported by other studies conducted in Africa, Asia and Ethiopia (Sommer *et al.* 2015; Ahmed Shallo *et al.* 2020; Cronk *et al.* 2021; Doral Health & Wellness 2024). Schoolgirls who had access to basic sanitation services showed 6.32 times higher odds of reporting better academic performance, while those with limited sanitation services had 1.56 times higher odds compared to girls with no sanitation services. This finding also compliments other studies (Hennegan *et al.* 2016; Hennegan & Montgomery 2016; Alexander *et al.* 2018; Korir *et al.* 2018; Belay *et al.* 2020; Habtegiorgis *et al.* 2021; Hasan *et al.* 2021; Sharma & Adhikari 2022; UNICEF 2022). This indicates that inadequate water and sanitation facilities disproportionately affect girls because of their additional hygiene needs during menstruation. During menstruation, girls often resort to waiting until all students leave class for fear of teasing. In addition, limited access to water often deters girls from routine hygiene practices, resulting in unhygienic conditions, which causes them to face criticism and mistreatment about bad odours by their peers and boys in schools. This finding also concurs with other similar studies (Mason *et al.* 2013; Sommer & Sahin 2013; Sommer *et al.* 2015; Belay *et al.* 2020; Schmitt *et al.* 2021). As a cultural norm, a significant number of girls believed that menses should be a secret, and this limited open discussions on menstrual hygiene. As the findings show, some teachers did not understand girls' conditions during menstruation time and there is very limited evidence of open discussion with girls. This finding is also in agreement with other similar studies (Sommer *et al.* 2016; Phillips-Howard *et al.* 2016b; Pan *et al.* 2018; Aidara & Gassama Mbaye 2020; Rossouw & Ross 2021).

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

Schoolgirls who were informed about menstrual hygiene before menarche had 1.81 times higher odds of reporting better academic performance compared to those who were not informed. This finding is also supported by other studies (Tegegne & Sisay 2014; Kuhlmann *et al*. 2017; Nalugya *et al*. 2020; Ahmed *et al*. 2021; Shah *et al*. 2022), and indicated pre-menarche education can help girls manage their menstruation more effectively and with greater confidence (Wall *et al*. 2016; World Bank 2018b; Sharma *et al*. 2020; Sharma & Adhikari 2022; Doral Health & Wellness 2024). This might be because being informed about menstrual hygiene before the onset of menarche is crucial for adolescent girls. Girls who receive adequate information and education about menstruation before they experience it are better prepared to manage it, which reduces absenteeism and helps maintain their academic performance.

The educational level of mothers plays a significant role in influencing their daughters' academic performances. Educated mothers are more likely to impart knowledge and practices that can positively influence their daughters' ability to manage menstruation without it affecting their school attendance and performance. Schoolgirls whose mothers were educated were 1.88 times more likely to demonstrate better academic performance compared to their counterparts. This finding is supported by other studies (Tegegne & Sisay 2014; Aidara & Gassama Mbaye 2020; Ahmed *et al*. 2021; UNICEF 2022; Demsash *et al*. 2023), which showed that maternal education positively influences children's health behaviours and academic outcomes. A possible reason might be that educated mothers are more aware of health and hygiene practices, including MHM. They can educate their daughters on proper hygiene, reduce menstruation stigma, and provide effective management strategies. They are also more comfortable discussing menstruation, providing accurate information, and empowering their daughters. Furthermore, educated mothers are more likely to challenge traditional taboos, creating a supportive environment for their daughters to discuss menstrual needs. This study supported by studies conducted in Ethiopia (two-thirds of women and girls in Tigray region stated that there are various social, religious and practical expectations and restrictions girls have to observe when menstruating, with 22% of women and 11% of men believing that girls should not attend school when menstruating) and other African countries (Sumpter & Torondel 2013; Beksinska *et al*. 2015; Phillips-Howard *et al*. 2016a; Pan *et al*. 2018; Baird *et al*. 2022; Asumah *et al*. 2023).

