REVIEW ARTICLE

Menstrual hygiene management among adolescent girls in West Africa: A systematic review

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Abstract

A systematic literature review was conducted to examine all recent academic, peer-reviewed studies of menstrual hygiene management (MHM) across adolescent girls in Anglophone West Africa. The objective was to assess the status of the scholarship surrounding the knowledge, attitudes, and practices of MHM across English-speaking West African countries and identify gaps in the literature for further research. The authors searched the epidemiological literatures indexed in PubMed and cross-referenced bibliographies for studies published between 2010-2022. Of 59 abstracts and articles screened, 35 met the final inclusion criteria. Despite differences in study design, setting, and data sources, the study results concurred on an average age of menarche between 12-15 years old among adolescent girls. The knowledge of MHM came from multiple sources, most commonly mothers, female siblings, and teachers and higher knowledge was associated with age, source, wealth, religion, and education level. Less than half of the adolescent girls knew about menstruation before menarche. Many studies showed that girls were shocked by their first period and fearful of staining. Menstruation was associated with dysmenorrhea, fear/embarrassment, and missing school. The existing studies suggest that more implementation and evaluation of menstrual hygiene management materials, education, and facilities are needed to address the educational, physical, and social disparities that exist among girls in West African countries. *(Afr J Reprod Health 2024; 28 [1]: 123-156).*

Keywords: Women's health, menstrual hygiene, female education, adolescence, hygiene

Résumé

Une revue systématique de la littérature a été menée pour examiner toutes les études universitaires récentes évaluées par des pairs sur la gestion de l'hygiène menstruelle (MHM) chez les adolescentes d'Afrique de l'Ouest anglophone. L'objectif était d'évaluer l'état de la recherche sur les connaissances, les attitudes et les pratiques de la GHM dans les pays anglophones d'Afrique de l'Ouest et d'identifier les lacunes dans la littérature pour des recherches plus approfondies. Les auteurs ont recherché dans la littérature épidémiologique indexée dans PubMed et des bibliographies croisées pour les études publiées entre 2010 et 2022. Sur les 59 résumés et articles examinés, 35 répondaient aux critères d'inclusion finaux. Malgré les différences dans la conception, le cadre et les sources de données de l'étude, les résultats de l'étude concordaient sur un âge moyen des premières règles entre 12 et 15 ans chez les adolescentes. La connaissance de la GHM provenait de sources multiples, le plus souvent des mères, des frères et sœurs et des enseignants, et les connaissances supérieures étaient associées à l'âge, à la source, à la richesse, à la religion et au niveau d'éducation. Moins de la moitié des adolescentes connaissaient leurs règles avant les premières règles. De nombreuses études ont montré que les filles étaient choquées par leurs premières règles et craignaient les taches. Les menstruations étaient associées à la dysménorrhée, à la peur/à la gêne et à l'absence à l'école. Les études existantes suggèrent qu'une plus grande mise en œuvre et une plus grande évaluation du matériel, de l'éducation et des installations de gestion de l'hygiène menstruelle sont nécessaires pour remédier aux disparités éducatives, physiques et sociales qui existent parmi les filles dans les pays d'Afrique de l'Ouest. *(Afr J Reprod Health 2024; 28 [1]: 123-156).*

Mots-clés: Santé des femmes, hygiène menstruelle, éducation des femmes, adolescence, hygiene

Introduction

Menstruation is a natural process experienced by over 300 million women across the globe[1]. However, despite being biologically the same process, there is increasing acknowledgment that the experience of women during their menstrual period is not equal. Across Sub-Saharan Africa,

poor menstrual hygiene management burdens above 50% of females[2]. Girls in low- and middle-income countries (LMIC) often enter their adolescence ill-equipped with knowledge, materials, and facilities to manage their menstruation[2]. Adequate menstrual hygiene management (MHM) is the safe use and disposal of sanitary material to collect menstrual blood and the option to change this material in privacy as many times as necessary during the period of bleeding (UNICEF)[3]. Menstrual hygiene management is accompanied by a taboo surrounding menstruation that propagates a lack of understanding, discomfort, and fear around menstruation, especially in low- and middle-income countries (LMIC)[4]. Many studies have highlighted the core challenges of girls' finding clean sanitary material, a place to change and dispose of their use sanitary material, and a general lack of understanding of the menstrual cycle[1,4,5]. These challenges are associated with school attendance[6,7], school participation[8], and mental health[4]. Consequently, issues surrounding menstruation contribute to the persistent gender disparity between girls and boys in relation to education, health, and overall well-being.

While MHM research has grown in recent years, and has included more sophisticated study methods, there has been no contemporary systematic review of the literature assessing MHM in West Africa. The primary aim of this systematic review is to critically examine the existing literature surrounding MHM among adolescent girls in Anglophone West Africa and assess gaps in the literature to make recommendations for future research and interventions. This review aims to answer the following questions: 1) What is the average age of menarche among adolescent girls in Anglophone West Africa? 2) How knowledgeable are girls in Anglophone West Africa about menstruation and who are the sources of information? 3) What are the prevalent attitudes and practices surrounding menstruation among girls in Anglophone West Africa? 4) What factors relate to the knowledge, attitudes, and practices of girl's during their menstruation? 5) How does poor menstrual hygiene management relate to health and educational outcomes among girls in Anglophone West Africa?

This review synthesizes scientific progress from 2010-2022 on this topic to identify gaps and make recommendations for future research.

Methods

Search strategy

A systematic literature review was conducted including all studies published in English that assessed menstrual hygiene management (MHM) among adolescent girls in Anglophone West Africa in accordance with the PRISMA guidelines[9]. The authors searched for articles published by academic, peer-reviewed journals using the PubMed database from January 2010 through April 2022 to assess recent developments in literature. The 12-year period was decided to give a large pool of articles from over the last decade as a representation of recent research. In addition, PubMed has a rigorous review process for indexing journals and ensuring a high quality in the articles included, thus for quality control we limited to this database. The following Boolean logic was applied: *[(menstrual hygiene management OR menstrual hygiene OR menstruation OR menarche) AND (attitudes OR knowledge OR practices OR experiences) AND (adolescent OR youth OR young OR teenager OR adolescence) AND (girl OR woman OR female) AND (west Africa)].* Bibliographies of the identified studies were also screened for any other articles.

Screening and review process

The authors screened and reviewed the articles retrieved from the search strategy. Articles were screened for studies that reported analyses of original data directly addressing menstrual hygiene management or menstrual practices. Studies with the following characteristics were excluded: 1) inadequate documentation and reporting of study methodology or results; 2) primary study outcome or exposure was something other than menstrual hygiene management and related practices, knowledge, and attitudes; 3) methodology too weak or poorly explained for assessment in a systematic review; 4) duplicate publications; 5) non-female and non-adolescent study samples; 6) methodological papers; 7) study populations outside of West Africa.

Tabulation of findings

The following information was obtained and tabulated for each included study: first author (year)

and setting; study design, data source(s), and sample size; outcome(s) and exposure(s); study sample exclusions; co-variables examined; results; study strengths and limitations. All quantitative studies used bivariate analysis measures or odds ratios for assessment of associations.

Results

Search findings

The search results and review process are summarized in the flow chart (Figure 1), in accordance with the PRISMA guidelines[9]. The PubMed and bibliography search yielded 59 citations published from January 2010 to April 2022. Thirty-eight of the 59 articles were considered relevant after reviewing the abstracts and were systematically reviewed. After further review, three of the 38 remaining studies were excluded. The specific reasons for exclusion included: unrelated exposure and/or outcome (e.g., menstruation after childbirth, male menstruation, methodology assessment, fertility control, breast milk, femininity and gender role, HPV, contraceptive methods), study sample not located in a West African country, or exposure or outcome not well-defined to measure menstrual hygiene management.

A total of 35 studies met the inclusion criteria: 16 were conducted in Ghana, 14 in Nigeria, 1 in The Gambia, 1 in Cameroon, 1 across all LMICs including some West African countries, and 2 across all Sub-Saharan African (SSA) countries including West African countries. For ease of understanding, the studies are presented in Table 1 for Ghana studies, Table 2 for Nigerian studies, and Table 3 for other studies. Within each table, the studies are organized in reverse chronological order by year of publication.

Study designs and sample populations

As shown in Tables 1-3, 25 of the studies were quantitative cross-sectional, two were qualitative cross-sectional, one was a non-randomized intervention trial, five were cross-sectional mixed methods, and two were literature reviews. In Ghana, 12 of the studies were cross-sectional with quantitative measures, two were cross-sectional with qualitative methods, one incorporated both cross-sectional quantitative and qualitative data collection methods, and one was a non-randomized trial (Table 1). The latter is the only published longitudinal intervention evaluation conducted in West Africa, a decade ago (Montgomery *et al.*[7]). Among the studies in Ghana, all but one (Anaba *et al.*[10]) were school-based studies sampling between 120-760 students (in quantitative studies) from junior schools, seniors schools, and universities, including range of ages from 11-25 years old. The school populations were demographically reflective of each other; however, cultural factors likely differed between populations and were not measured. On a larger scale, Anaba *et al*. analyzed data from the 2017/18 Multiple Indicator Cluster Survey to give a nationally representative sample (N=10,861) of menstruating women in Ghana, providing more externally valid results than the school-based studies. However, their sample was not exclusive to adolescent girls.

In Nigeria, 11 of the studies were cross-sectional design with quantitative methods, two studies were cross-sectional with qualitative methods, and one study was mixed methods using both quantitative and qualitative cross-sectional data collection methods (Table 2). Among the 14 Nigerian studies, 11 were school-based studies conducted at all levels of education in which adolescents partake with sample sizes ranging from 122-494 individuals (quantitative) and 10 in-depth interviews (qualitative). Similar to Anaba and colleagues'[10] large scale study in Ghana, Hennegan *et al.*[11] used data from the 2015 Performance Monitoring and Accountability 2020 (PMA2020) dataset (N=1,994) to assess menstruation among a large, representative sample of women of reproductive age. Furthermore, the studies from Cameroon and across SSA were quantitative cross-sectional studies with large sample sizes (N=1,157 and N=7,116, respectively) (Table 3). Shah and associate's study from The Gambia also used a cross-sectional design, with a mix of qualitative and quantitative data collection methods giving a smaller sample size (N=331 survey respondents; 20 focus groups; 13 in-depth interviews) but allowing for a deeper dive into the challenges of menstrual hygiene among adolescents.

Among all 35 studies assessed, male participants were excluded from all studies apart from four (Shah *et al*., Mohammad *et al*., Dorgbeter *et al*., and Finlay *et al*.)[5,12–14]. Pre-menarcheal girls

were excluded from all studies. Therefore, the measures of knowledge of menstruation before experiencing menarche may have had a higher chance of recall bias, especially among older girls.

Findings about the age of menarche and cycle length

Out of the 21 studies that reported the age of menarche and the four studies that measured menstrual cycle length, the age of menarche ranged from 12.5-15.0 years and the median cycle length ranged from 21 to 35 days (Tables 1 and 2). The two literature reviews assessing countries in SSA and LMICs reported a mean age of menarche between 11 and 15 years old (Table 3).

Only three studies assessed the factors affecting age of menarche, finding that in Cameroon, rural participants reported a slightly older age of menarche (13.0 years) when compared to urban dwellers (12.5 years) and those with a higher BMI experienced menarche earlier in Nigeria[15–17]. Moreover, when fully adjusted for father's education and occupation, number of house occupants, number of parents alive, religion, and BMI, participants in urban settings were 4.4 times (2.27-8.33) more likely to experience earlier menarche than rural participants[15]. In addition, the age of menarche was more likely to be younger among adolescent girls who live with two parents, have parents with skilled occupations, watched television more, and who have a higher BMI compared to their counterparts;[15] however, these associations were not adjusted for potential confounding. Additional confounders that could be considered in future studies include medication use, physical activity, and urban/rural residence, which have been found to relate to menarche and may relate to age. Furthermore, Anikwe *et al*. found a significant positive association between lower social class, measured by the educational level of the respondent's mothers and the occupation of their fathers, and a younger age of menarche after the age of 13 years, possibly due to urbanicity but this factor was not assessed.[16]

Findings about menstruation knowledge

Knowledge

The assessed studies showed a mixed prevalence of girls with a current general knowledge related to menstruation ranging from 51.9%-97.8%[5,12,13,15,18–21]; however, studies that assessed the level of knowledge showed that although most girls know that menstruation is a monthly flow of blood, arriving around the age of 11-16 years, and lasting 2-7 days each month, only one-third of girls knew that a menstrual cycle lasts from one period to the next and only a quarter of girls knew that the length can vary from 30 days[20]. Additionally, Boakye-Yiadom *et al*., 2018[22], concluded that 67.5% of adolescent girls had adequate MHM knowledge, defined as scoring five out the eight questions asked correctly. Oche *et al*.[23] similarly reported that 35% of adolescent girls in their study had low knowledge of menstruation, answering less than half the questions correctly, with 79% of girls reporting that the blood came from the womb. In addition, many girls did not know about menstruation before they experienced menarche (33-49.4%) and studies reported that 53-65% expressed fear and shame when they first menstruated[12,13,15,22].

More knowledge of menstruation was found to be associated with older age and an older age of menarche, for example, Finlay *et al*. showed that participants aged 19 were 6.5 times (95% CI 5.203, 8.060) more likely to know about menstruation than 10-year-olds[5]. Those with a school teacher as the main source of menstruation information and those in school were also more likely to know more about menstruation than those with other sources of information (e.g. friend, parent, sibling, other relative, no-one) or those who did not attend school[5,19]. Ssewanyana *et al*.'s[24] literature review based in countries across Sub-Saharan Africa suggest that low knowledge before menarche ranges from 4-90%. Respondents with greater wealth reported greater knowledge of menstruation; thus, those who worked in the past year, reported from the highest wealth quintile, had a well-educated mother, attained a higher education level, and owned a television were more knowledgeable[5,13,18,23]. Girls who identified as Christian instead of Muslim generally had better knowledge[19]. Finally, a surprising finding in Cameroon was that 80.6% of rural participants had correct knowledge of menstruation compared to 63.0% of urban participants[15].

The major sources of menstruation information included mothers (28.0-95.0%), teachers/school (7.4-91%), mass media (34-72.4%), health workers (10.0-46.1%), female

relatives (11.4-42.6%), and peers (6.1-57.4%)[12,21,22,25–29]. Iliyasu *et al*.[27] discussed the hesitation from mothers surrounding sexual reproductive health information because of a fear of sexual experimentation; nevertheless, 81.1% of mothers agreed that girls should be informed about menstrual hygiene. Similarly, 47.3% of students in a Benin City, Nigeria, study advocated for more public awareness and education on menstruation[29].

Attitudes towards menstruation

Feeling unclean and ashamed

The prevalence of positive attitudes towards menstruation (e.g., "I feel confident during my period") was estimated to be 13.6% of adolescent girls in a Ghana study[22]. Across various studies, 70.1-85.8% of girls reported they felt impure or unclean during their menses[12,13,22,30]. For example, Mohammad *et al*. found that 85.8% of girls believed menstruating was impure and shameful resulting in many girls (73.2%) not attending religious services and a few girls (14.7%) sleeping separately from family members during the time of bleeding[13]. Further, Shah *et al*. found that girls often do not cook, attend crowded gatherings, or touch the Qur'an during their menses because of feeling impure[12]. Rheinlander *et al*. reported that the association of menstruation with shame and feeling dirty meant that girls used code names, had a fear of changing, and missed school to conceal their menses from others[30]. Similarly, Boakye-Yiadom *et al*. reported that over half the adolescent girls (57.5%) thought menstruation is shameful to discuss[22].

Poor body image and low self-esteem and anxiety were found to be significantly correlated to negative attitudes towards menstruation, with some studies alluding this to poor preparation and misinformation surrounding menstruation[4,23]. For example, suspicion around menstruation and its relation to sexual behavior was reported to cast shame over menstruation in some communities. Iliyasu *et al*. reported that conversations about menstruation were initiated by mothers and were not interactive because questions back from girls were seen as suspicious[27]. In addition, Gyan *et al*. reported that adolescents perceived early onset menarche as a sign of sexual and reproductive health risk[31].