4.1. Study limitations

Not included in this study were private-owned schools, where the WASH facilities might differ from those owned by the government. School dropout and absenteeism due to financial problems and family-related reasons (parents' instability or divorce, early marriage) and inaccessibility of schools were not included in the study.

5. CONCLUSIONS

A significant proportion of schoolgirls achieved good academic performance during the calendar year. But this academic performance of girls was significantly influenced by school absenteeism, mothers' education, water service, sanitation service, and pre-menarche education. School absenteeism was higher in schools with poor WASH and MHM services. The response for MHM is weak including limited space for changing pads, unimproved toilets and a lack of water, and discrimination/teasing. Also, sanitary pads are not easily available for the local market due to their high cost. Addressing these factors through targeted interventions can help improve schoolgirls' educational outcomes. Also, improving menstrual health literacy for girls and boys in LMICs through life-skills programming is invaluable. It is recommended to improve the awareness and the capacity of the young girls about menstrual hygiene and aligned with menstrual health within the school community, especially teachers and boys to reduce cultural and, social barriers and taboos. Schoolgirls' empowerment in arranging special tutor classes for the classes lost during menstruation is very helpful and will encourage them to continue their school and improve academic performance. It is important to work closely with local authorities and governments to increase the WASH infrastructure or commit more resources for school WASH and MHM services. Further rigorous research is recommended by including private schools and other determinants of school dropouts.

6. POLICY IMPLICATIONS

Findings reported in this study provide vital evidence to inform policy and decision makers to respond to WASH and MHM in alignment with the SDGs by 2030. Community-based advocacy campaigns play a great role and can help catalyse shifts in power so that girls have open discussions and can take a step higher onto the participation of schooling. Thus, a legal framework to accommodate education and provision of WASH and MHM services for girls should be supported by strategies.

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

AUTHOR CONTRIBUTIONS

G.M.A. was involved in conceptualisation, methodology, analysis, visualisation, writing – review and editing. G.M.A. and M.D.M were involved in validation, comments, and editing of the manuscript. G.M., L.A., V.S., E.S., and W.G. were involved in comments of the manuscript. All authors have read and agreed to the published version of the manuscript.

FUNDING

This research was funded by Amref Health Africa in Ethiopia through WASH flagship projects, grant number R173 and the APC was funded by R173.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of Oromia region protocol code ETCO 0198/2021 and April 2021.

DATA AVAILABILITY STATEMENT

We encourage all authors of articles published in MDPI journals to share their research data. In this section, please provide details regarding where data supporting reported results can be found, including links to publicly archived datasets analysed or generated during the study. Where no new data were created, or where data are unavailable due to privacy or ethical restrictions, a statement is still required. Suggested Data Availability Statements are available in section 'MDPI Research Data Policies' at https://www.mdpi.com/ethics.

ACKNOWLEDGEMENTS

We acknowledge Amref Health Africa in Ethiopia for providing the fund for this study. This research is part of the WASH flagship – MHM project. We are also grateful for the DAG consultancy support in the process of data collection. We also thank Jose and Sluijs for reviewing.

INFORMED CONSENT STATEMENT

Informed consent was obtained from all subjects involved in the study.

DISCLAIMER/PUBLISHER'S NOTE

The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.

DATA AVAILABILITY STATEMENT

Data cannot be made publicly available; readers should contact the corresponding author for details.

CONFLICT OF INTEREST

The authors declare there is no conflict.

REFERENCES

Ahmed, M. S., Yunus, F. M., Hossain, M. B., Sarker, K. K. & Khan, S. (2021) Association between menstrual hygiene management and school performance among the school-going girls in rural Bangladesh, *Adolescents*, **1**, 335–347. https://doi.org/10.3390/adolescents1030025.