Feeling physical and emotional pain

The biggest challenges contributing to the negative attitudes surrounding menstruation included period cramps, which could sometimes lead to dysmenorrhea[13,15,16,25,27,29,32]. Period cramps, described in one study as "like two fresh sores being sawed"[32] interfered with daily activities like school attendance[16], sleep[32], and physical activity[33]. The use of contraceptive pills[27] and irregular menstrual flow[16] were significantly associated with an increased odds of pain. In addition, some studies reported an increase in feelings of being "irritable" or "depressed," or having "altered emotions" during their menses[13,29,32].

Practices of menstrual hygiene

Materials used

The most used menstrual product across studies was commercial disposable pads with use ranging from 21%-87%[6,8,10,13,22,27,29]. Other materials included reusable pads used by 6%-54.2% of respondents, old cloth or pieces of mattresses used by 9%-54% of respondents[13,20,22]. The choice of material was influenced primarily by cost, in addition to comfort, safety, fear of stigma, and availability (presence of a shop and distance to travel)[22]. Salami *et al*. reported that despite preferring disposable pads, 37% of girls could not afford them[34].

Changing materials

Respondents reported that they change their sanitary pad 2-3 times a day and bathe with soap and water 1-2 times a day[23,29]. The changing facility varied by study but most reported was the lack of adequate MHM facilities in schools. Mohammad *et al*. reported that although toilets were separated by sex, only two out of five schools assessed had handwashing facilities and clean toilets[13]. None of the studies mentioned the presence of locks in the toilet facilities. In addition, none of the schools had a mirror, soap, or a consistent supply of water[13]. Poor sanitation infrastructure was also highlighted in Rheinlander *et al*.'s study where there was a lack of functioning toilets, no lights in the toilet building, a water shortage, mixed sex toilets with no privacy, and reports of vaginal infections caused by dirty toilet pits[30]. Kumbeni *et al*. and Ssewanyana *et al*. also showed concordant results of lack of

adequate sanitation facilities in most schools assessed, leading girls to defecate and change their pads outside or not change at all during the school day[8,24]. Furthermore, Hennegan *et al*. showed that measures of sanitation access may not relate directly to the sanitation available for MHM, so more specific measures need to be assessed[11].

Disposal of materials

Many studies in the literature have shown that inappropriate disposal of absorbents during menstruation contributes to growing urban waste problems in lower-income countries. Across the studies assessed, only 20-33% of schools had adequate waste disposal facilities at the source; moreover, even at these sites, there was no mention of waste collection or large waste management procedures[6,13]. Respondents reportedly hid their sanitary materials until after school and used domestic waste bins at home (71.2%), burned the product (24.3%-53.0%), flushed the product down the toilet (0.3%-16.5%), threw the product in open spaces (47.0%) or buried the product at school or home (4.3-46.6%)[12,20,23,29,30]. These methods can cause problems with a lack of sewage systems and waste management infrastructure to remove the waste safely. In addition, burning disposable sanitary pads can release many harmful chemicals into the environment[35].

Use of medication

The most common symptom of menstruation was cramps and period pains, which were treated with pharmacological agents and/or bed rest (59%)[18], a visit to the doctor (16.3-17.5%)[18,29], or nothing (41-63.9%)[18,26,29].

Factors associated with MHM practices

Adequate menstrual hygiene practices were associated with an adequate knowledge of menstrual hygiene[22], increased age[20], increased education of respondents' mother, occupation of respondents' mother, and identifying as a Christian (compared to other religions)[23]. More specifically, the use of disposable sanitary pads was positively associated with a higher educational status, higher wealth, married status, and able-bodied[10]. The associations presented here are correlations only and not cause-effect relationships.

Educational outcomes (e.g., school attendance) associations with MHM

The most researched outcome across the Ghanian studies assessed was school attendance. Studies suggested that 12.2%-90.0% of girls missed school due to their period[6,8,13,16,22,29,36,37] and one study stated a mean of 2.76±1.56 days missed of school due to period every month[8]. Missing school was primarily due to abdominal pain, in addition to fear of staining, fear of being teased, no pads available, and a lack of private place to change, no water source, and no disposal for used pads available at school[13,16,22,29]. The use of disposable sanitary pads[6,8], younger age[6], higher wealth of family[6], and higher knowledge of menstruation[5] reduced the odds of girls missing school due to their period. Cultural restrictions, viewing menstruation as a period of impurity, increase the odds of girls missing school due to their period[6]. Furthermore, girls who miss school are less likely to learn about reproductive health and MHM as teachers are often a prominent source of information[5,19]. Although many Nigerian studies allude to poor MHM leading to poor educational outcomes, there are no studies quantitively analyzing the association between MHM and school attendance or school engagement in Nigeria to date. Further research needs to be conducted to scientifically assess the effect of menstrual hygiene on the education of girls to power effective and resource-specific interventions.

Existing intervention evaluations in Anglophone West Africa

Of the 35 studies assessed, two were intervention evaluations in Ghana. Dorgbetor *et al*. assessed a MHM-themed Play-Based Approach in 60 schools that involved structured educational games using local and foreign materials to engage the individual students[14]. The intervention schools were assessed using mixed methods through school assessments and interviews with teachers, school leaders, and students and compared to 60 non-intervention schools. The intervention schools were shown to have increased levels of menstruation knowledge among schoolgirls, increased confidence to discuss MHM among schoolchildren and teachers, better attitudes and less embarrassment reported from schoolgirls, and less school absenteeism due to menstruation. In addition, two schools out of 60 in the intervention group had installed changing

spaces compared to none of the non-intervention schools.

In addition, a pilot study assessing pad distribution and MHM education and the effect on school attendance was conducted by Montgomery *et al*. in 2012[7]. The study showed that school attendance rose in the Pads-with-Education group by 6 days per 65-day term, equating to a 9% increase and a significant decrease in missed days when compared to the no-intervention group.

Discussion

In this systematic review, the authors screened 59 journal articles and selected 38 articles which contained information about the knowledge, attitudes, and practices related to menstrual hygiene management and associated factors among adolescent girls in Anglophone West Africa. The collective evidence of this review indicates that inadequate menstrual hygiene management is prevalent across Anglophone West Africa with many girls lacking informative menstruation education, access to materials, and access to facilities to change, wash, and dispose materials during menstruation. These findings were consistent with existing review papers that include West African countries. The focus of this review, however, finds specific themes pertaining to current barriers and existing interventions that can be expanded on in a more specific method.

In addition to the agreement with this review, existing reviews have found consistent themes across Sub-Saharan Africa (SSA) and Lower-Middle-Income Countries (LMIC) that have allowed for the design of diverse conceptual models to act as frameworks for developing large scale interventions and guide future research. Hennegan *et al*., for example, designed a model to guide practice and research to respond to the important factors contributing to poor menstrual hygiene, including sociocultural contextual factors and resource limitations[1]. Similarly, Chandra-Mouli and Patel assessed MHM studies across 25 LMICs giving a large range of recommendations to address the concurrent themes identified[37].

The wide scope of these studies allows for a greater generalization of the results; however, the findings are limited by the wide cultural variation over these large regions. Because so many studies have been set in Uganda and other East African countries, our review assessing only Anglophone West Africa allows us to focus on the populous, Anglophone countries like Nigeria and Ghana. The summary of these findings can, therefore, hold more external validity for Anglophone West African countries, especially Nigeria and Ghana. In addition, the findings of this review can build on existing and older studies to design evidence-based, relevant interventions that can improve menstrual hygiene management for adolescents in the Anglophone West African region.

Knowledge of menstruation

First, this review showed that most girls (51.9%-97.8%)[5,12,13,15,19,20,23,38] experiencing menstruation know what menstruation is on a basic level. Nevertheless, specifics about the biological changes happening to female bodies through the menstrual cycle were less known. One identified knowledge gap was the origin of the blood; for example, Oche *et al*. reported that 79% of respondents in their study believed the blood came from the womb[21] and Boakye-Yiadom *et al*. reported that 47.3% of their respondents did not know the origin of the blood[22]. In addition, Lawan *et al*. reported that fewer than 33% of girls knew that the menstrual cycle extends from one period to the next, suggesting a need for formal education of the biology behind menstruation[20].

Ssewanyana *et al*. reported a variation in knowledge level based on the socioeconomic status of the family, age of the child, education level, and religion (Christians had higher knowledge than other religions)[24]. Like the current review, Ssewanyan *et al*. shows that MHM education is not uniformly available to pre-pubescent adolescents in West Africa; however, few studies assessed specific research questions into the interactions surrounding behavioral expectations and cultural norms that are embedded into acquiring knowledge about MHM. Inadequate knowledge about MHM can lead to increased fear and shame around menstruation, especially among adolescents that do not have access to open spaces to discuss their personal experiences[21]. In addition, religion can intensify the silence around menstruation; for example, Muslim families do not often discuss menstruation openly and girls are sometimes banned from attending the mosque and other religious events during menstruation[3]. It is important that future interventions and evaluations explore the effect of

focusing on two-way interactions to grow a social acceptance of discussing MHM.

Across the four West African countries studied in this review, mothers were the most frequently cited source of information for menstruation knowledge provided to girls. Additionally, another dominant source of information was schools and teachers, although this could have been overestimated as most of the studies were school based and do not include girls in the general population, many of whom have not attended any school or may have dropped out prior to the age 12 years. Iliyasu *et al*. reported that despite having access to information, the cultural restrictions in Northern Nigeria meant that open discussion about menstruation was frowned upon referring to the importance of "kunya" (a term used to describe modesty in the Islamic religion) and the risk of open MHM discussion leading to sexual promiscuity[27]. Rheinlander and colleague's study based in Ghana also reported the sexualization of menstruation education and the emphasis on the ability to be pregnant without including information about the safe management of menstruation[30]. The type of information received may be due to an increased availability of information online.

Iliyasu *et al*. reported that 72.4% girls receive most of their information from mass media sources like the internet and social media, showing a generational shift from the 34% of mothers in the study that were said to use mass media as a source of MHM information[27]. The source of information regarding MHM is an important factor to determine where to intervene with reliable and factual and information to dismantle cultural myths and prevent the spread of misinformation more efficiently. In addition, it is important to note that the accessibility to certain sources, like mass media, will be mixed depending on location and socioeconomic factors. The review highlighted that the studies focused on MHM knowledge ask simple categorical questions about the level and source of information, but few explore the types of information and the way they are distributed. Considering the importance of the content of MHM information, studies that collect qualitative information would be an avenue for further research to help design more efficient education campaigns.

Attitudes and practices

Practices and attitudes towards menstruation were driven by the social acceptance of menstruation. One theme that was highlighted was containment of blood; for example, Rheinlander *et al*.[30] noted that girls wanted to hide their bleeding and make sure they did not smell during their period. Mohammad *et al*. and Rheinlander *et al*. reported study respondents feeling unclean and impure during their menses, leading them to miss school, miss religious activities, and even sleep away from family for the period of bleeding[13,30]. In addition, feeling unclean and the desire to hide their menses led respondents to prefer disposable sanitary pads because of a fear of leakage; however, Shah *et al*. and Salami *et al*. reported that girls could not afford disposable pads despite their stated preference for them[12,34]. Fear also influenced the changing practices of girls during school. For example Ssewanyana *et al*., among other studies, reported that girls did not change their sanitary material in school because of a lack of privacy, lack of disposal, and fear of being seen[22,24]. Ssewanyana's review highlighted the multi-faceted and complex matrix of society, structures, and individual characteristics that work together to prevent adequate MHM for girls. The studies in this review highlight these important factors individually, but it is important that future research looks at the influence of societal (including religious), structural, and individual behavioral factors on the individual's MHM within one multi-level model.

Education

The final prominent finding was the substantial impact menstruation has on the education of girls. Many of the school-based studies focused on school attendance and engagement as an outcome related to poor MHM[6,8,13,22,29]. Fear of leaking in school and lack of facilities to change and wash in school leads to reluctance to attend school or increases the number of girls who leave to go home when they needed to change, resulting in partial day absences[6,13]. In addition, dysmenorrhea made school attendance and engagement difficult[13,22]. The effect of poor MHM on education contributes to the growing gender disparity between girls and

boys and their future economic prosperity. The reduction in girls' attendance and engagement in school is an area that needs to be urgently researched with specific research questions to guide effective intervention design, especially in countries like Nigeria where this has not been statistically assessed yet.

Study methodologies

The studies assessed in this review had many strengths including large sample sizes[5,6,8,11,16,22,28,34,36–38],data collection designed to answer specific study questions[11,17,33], qualitative and quantitative study designs, and very high response rates[6,10,20] (>90%). However, there were some limitations to note for further research to address.

First, all the studies but one (Montgomery *et al.*[7]) were cross-sectional in design, giving no longitudinal data for causal inference over time. Therefore, we cannot know for certain the direction of associations. In addition, many of the studies were school based which may have underestimated the level of poor MHM because the accessibility to school indicates a level of accessibility that may not be available to those who do not attend school. Furthermore, the studies were based on self-reported measures of experiences and MHM factors, therefore there may be some social desirability bias in which the participants recall what they think they should say instead of the true answer. Self-reported measures often also fall victim to recall bias, especially with the included studies that exclude pre-menarcheal girls, as some experiences occurred before menarche and respondents may inaccurately remember previous experiences resulting in the misclassification of exposures and outcomes. While non-differential misclassification is not an issue if all girls have a similar poor recall of their outcome or exposures, girls who have had negative or traumatic experiences due to menstruation may disproportionately remember poor MHM exposures or poor outcomes related to menstruation compared to those that have had less issues with menstruation. Differences in recall could lead to differential exposure or outcome misclassification and can bias the results toward or away from the null. Finally, the absence of males from most of the studies eliminates an important piece of the puzzle for assessing the experience of menstrual hygiene management males are a large proportion of populations that play a role in the socio-cultural experience of menstruating girls; thus, an assessment of the male perceptions and attitudes towards menstruation should be assessed in further studies.

In addition to addressing the limitations of the studies highlighted above, there are limited studies that directly assess school facilities through ecological-level assessment. Second, only two studies in the review evaluated interventions (Montgomery *et al.* and Dorgbeter *et al.*), highlighting the need for more design and longitudinal evaluation of interventions. Future studies should focus their efforts on progressing forward with community-based intervention design and conducting longitudinal studies for a more robust data collection and sustainable interventions that involve the opinions of those being affected.

Strengths and Limitations

This review identified a large body of recent literature from a more specified region than previous systematic studies. The review draws from best practice using the PRISMA guidelines to summarize the status of the literature and highlight gaps for further work. However, in addition to the limitations of the individual studies included, there were a few limitations to review itself. Firstly, although studies from all over West Africa were searched for, only four countries were included in the review, with most studies set in Ghana and Nigeria. This reflects the global focus of menstrual hygiene research in specific geographical areas but may mean our results are more reflective of these countries than West Africa as a whole, as opposed to other literature from low-income countries in general. Also, despite extensive searching, some eligible studies may have been missed, for instance if we had extended the time frame to include earlier studies from 2000 to 2009, there would have been 14 more hits from the search terms. However, when screened, none of these studies provided additional information about menstrual hygiene in West Africa. Studies published in smaller journals that are not online may have also been missed, especially from lesser resourced West African countries.

The review highlights the gaps for future research and guides the resource distribution for future interventions. There is an abundance of

research assessing menstrual characteristics, symptoms, knowledge, and resources among adolescents in Nigeria and Ghana. In these areas, where research and resources are often more available, intervention and evaluation should be the focus of the future researchers. The existing information can be used to guide the researchers in the community-led design of interventions to counteract the poor menstrual hygiene management that persists in these communities. For example, the lack of school wash facilities was evident within this review and existing reviews that include West African countries, policy changes could address school resources to ensure girls could learn about menstruation, change material during their menses, and wash their hands and bodies in privacy when needed. Outside of Nigeria and Ghana, there is less research surrounding menstrual hygiene. It is possible that assuming the same results across countries in Anglophone West Africa would lead to adequate intervention design; however, it is important to conduct formative research in the other, smaller, countries in West Africa.