Ahmed Shallo, S., Willi, W. & Abubeker, A. (2020) Factors affecting menstrual hygiene management practice among school adolescents in ambo, western Ethiopia, 2018: a cross-sectional mixed-method study, *Risk Management and Healthcare Policy*, **13**, 1579–1587. https://doi.org/10.2147/RMHP.S267534.

Aidara, R. & Gassama Mbaye, M. (2020) Practice Note: Menstrual Hygiene Management – Breaking Taboos and Supporting Policy Change in West and Central Africa. In: Bobel, C. (ed.) *The Palgrave Handbook of Critical Menstruation Studies*: Palgrave Macmillan, London, UK, pp. 529–537.

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

Alexander, K. T., Zulaika, G., Nyothach, E., Oduor, C., Mason, L., Obor, D., Eleveld, A., Laserson, K. F. & Phillips-Howard, P. A. (2018) Do water, sanitation and hygiene conditions in primary schools consistently support schoolgirls' menstrual needs? A longitudinal study in rural western Kenya, *International Journal of Environmental Research and Public Health*, **15** (8), 1682. https://doi.org/10.3390/ijerph15081682.

Ameade, E. P. & Garti, H. A. (2016) Age at menarche and factors that influence it: a study among female university students in Tamale, Northern Ghana, *PloS one*, **11** (5), e0155310. https://doi.org/10.1371/journal.pone.0155310.

Assefa, G. M., Sherif, S., Sluijs, J., Kuijpers, M., Chaka, T., Solomon, A., Hailu, Y. & Muluneh, M. D. (2021) Gender equality and social inclusion in relation to water, sanitation and hygiene in the Oromia Region of Ethiopia, *International Journal of Environmental Research and Public Health*, **18** (8), 4281. https://doi.org/10.3390/ijerph18084281.

Asumah, M. N., Adnani, Q. E. S., Dzantor, E. K., Beig, M. A., Wuffele, G. M., Donkor, D.-R., Abdulai, A.-M., Azanu, W. K., Parsa, A. D. & Kabir, R. (2023) Menstruation-Related school absenteeism: an urban centre study in the Northern Region of Ghana, *Women*, **3**, 497–507. https://doi.org/10.3390/women3040038..

Baird, S., Hamory, J., Gezahegne, K., Pincock, K., Woldehanna, T., Yadete, W. & Jones, N. (2022) Improving menstrual health literacy through life-skills programming in Rural Ethiopia, *Frontiers in Global Women's Health*, **3**, 838961. https://doi.org/10.3389/fgwh.2022.838961.

Beksinska, M., Smit, J., Greener, R., Maphumulo, V. & Mabude, Z. (2015) Better menstrual management options for adolescents needed in South Africa: what about the menstrual cup?, *South African Medical Journal=Suid-Afrikaanse Tydskrif vir Geneeskunde*, **105** (5), 331. https://doi.org/10.7196/samj.9205.

Belay, S., Kuhlmann, A. K. S. & Wall, L. L. (2020) Girls' attendance at school after a menstrual hygiene intervention in northern Ethiopia, *International Journal of Gynaecology and Obstetrics: The Official Organ of the International Federation of Gynaecology and Obstetrics*, **149** (3), 287–291. https://doi.org/10.1002/ijgo.13127.

Chinyama, J., Chipungu, J., Rudd, C., Mwale, M., Verstraete, L., Sikamo, C., Mutale, W., Chilengi, R. & Sharma, A. (2019) Menstrual hygiene management in rural schools of Zambia: a descriptive study of knowledge, experiences and challenges faced by schoolgirls, *BMC Public Health*, **19** (1), 16. https://doi.org/10.1186/s12889-018-6360-2.

Cronk, R., Guo, A., Fleming, L. & Bartram, J. (2021) Factors associated with water quality, sanitation, and hygiene in rural schools in 14 low- and middle-income countries, *The Science of the Total Environment*, **761**, 144226. https://doi.org/10.1016/j.scitotenv.2020.144226.