Conclusion

In summary, studies across Anglophone West Africa over the last decade have identified consistent themes of poor education, poor mental health, and restrictions from social participation due to a lack of adequate MHM. The large body of evidence highlights the need for more specified and multi-level studies to guide policymakers in specified regions. This review highlighted the multifaceted approach needed to explore and act upon MHM as there are a myriad of factors acting together. For example, the knowledge of reproductive health and safe management of menstruation, the structural access to facilities and clean water, the affordable availability of materials, the social perception of menstruation and the perceptions and attitudes of women experiencing menstruation, all acting together to produce the overall impact of menstruation on a girls' life. This review helps to guide future comprehensive studies and intervention evaluations to capture the entire MHM experience across different communities and cultures.

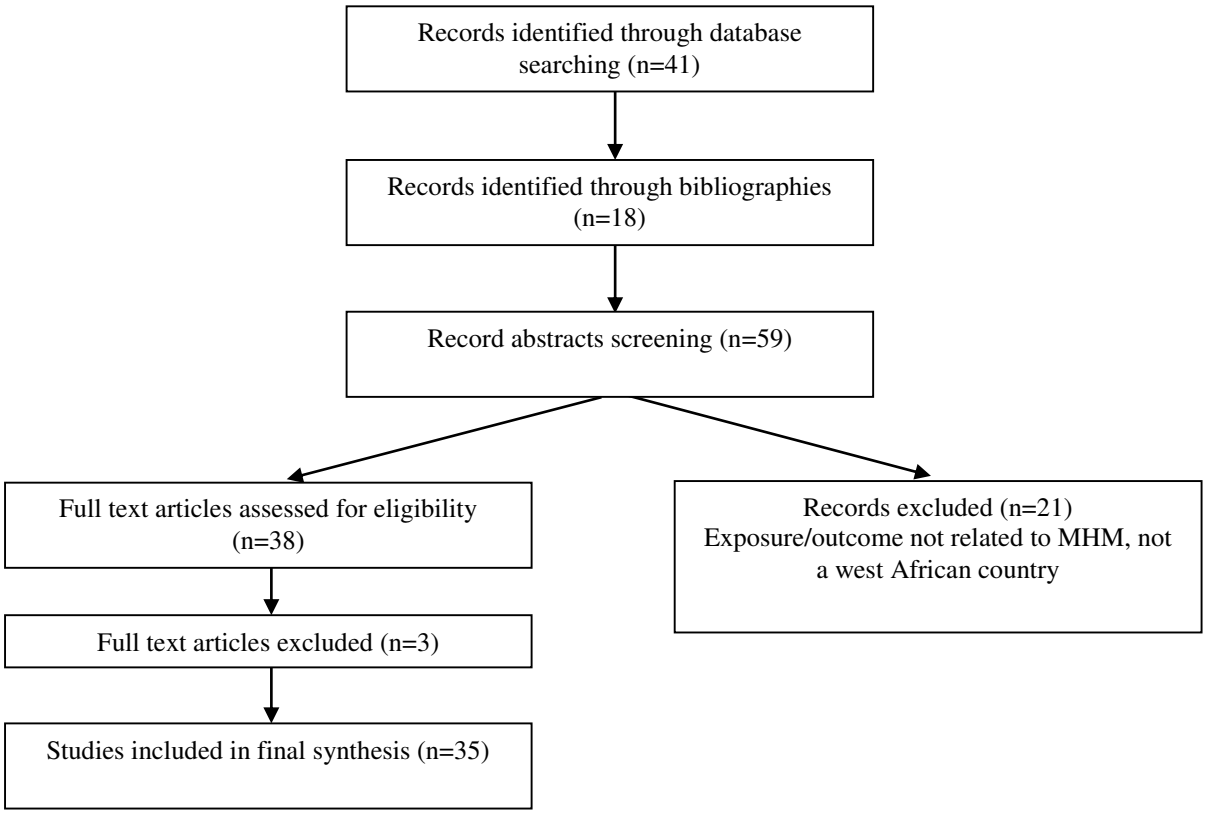

Figure 1: Article search strategy based on PRISMA guidelines (Moher *et al*, 2009)

Table 1: Systematic review of studies assessing the knowledge, attitudes, and practices surrounding menstrual hygiene management in Ghana from 2010-2022

	Study Design Data Source(s) and Sample Size	**Exposure(s) and Outcome(s)**	**Co-variates**	**Major Findings/Conclusions**	**Strengths (+) & Limitations (-)**
Anaba *et al.*, 2022[10] *Use of reusable menstrual management materials and associated factors among women of reproductive age in Ghana: analysis of the 2017/18 Multiple Indicator Cluster Survey*	Cross-sectional study N=10, 861 women aged 15-49 years old Nationally representative population from the 2017/18 Multiple Indicator Cluster Survey (MICS) collected via Computer Assisted Personal Interviewing (CAPI)	Exposure: sociodemographic characteristics; disability status Outcome: the use of reusable menstrual management material	Sociodemographic characteristics (age, educational status, household wealth index, marital status, type of residence, region), disability status, and exposure to mass media.	29% of women aged 45-49 years used reusable materials compared to 6% of 15–19-year-olds. Use of reusable materials was significantly associated with educational status (at least primary school education less likely to use reusable materials compared to women with no education), wealth (middle wealth quintile less likely to use reusable material compared to poorest quintile), marital status (never married more likely to use reusable than current married), disability (women with a disability a more likely to use reusable)	+Nationally representative data among women of reproductive age giving external validity. +Weighting for over and under-sampling +99.8% response rate -Cross-sectional study design -Recall bias and social desirability bias from self-reports -No information on the types of reusable materials used
Kumbeni *et al.*, 2021[6] *Prevalence and factors associated with*	Cross-sectional self-administered survey	Exposure: age, religion, mother's education, parent(s) income, type of	Age, religion, mother's education, parent(s) income, type of sanitary material used, privacy in school,	65.5% of the girls used sanitary pads, 65.7% had privacy in school during menstruation, 43.5% had faced cultural restrictions during their menses. School absenteeism prevalence was 27.5%	+Large sample size +Good response rate +Assessed school absenteeism at multiple ages

menstruation-related school absenteeism among adolescent girls in rural northern Ghana	N=705 adolescent girls attending junior high school in Talensi district of Ghana aged 12-19 years old	sanitary material used, privacy in school, and cultural restrictions. Outcome: menstruation-related school absenteeism defined as "being absent from school due to menstruating issues during last menses	and cultural restrictions.	Girls aged 18-19 years were 2.38 times more likely to stay away from school during menses than those aged 12-15 years. Girls with moderate income parents were 0.57-times less likely to stay away from school. Cloth use increased the odds of school absenteeism by 3.21-times. Cultural restrictions increased the odds of school absenteeism by 2.54-times.	-Cross-sectional -Did not consider soap or water availability at school (part of WASH) -Self-reported variables may cause recall bias -Selection bias to those just in school
Mohammed *et al*., 2020[39] *Menstrual Hygiene Management and School Absenteeism among Adolescents in Ghana: Results from a School-Based Cross-Sectional Study*	Cross sectional study design N=250 schoolgirls aged 10-19 years old from five junior High schools in the Kumbungu District capital.	Exposure: sociodemographic characteristics Outcome: menstrual related absence from school; menstrual hygiene management	Age, father's occupation, mothers' occupation, TV/radio ownership, earn money, receive money for MHM	50.8% had good MHM Odds of poor MHM was highest among those aged 14-16 compared to those aged 17-19 Those who did not receive money for menstrual products (58.2%) had 1.81-times higher odds of poor MHM compared to those that did 40% were absent from school because of menstruation, the most reported reasons were pain, fear of staining, fear of being teased, no pads available, and lack of private place to change at school.	+Random sampling frame +Informs policy makers -Cross sectional -Recall bias -Social desirability bias -Data on school facilities, household income, parental education, and other potential risk factors for poor menstrual