CSA. (2022) *Ethiopia Demographic and Health Survey*. Ethiopian central statistic agency, Addis Ababa. Accessed on 20 Sept 2022. Available at: https://www.dhsprogram.com/publications/publication-fr328-dhs-final-reports.cfm.

Demsash, A. W., Tegegne, M. D., Wubante, S. M., Walle, A. D., Donacho, D. O., Senishaw, A. F., Emanu, M. D. & Melaku, M. S. (2023) Spatial and multilevel analysis of sanitation service access and related factors among households in Ethiopia: using 2019 Ethiopian national dataset, *PLOS Global Public Health*, **3** (4), e0001752. https://doi.org/10.1371/journal.pgph.0001752.

Deshpande, T. N., Patil, S. S., Gharai, S. B., Patil, S. R. & Durgawale, P. M. (2018) Menstrual hygiene among adolescent girls – A study from urban slum area, *Journal of Family Medicine and Primary Care*, **7** (6), 1439–1445. https://doi.org/10.4103/jfmpc.jfmpc_80_18.

Doral Health & Wellness. (2024) *Overcoming Common Challenges in Menstrual Hygiene Management*. Doral Health & Wellness. New York. Available at: https://doralhw.org/overcoming-common-challenges-in-menstrual-hygiene-management/#:~:text=Role%20Models%20%E2%94%80%20Encourage%20your%20male%20leaders%20and%20influeners%20to%20speak%20openly%20about%20menstruation%20to%20help%20change%20perceptions.

Ethiopia Demographic and Health Survey. Available online: https://dhsprogram.com/publications/publication-fr328-dhs-final-reports.cfm (accessed on 27 May 2022).

Habtegiorgis, Y., Sisay, T., Kloos, H., Malede, A., Yalew, M., Arefaynie, M., Damtie, Y., Kefale, B., Tegegne, T. B., Addisu, E., Lingerew, M., Berhanu, L., Berihun, G., Natnael, T., Abebe, M., Feleke, A., Gizeyatu, A., Ademas, A., Fentaw, Z., Yayeh, T. M., Dangura, F. & Adane, M. (2021) Menstrual hygiene practices among high school girls in urban areas in Northeastern Ethiopia: a neglected issue in water, sanitation, and hygiene research, *PloS one*, **16** (6), e0248825. https://doi.org/10.1371/journal.pone.0248825.

Hasan, M., Hassan, M. N., Mita, M. H., Zahara, F. T. & Hasib, M. (2021) Menstrual hygiene practices and school absenteeism among adolescent girls in Bangladesh: a cross-sectional study, *Population Medicine*, **3**, 8. https://doi.org/10.18332/popmed/133641.

Hennegan, J. & 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. https://doi.org/10.1371/journal.pone.0146985.

Hennegan, J., Dolan, C., Wu, M., Scott, L. & Montgomery, P. (2016) Schoolgirls' experience and appraisal of menstrual absorbents in rural Uganda: a cross-sectional evaluation of reusable sanitary pads, *Reproductive Health*, **13** (1), 143. https://doi.org/10.1186/s12978-016-0260-7.

Hennegan, J., Dolan, C., Steinfield, L. & Montgomery, P. (2017) A qualitative understanding of the effects of reusable sanitary pads and puberty education: implications for future research and practice, *Reproductive Health*, **14** (1), 78. https://doi.org/10.1186/s12978-017-0339-9.

Hennegan, J., Zimmerman, L., Shannon, A. K., Exum, N. G., OlaOlorun, F., Omoluabi, E. & Schwab, K. J. (2018) The relationship between household sanitation and women's experience of menstrual hygiene: findings from a cross-sectional survey in Kaduna State, Nigeria, *International Journal of Environmental Research and Public Health*, **15** (5), 905. https://doi.org/10.3390/ijerph15050905.