in a Rural Community				Teachers said that menstruation doesn't affect girls' attendance (not congruent with girl's)	hygiene management were not collected
Kumbeni *et al*., 2020[8] *Menstrual hygiene among adolescent girls in junior high schools in rural northern Ghana*	Cross sectional study N = 705 schoolgirls who had reached menarche aged 10-19 years old	Exposure: sociodemographic characteristics Outcome: menstrual hygiene management index	Sociodemographic characteristics of respondent and family	The prevalence of good menstrual hygiene was 61.4%. 65.8% used disposable pads Burial of the used sanitary material was the most practiced method (46.4%) among the good MHM group whereas throwing used pads in open spaces was common among the poor MHM group (47%) Inadequate sanitation facilities were a major challenge to menstrual hygiene management at schools. Only one out of the fifteen schools did not have a toilet facility. All the toilet facilities were latrines pits with no soap. Two schools combined facilities for girls and boys. Only two of the fourteen schools had water supply at the toilet facilities. Three of the schools had dustbins in the toilets for disposal of used sanitary materials Mean of 2.76±1.56 days missed of school due to period. The use of sanitary pads was significantly associated with school attendance.	+First assessment like this in rural Ghana +Large sample size -Cross-sectional -Recall bias or social desirability bias -Conducted in an area where there was an ongoing free supply of sanitary pads to junior high school girls though the supply was not regular. May not be generalizable to those without a supply of pads.
Mohammed *et al*., 2020[13] *Menstrual knowledge, sociocultural*	Cross sectional N=250 girls; 30 boys; 5 teachers Survey to schoolgirls aged	Exposure: age of the adolescents, age at menarche, religious affiliation, and	Parents occupation and education; religion; age of participant; TV at home wealth proxy	63.9% of girls aged 10-14 years old and 51.9% of girls aged 15-19 years old had poor menstrual knowledge Menstrual knowledge was improved among girls who: were older, reached menarche later, had mothers who had reached	+ Lots of covariates + Included boys and teachers + Mixed methods - Cross sectional - Small sample size

restrictions, and barriers to menstrual hygiene management in Ghana: Evidence from a multi-method survey among adolescent schoolgirls and schoolboys	11-19 years old and focus group discussions/key informant interviews with schoolboys and teachers.	the educational level of their parents Outcome: adolescents' menstrual knowledge, access to menstrual hygiene materials, sociocultural and religious restrictions on menstruation, and the availability of suitable water, sanitation, and hygiene facilities in the schools		secondary education, and those who owned a TV Most girls used commercial sanitary pads (60.7%) and reusable cloth (54.2%). Choice was influenced by comfort, safety, cost, and availability. Boys had good knowledge of menstruation but saw it as something boys didn't discuss. School teachers said access to pads was a big barrier if NGOs (e.g., CAMPFED) and schools did not provide. 85.77% of girls believed menstruating girls were impure and unclean. 73.22% did not participate in religious activities during their period. 14.65% slept separate from family members during menstruation. All schools had toilets separated by girls and boys with doors. 2/5 schools had clean facilities and working handwashing facilities. None had a mirror or soap or regular supply of water (Veronica buckets). 1/5 had disposal in the toilet.	
Acheampong *et al*., 2019[33] *Prevalence and Predictors of Dysmenorrhea, Its Effect, and*	Cross sectional study with self-administered questionnaires in selected schools	Exposure: -Chronological age, level of education, place of stay, age at menarche, the	Chronological age, level of education, place of stay, age at menarche, the history of the menstrual cycle, the nature of menstrual	The overall prevalence of self-reported dysmenorrhea in this study was 68.1% Many respondents with dysmenorrhea (70.8%) were between the ages of 16–19 years old.	+Large sample size +Data collected specifically for these research questions -Involved only schools in the district capital

Coping Mechanisms among Adolescents in Shai Osudoku District, Ghana	N=760 healthy adolescents aged 12–19 years	history of the menstrual cycle, the nature of menstrual flow, length of the cycle, duration of menstruation, and family history of dysmenorrhea Outcome: History of dysmenorrhea	flow, length of the cycle, duration of menstruation, and family history of dysmenorrhea	Adolescents who do not live with their parent experienced a 53.1% increase in odds of self-reporting dysmenorrhea. Respondents who had irregular menstrual cycle experienced a 72.5% increase in odds of self-reporting dysmenorrhea 34.8% of adolescents with dysmenorrhea reported a history of severe menstrual pain The presence of menstrual pain affects physical activities by 22.5% Only 19.4% of adolescents with dysmenorrhea reported to have consulted a physician for their menstrual pain.	which may reduce external validity. -Cross-sectional -Self-reported measures may lead to recall bias -Very broad outcome, "ever experienced' and a clinical measure without clinical measurement.
Rheinlander *et al*., 2019[30] Secrets, shame, and discipline: School girls' experiences of sanitation and menstrual hygiene management in a peri-urban community in Ghana	Cross-sectional qualitative methods Focus groups=4 IDIs=4 School walk through = 2	Variables: Hygiene poverty, waste management systems, girl's toilet strategies, managing menstruating and menstrual waste, advice on menses	N/A	Infrastructural hygiene poverty - lack of functioning toilets, no lights, no waste management systems, water shortage, vaginal infections caused by dirty toilet pits, girls choosing to defecate outside Secrecy around menstruation – feeling dirty, embarrassed, no privacy, fear of changing, missing school, code names No waste disposal – hiding it in bags Menstrual education – sexualized about getting pregnant Girls find peer-related solutions in their hard circumstances Need to change the narrative around menstruation Girls felt like they had to lie because of discipline if missing for period	+Qualitative hearing from girls themselves + School assessments - Wide range of ages varying levels of MHM - Teachers may select students with better social status to represent their school more -Social desirability bias

Boakye-Yiadom *et al.*, 2018[22] *Assessing the Knowledge, Attitude and Practice of Menstrual Hygiene Management Among Junior High Schools Adolescent Females in the Yendi Municipality in the Northern Region of Ghana*	Cross sectional N=430 adolescent girls attending junior high school aged 10-19 years old	Exposures: age, parents living with child, amount of money given for MHM resources, knowledge of MHM Outcomes: knowledge of MHM; attitudes towards MHM; practices during menstruation	Not adjusted	77.9% of the girl's source of MHM information is their mother and 91% also receive information about MHM in school 80.7% know about pad or cloth and 22% know of tampons 67.5% scored adequate MHM knowledge. 9/10 students ever missed school for menstruation: odour, teased, pain, lack of water, changing facility, disposal, pads. 70.1% see menstruation as unclean. 57.5% say menstruation is shameful 13.6% had positive attitudes to MHM 21% used disposable pads, 57% use cloth, and 9.1% use pieces of mattresses. Out of the 258 (72.9%) adolescents who have ever been unable to buy a pad, majority (49.6%), lack of money, followed by unavailability/long distance to shop (31.4%) and fear of stigma (16.7%). 72.9% have parents as main source of funds. Older girls were significantly more likely to have higher MHM knowledge, practice proper MHM	+Large sample size -Cross sectional -Not adjusted in logistic regression, potential confounding -Selection bias only school-going adolescents -Recall bias, self-reported measures
Ameade *et al.*, 2018[18] *Prevalence of dysmenorrhea among University students in Northern Ghana; its*	Cross sectional study Self-administered questionnaire March-April 2015	Exposure: dysmenorrhea (pain) Outcomes: daily activities, hospital referral, pain medication use,	Age, age of menarche, religion, accommodation/residence, irregular flow, length of flow, exercise level	83.6% of girls experienced dysmenorrhea, moderate level for 56.3% and beginning before onset of bleeding for 58.4% and lasts 3 days. Affects daily activities of 61.2%, affecting attendance to lectures in 70.7%. Severe dysmenorrhea was experienced more by those with an irregular flow:	+ Perceived experiences and many outcomes + Large enough sample size for power -Cross sectional, no causal inference

impact and management strategies	N=293 female students from the Tamale campus of the University of development	severity of dysmenorrhea		16.3% reported going to hospital for pain. 41% use no painkiller. Others used bed rest or non-steroidal anti-inflammatory drugs. Pain more prevalent in those whose age of menarche <13 years, older age, Christian, rural dwellers, longer flow time, more exercise.	-Only college aged students in college (selection bias)
Gyan, 2017[31] *Exploring the Causes of Change in Adolescent Girls' Sexual Behaviour in Begoro, Ghana*	Cross-sectional qualitative Interviews and focus groups (N=54)	Study assessed the changing sexual behavior of the traditional norms of puberty rites, marriage, sex, family	N/A	The educational system offers opportunities for adolescent girls to learn about their sexuality and manage their sexual experience as stated in the following narrative: *"They (teachers) teach us those things (sexual and reproductive health) at school. The teachers teach us how to use condoms to protect ourselves and how to access family planning. They also teach us that we can buy medicine at the pharmacy shop to prevent pregnancy."* (Adwoa, an adolescent girl) The early onset of menarche is perceived as a factor that increases the likelihood of adolescent girls becoming pregnant when they engage in early sexual activities.	+ Talks to community members and boys and girls + The stories align with just different emphases on the attitudes + More modern perspectives talking to the community before using quantitative methods; an in-depth look into lived experiences - Cross-sectional -Only talks about menarche age pertaining to MHM
Ameade *et al*., 2016[38] *Relationship between Female University*	Cross sectional N=292 female undergraduate students studying Medicine,	Exposure: sociodemographic characteristics Outcome:	Not adjusted	54.3% were aware of menstruation before the onset of menarche and main source of information was teachers 38.5% were struck by fear and panic when first seeing blood.	+ Simple random sampling of students removes selection bias -Cross sectional -Self report could introduce recall bias