Janoowalla, H., Keppler, H., Asanti, D., Xie, X., Negassa, A., Benfield, N., Rulisa, S. & Nathan, L. M. (2020) The impact of menstrual hygiene management on adolescent health: the effect of Go! pads on rate of urinary tract infection in adolescent females in Kibogora, Rwanda,

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

International Journal of Gynaecology and Obstetrics: The Official Organ of the International Federation of Gynaecology and Obstetrics, **148** (1), 87–95. https://doi.org/10.1002/ijgo.12983.

Korir, E., Okwara, F. N. & Okumbe, G. (2018) Menstrual hygiene management practices among primary school girls from a pastoralist community in Kenya: a cross sectional survey, *The Pan African Medical Journal*, **31**, 222. https://doi.org/10.11604/pamj.2018.31.222.13521.

Kuhlmann, A. S., Henry, K. & Wall, L. L. (2017) Menstrual hygiene management in resource-poor countries, *Obstetrical & Gynecological Survey*, **72** (6), 356–376. https://doi.org/10.1097/OGX.0000000000000443.

Mason, L., Nyothach, E., Alexander, K., Odhiambo, F. O., Eleveld, A., Vulule, J., Rheingans, R., Laserson, K. F., Mohammed, A. & Phillips-Howard, P. A. (2013) 'We keep it secret so no one should know'–a qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural western Kenya, *PloS one*, **8** (11), e79132. https://doi.org/10.1371/journal.pone.0079132.

McMahon, S. A., Winch, P. J., Caruso, B. A., Obure, A. F., Ogutu, E. A., Ochari, I. A. & 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**, 7. https://doi.org/10.1186/1472-698X-11-7.

Ministry of Education (2020) *Ethiopian Education Statistics Annual Abstract September 2019-March 2020*. Ministry of Education, Addis Ababa. Available at: https://www.scribd.com/document/557579564/Education-Statistics-Annual-Abstract-March-2019-September-2020.

Mohammed, S. & Larsen-Reindorf, R. E. (2020) Menstrual knowledge, sociocultural restrictions, and barriers to menstrual hygiene management in Ghana: evidence from a multi-method survey among adolescent schoolgirls and schoolboys, *PloS one*, **15** (10), e0241106. https://doi.org/10.1371/journal.pone.0241106.

Morgan, C., Bowling, M., Bartram, J. & Lyn Kayser, G. (2017) Water, sanitation, and hygiene in schools: status and implications of low coverage in Ethiopia, Kenya, Moaique, Rwanda, Uganda, and Zambia, *International Journal of Hygiene and Environmental Health*, **220** (6), 950–959. https://doi.org/10.1016/j.ijheh.2017.03.015.

Nabwera, H. M., Shah, V., Neville, R., Sosseh, F., Saidykhan, M., Faal, F., Sonko, B., Keita, O., Schmidt, W. P. & Torondel, B. (2021) Menstrual hygiene management practices and associated health outcomes among school-going adolescents in rural Gambia, *PloS one*, **16** (2), e0247554. https://doi.org/10.1371/journal.pone.0247554.

Ruth Nalugya, Clare Tanton, Laura Hytti, Catherine Kansiime, Kevin Nakuya, Prossy Namirembe, Shamira Nakalema, Stella Neema, Connie Alezuyo, Saidat Namuli Musoke, Belen Torondel, Suzanna C. Francis, David A. Ross, Chris Bonell, Janet Seeley & Helen A. Weiss (2020) Assessing the effectiveness of a comprehensive menstrual health intervention program in Ugandan schools (MENISCUS): process evaluation of a pilot intervention study, *Pilot Feasibility Stud*, **6** (51). https://doi.org/10.1186/s40814-020-00585-2.

Pan, S. M., Armitage, N. P. & van Ryneveld, M. B. (2018) Assessing equity: a way to improve sanitation service delivery in South African informal settlements, *Journal of Water, Sanitation, and Hygiene for Development : A Journal of the International Water Association*, **8** (3), 429–438. https://doi.org/10.2166/washdev.2018.166.