Students' Knowledge on Menstruation and Their Menstrual Hygiene Practices: A Study in Tamale, Ghana	Nursing, Midwifery, Health Science Education, and Community Nutrition Semi-structured questionnaire	- menstruation knowledge; menstrual hygiene (poor, average, good, excellent)		Mean knowledge score was 57.3%, less knowledge on the specific biology of menstruation Females older than 25 years were significantly more knowledgeable about menstruation than their younger colleagues Significant difference in knowledge scores among the students based on their courses of study There was a weak positive but significant relationship between the age of respondents and their knowledge of menstruation Association between the knowledge of respondents about menstruation and their practice of good menstrual hygiene	and social desirability bias -University students only reduced external validity -No adjusted associations – residual confounding not controlled for
Dorgbeter, 2015[14] *Mainstreaming MHM in schools through the play-based approach: lessons learned from Ghana*	Qualitative and quantitative exploratory evaluation of a lay-based approach to improve MHM – interviews, focus groups, observation, and field level reports N=120 schools (60 with the approach and 60 control)	Evaluated the opinions of head-teachers, school-based health coordinators, school children. Observed the school activities and updates posted on the WhatsApp group platform.	N/A	Intervention improved: -Teacher involvement with MHM -Schoolgirls and boys confidence to discuss MHM -Parent and father involvement -Less delay for WASH plans -Increased knowledge, better attitudes, and less embarrassment and stigma from girls and boys regarding MHM -Reduction of girls going home during menstruation -Materials in school and changing spaces in two schools	+Widespread study over 7 regions +Evaluation of an intervention +Mixed methods +Included all stakeholders- teachers, school nurses, girls, boys, parents +6 month follow up period -No statistical evaluation of outcomes just observation – lack of clear comparison especially regarding

					how schools were different before -Action plan was hard to assess
Aziato *et al*., 2014[32] *The experience of dysmenorrhea among Ghanaian senior high and university students: pain characteristics and effects*	Cross sectional Qualitative assessment N=16	Descriptive assessment of dysmenorrhea and its effect	N/A	Pain was rated at 6-10 severity out of 10 and described as "unbearable" Associated with nausea, vomiting, joint paints, sweating, fear, unable to pass urine and others. Physical and social effect of the pain – irritable, couldn't undertake normal activities, suicidal ideations, poor sleep, altered emotions, regrets of being female. Absenteeism from class – "I sleep in class", "I can hardly focus in class", "I am at the sickbay". Misconceptions that pain led to infertility.	+ In-depth discussions + Lived experiences - Cross sectional - No males or non-students
Montgomery *et al*., 2012[7] *Sanitary Pad Interventions for Girls' Education in Ghana: A Pilot Study*	Non-randomized trial of sanitary pad provision with education. N=120 schoolgirls aged 12-18	Exposure was 3 intervention levels: 1. Pads and puberty education 2. Education alone 3. Control Outcome: - school attendance from two whole terms from teacher records	Demographics, poverty index, rurality, time to school	Attendance rose in the Pads-with-Education groups by around 6 days per 65-day-term (or 9% of a girls' school year) Education group attendance also rose but was delayed. No significant difference between urban and rural sites. Qualitative results showed girls missed 3-5 days a month when menstruating showing the need for intervention.	+Assessed change using the ecological model of change +Evaluated an intervention +Peri-urban and rural areas +No loss to follow up +First study to assess pad access and education with school attendance in Africa -Small sample size -Short follow-up time

		(unplanned visits to check records)			-Limited generalizability and results may reflect the site not the country of SSA overall -Selection bias in those participating were attending school despite menstruating
Gumanga *et al*., 2012[28] *Menstrual Characteristics in Some Adolescent Girls in Accra, Ghana*	Cross sectional descriptive study N=456 girls at St Mary's senior secondary school in Accra, Ghana	Descriptive study of age of menstruation characteristics	N/A	24% had irregular menses 74.4% of girls experienced dysmenorrhea 80.2% received information about menstruation from their parents, less than 10% from health professionals.	+Large sample size to represent this area -One school in an urban area making external validity limited -Only descriptive, no associations

Table 2: Systematic review of studies assessing the knowledge, attitudes, and practices surrounding menstrual hygiene management in Nigeria from 2010-2022

Citation	Study Design and Sample Size	Exposure(s) and Outcome(s)	Co-variables Examined	Results Conclusions	Strengths (+) & Limitations (-)
Lawal *et al*., 2020[4] *Menstrual attitude dimensions, Anxiety and Body Esteem in adolescent girls*	Cross sectional N = 276	Exposures: - anxiety measured using the self-rated anxiety scale (Zung) -Body esteem using the body esteem scale (Mendelson) Outcome: - attitudes towards menstruation the Menstrual Attitude Questionnaire (MAQ) (Brooks-Gunn and Ruble)	No other covariables, just anxiety and body esteem measures.	Body esteem-appearance was independently significant for adolescent girls' acceptance of menstruation as debilitating (p=0.003), bothersome (p<0.001). Anxiety was independently significant for girl's acceptance of menstruation as predictable (p=0.013). Interactively, the body esteem and anxiety affected girls' acceptance of menstruation as predictable (p=0.031).	+ Looks at the psychological factors associated with MHM + Used validated scales (but they are old) - No other covariates adjusted for - Cross sectional
Anikwe *et al*., 2020[16] *Age at menarche, menstrual characteristics, and its associated morbidities among*	Cross sectional N = 400	Exposure: - sociodemographic characteristics (age, social class, BMI, urban/rural residence, ethnicity, source of menstrual information Outcome:	Socio-demographic characteristics of the respondents The height and weight of the study population	Main source of information about menstruation is mothers (80.0%), friends (75.0%), and teachers (75.5%) – multiple answers allowed. Dysmenorrhea was present in 82% of respondents, school absenteeism is 56.5% due to dysmenorrhea/ Fatigue was the most common symptom. No medical advice was sought, all medications was provided by parent or guardian. Positive association between lower social class and age of menarche after age 13 years (p value: 0.001).	+Data collected for research questions +Included familial factors +Large age range and sample size -Restricted to those who had started menarche -Self-reported measures

secondary school students		- Menarche and menstrual characteristics and experiences			
Salau *et al*., 2019[40] *Pubertal Communication Between School Nurses and Adolescent Girls in Ile-Ife, Nigeria*	Cross sectional mixed methods quantitative and qualitative N = 10 school nurses; 420 adolescent girls	Exposure: - sociodemographic factors, menstrual characteristics Outcome: -type of information distributed -materials of communication	N/A	School nurses paid more attention to physical body changes, menarche, and menstrual hygiene as contents of pubertal communication rather than contraception, prevention of sexually transmitted infection, and teenage pregnancy prevention. Materials for communication were reportedly lacking in many of the schools while the school management censors pubertal information.	+Mixed methods +Data collected based on research question -Small sample size -Lack of teachers to give insight into why the communication has issues - Private schools only
Salami, 2019[34] *Onset of Menarche and Adolescent Menstrual Hygiene Practices in Semi-Urban Ibadan Community, Nigeria*	Cross sectional descriptive study. N = 492 girls	Descriptive study of the knowledge of and practices during menstruation	N/A	Almost one half (49.4%) had received no education about menstruation before menarche. Most (65.3%) of the girls got menstrual information from their mothers, but 40.9% believed that such information should not be discussed openly. A little over one third (37%) of girls could not afford disposable menstrual materials, and 61.8% reportedly dried their reusable menstrual materials indoors.	+Semi-urban population +Large sample size +Explores attitudes and affordability of menstruation products -Cross sectional -Recall bias -No associations tested or adjustment
Hennegan *et al*., 2018[11] *The Relationship between Household Sanitation and*	Cross-sectional N = 1,994	Exposure: - Different types of sanitation facilities in the household (safely managed or basic,	Socio-demographic characteristics, the type of menstrual material used, and the presence of a handwashing facility in the household	42.59% used a basic or safely managed facility, 15.15% used a limited facility, and 42.26% used an unimproved facility. Women and girls with access to improved (safely managed/basic) sanitation facilities or limited facilities had	+ Large scale survey data using a diverse range of women not just schoolgirls