Phillips-Howard, P. A., Caruso, B., Torondel, B., Zulaika, G., Sahin, M. & Sommer, M. (2016a) Menstrual hygiene management among adolescent schoolgirls in low- and middle-income countries: research priorities, *Global Health Action*, **9**, 33032. https://doi.org/10.3402/gha.v9.33032.

Phillips-Howard, P. A., Nyothach, E., Ter Kuile, F. O., Omoto, J., Wang, D., Zeh, C., Onyango, C., Mason, L., Alexander, K. T., Odhiambo, F. O., Eleveld, A., Mohammed, A., van Eijk, A. M., Edwards, R. T., Vulule, J., Faragher, B. & Laserson, K. F. (2016b) Menstrual cups and sanitary pads to reduce school attrition, and sexually transmitted and reproductive tract infections: a cluster randomised controlled feasibility study in rural Western Kenya, *BMJ Open*, **6** (11), e013229. https://doi.org/10.1136/bmjopen-2016-013229.

Rossouw, L. & Ross, H. (2021) Understanding period poverty: socio-economic inequalities in menstrual hygiene management in eight low- and middle-income countries, *International Journal of Environmental Research and Public Health*, **18** (5), 2571. https://doi.org/10.3390/ijerph18052571.

Schmitt, M. L., Wood, O. R., Clatworthy, D., Rashid, S. F. & Sommer, M. (2021) Innovative strategies for providing menstruation-supportive water, sanitation and hygiene (WASH) facilities: learning from refugee camps in Cox's bazar, Bangladesh, *Conflict and Health*, **15** (1), 10. https://doi.org/10.1186/s13031-021-00346-9.

Shah, V., Nabwera, H., Sonko, B., Bajo, F., Faal, F., Saidykhan, M., Jallow, Y., Keita, O., Schmidt, W. P. & Torondel, B. (2022) Effects of menstrual health and hygiene on school absenteeism and drop-out among adolescent girls in rural Gambia, *International Journal of Environmental Research and Public Health*, **19** (6), 3337. https://doi.org/10.3390/ijerph19063337.

Sharma, M. K. & Adhikari, R. (2022) Effect of school water, sanitation, and hygiene on health status among basic level students' in Nepal, *Environmental Health Insights*, **16**, 11786302221095030. https://doi.org/10.1177/11786302221095030.

Sharma, S., Mehra, D., Brusselaers, N. & Mehra, S. (2020) Menstrual hygiene preparedness among schools in India: a systematic review and meta-analysis of system-and policy-level actions, *International Journal of Environmental Research and Public Health*, **17** (2), 647. https://doi.org/10.3390/ijerph17020647.

Sommer, M. & Sahin, M. (2013) Overcoming the taboo: advancing the global agenda for menstrual hygiene management for schoolgirls, *American Journal of Public Health*, **103** (9), 1556–1559. https://doi.org/10.2105/AJPH.2013.301374.

Sommer, M., Hirsch, J. S., Nathanson, C. & Parker, R. G. (2015) Comfortably, safely, and without shame: defining menstrual hygiene management as a public health issue, *American Journal of Public Health*, **105** (7), 1302–1311. https://doi.org/10.2105/AJPH.2014.302525.

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest

Sommer, M., Caruso, B. A., Sahin, M., Calderon, T., Cavill, S., Mahon, T. & Phillips-Howard, P. A. (2016) A time for global action: addressing girls' menstrual hygiene management needs in schools, *PLoS Medicine*, **13** (2), e1001962. https://doi.org/10.1371/journal.pmed.1001962.

Sommer, M., Zulaika, G., Schmitt, M. L., Khandakji, S., Neudorf, K., Gellis, L. & Phillips-Howard, P. A. (2020) Improving the impact of menstrual health innovations in low- and middle-income countries: a theory of change and measurement framework, *Journal of Global Health Reports.*, **4**, e2020007. doi:10.29392/001c.12105.

Sommer, M., Caruso, B. A., Torondel, B., Warren, E. C., Yamakoshi, B., Haver, J., Long, J., Mahon, T., Nalinponguit, E., Okwaro, N. & Phillips-Howard, P. A. (2021) Menstrual hygiene management in schools: midway progress update on the 'MHM in ten' 2014–2024 global agenda, *Health Res Policy Sys*, **19**, 1. https://doi.org/10.1186/s12961-020-00669-8.

Ssewanyana, D. & Bitanihirwe, B. K. Y. (2019) Menstrual hygiene management among adolescent girls in sub-Saharan Africa, *Global Health Promotion*, **26** (1), 105–108. https://doi.org/10.1177/1757975917694597.

Sumpter, C. & Torondel, B. (2013) A systematic review of the health and social effects of menstrual hygiene management, *PloS one*, **8** (4), e62004. https://doi.org/10.1371/journal.pone.0062004.

Tegegne, T. K. & Sisay, M. M. (2014) Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia, *BMC Public Health*, **14**, 1118. https://doi.org/10.1186/1471-2458-14-1118.

UNICEF (2022) *Effect of Improved WASH in Schools on Girls' Educational Outcomes*. New York 10017, USA. Available at: https://www.unicef.org/india/reports/effect-improved-wash-schools-girls-educational-outcomes.

UNICEF Ethiopia (2017) *Menstrual Hygiene Management in Ethiopia*. UNICEF. Addis Ababa. Retrived May 2024. Available at: https://www.unicef.org/ethiopia/media/3096/file/MenstrualHygieneManagementinEthiopia.pdf.

Wall, L. L., Belay, S., Bayray, A., Salih, S. & Gabrehiwot, M. (2016) A community-based study of menstrual beliefs in Tigray, Ethiopia, *International Journal of Gynaecology and Obstetrics: The Official Organ of the International Federation of Gynaecology and Obstetrics*, **135** (3), 310–313. https://doi.org/10.1016/j.ijgo.2016.05.015.

World Bank (2018a) *An Institutional View on Menstrual Hygiene Management*. World Bank Blogs. Washington, D.C., USA. Available at: https://blogs.worldbank.org/en/water/institutional-view-menstrual-hygiene-management.

World Bank (2018b) *Menstrual Hygiene Management*. World Bank. Washington, D.C., USA. Available at: https://www.worldbank.org/en/news/feature/2018/05/25/menstrual-hygiene-management.

World Health Organization (WHO) and the United Nations Children's Fund (UNICEF). (2022) *Progress on Drinking-Water, Sanitation and Hygiene in Schools: 2000–2021 Data Update*. World Health Organization. New York 10017, USA. Available at: https://www.who.int/publications/m/item/progress-on-drinking-water–sanitation-and-hygiene-in-schools–2000-2021-data-update#:~:text=6%20MB%29%20Overview%20The%20World%20Health%20Organization%20%28WHO%29%20and%20the%C2%A0United%20Nations%20Children%E2%80%99s%20Fund%20%28UNICEF%29%20Joint%C2%A0Monitoring%20Programme%20for%20Water%20Supply%2C%20Sanitation%C2%A0and%20Hygiene%20%28JMP%29%20produces%20internationally%C2%A0comparable%20estimates%20of%20progress%20on%20drinking%20water%2C%C2%A0sanitation%20and%20hygiene%20%28WASH%29%20and%20is%20responsible%20for%C2%A0global%20monitoring%20of%20the%20Sustainable%20Development%C2%A0Goal%20%28SDG%29%20targets%20related%20to%20WASH.

First received 24 July 2024; accepted in revised form 17 February 2025. Available online 27 February 2025

Downloaded from http://iwaponline.com/washdev/article-pdf/15/3/192/1544459/washdev2025233.pdf
by guest