Women's Experience of Menstrual Hygiene: Findings from a Cross-Sectional Survey in Kaduna State, Nigeria		limited, unimproved, or open defecation) - Girl's perception of menstrual hygiene environment Outcome: - Girls' self-reported location of menstrual management including	Contraceptive use	significantly higher odds of using the main household facility to change their menstrual materials than those with an unimproved sanitation facility. Findings of this study suggest that the level of household sanitation does not necessarily indicate women's menstrual management location or lack of access to a location to change absorbents. For example, access to soap and water may not mean soap and water is available for menstrual hygiene management.	-Cross sectional design prevents causal inference -Data was not specifically collected for research question
Adegybayi *et al*., 2017[26] *Blood, joy, and tears: menarche narratives of undergraduate females in a selected in Nigeria Private University*	Cross sectional N= 136 undergraduate females	Descriptive study of the knowledge of and practices during menstruation	N/A	Almost all the respondents (95%) received information about menstruation from mothers, female relatives, and school lessons prior to menarche. Most of the respondents first told either their mother or a female relative when they first got their period and viewed menarche as a crisis. Two salient themes emerged from the contents of the narratives: celebration and advice. The advice theme was further explored, and three advice patterns were identified: being a woman, hygiene and changed dynamics in relationships with males. All respondents reported using sanitary towels during their menstrual period with the majority experiencing cramps regularly and (61%) using pharmacological agents for remedy.	+Qualitative gave more depth for lived experiences - Only 1 private university not much external validity and potential selection bias -No males -Small samples size -Cross sectional
Nwokocha *et al*., 2016[17]	Cross sectional N = 897	Exposure: -age, BMI	Sociodemographic variables, demographics	The study showed that the age of menarche is declining with a mean age of 12.5 (1.2 years).	+Few studies assess menarche specifically +Large sample size

Pattern of teen menstruation among secondary school girls in south east Nigeria.		Outcome: -menarche, cycle length		Teens with a higher BMI reached menarche earlier and had longer menstrual cycles than those with lower BMIs.	- Cross sectional -Recall bias - Only schoolgirls - No males -Large sample and age range
Ajah *et al*., 2015[36] *Adolescent reproductive health challenges among schoolgirls in southeast Nigeria: role of knowledge of menstrual pattern and contraceptive adherence*	Cross sectional N = 482	Descriptive study of the knowledge of and practices during menstruation	N/A	The mean age at menarche was 13.13±1.37 years. The mean menstrual cycle length was 27.8±3.14 days, and the mean duration of menstrual flow was 4.8±1.14 days. Thirty-seven (7.7%) respondents were ignorant of their cycle length, while 29 (6.0%) had irregular cycles. Premenstrual syndrome and dysmenorrhea were major menstrual issues, which resulted in 69 (14.3%) and 59 (12.2%) of respondents resorting to self-medication and absenteeism from school, respectively. Mothers were the main source of their daughters' adolescent education.	+Large sample size +Random sampling of schools -Descriptive, no associations -Cross sectional -Potential recall bias of the topics
Amu *et al*., 2014[25] *Prevalence of menstrual disorders among adolescent girls in Osogbo, Southwestern Nigeria*	Cross sectional N = 402 girls	Descriptive study of the knowledge of and practices during menstruation	Socioeconomic characteristics, demographics.	A total of 391 (97.8%) respondents had heard about menstruation before, with the three most important sources of information being their mothers (81.8%), teachers (7.4%), and peer groups (6.1%). The mean age at menarche was 12.5±1.0 years. Menstrual bleeding lasted between 2-7 days in 81.1% and cycle length lasted for 21-35 days in 81.6% of the respondents.	+ Large sample size for descriptive analyses + No associations assessed - Cross sectional - Only girls from private schools

				The three most important menstrual disorders they experienced were dysmenorrhea (77.8%), menorrhagia (57.4%) and metrorrhagia (18.6%), among others.	
Ghararo, 2013[29] *Menstrual Hygiene Practices among Junior Secondary School Students in Benin City*	Cross sectional descriptive study N = 494 junior secondary school girls	Descriptive study of the knowledge of and practices during menstruation	N/A	Average age at first menstruation 12.88 Mothers were the major source of information 238 (52.2%), next is teacher 156 (34.2%), and sisters 52 (11.4%). Most respondents 480 (97.4%) think that menstruation is a normal body function, while 13 (2.6%) think it is a disease condition. Majority of the respondents, 395 (84.5%) could explain the function of the menstrual cycle. Abdominal pains and cramps were the major complaints 264 (75.6%), next is feeling depressed, 41(11.7%) 63.9% do nothing to relieve the discomfort, while 61 (17.5%) visit a doctor for treatment Eighty-three (83.4%) use sanitary pads, while none (0.0%) use the Tampons. Sixty-eight 68 (13.8%) students have missed school during menses mostly due to severe menstrual pain [dysmenorrhea] 49 (72.1%) students More than half (52.1%) of the student change their sanitary pads twice daily and a majority of 83.9% bathe two or more times a day. Most of the students burn their sanitary material (39.6%) but a small minority (16.5%) flush their sanitary pads in the toilets. 93.9% of the students felt that enough of information is being taught on menstrual hygiene in the school curriculum. A large majority (47.3%) advocated for an increase in public enlightenment and discussion	+First study in Benin City, Nigeria +Large sample size -Cross sectional -No associations assessed

				to be organized in the society, 15.8% suggested an increase in the toilet facility by government in the public schools.	
Iliyasu *et al*., 2012[41] *Menstrual Patterns and Gynecologic Morbidity among University Students in Kano, Nigeria*	Cross-sectional N = 383	Exposure: -menstrual characteristics, contraceptive use Outcomes: - Sociodemographic characteristics, menstrual patterns, and associated symptoms.	Sociodemographic variables	The mean age at menarche was 13.7 ± 1.68 years. Approximately 72% of respondents reported dysmenorrhea. After adjusting for confounding, age at menarche, menstrual cycle length, duration of menstrual bleeding and use of contraceptive pills remained significant predictors of dysmenorrhea. Menstrual disorders interfered with social and academic life of 91% and 84% of respondents respectively.	+Survey made for the research questions +Large sample of adolescents +Associations assessed for dysmenorrhea adjusted for confounding -Cross sectional -Only one university -Selection bias with university students only (more educated)
Iliyasu *et al*., 2012[27] *Sexual and reproductive health communication between mothers and their adolescent daughters in northern Nigeria*	Cross sectional N = 184	Descriptive study assessing menstrual knowledge source and practices	NA	Median age of menarche = 14 years old Sexual and reproductive health discussions took place between 69-74% (daughter-mother report) of mother-daughter dyads, mostly triggered by onset of menstruation and mainly centered on menstruation (including mandatory religious cleansing). Mothers received information from health workers (46.1%), mass media (34%), and elder sisters (30.3%). Daughters reported gaining knowledge from mass media (72.4%), peers (57.4%), school (31.4%), health workers (26.2%), and mothers/aunts (42.6%) Discussions were initiated by mothers and were not interactive, questions back from the girls were considered suspicious or stubborn. Some said discussions were dangerous because it may lead to sexual experimentation. However,	+ Literate and non-literate respondents +Interviews conducted in the Hausa language +Grounded theory used for analysis -Participants may have given socially acceptable answers – information bias -Hesitance to discuss some issues

				81.1% of mothers agreed that girls should be informed about menstrual hygiene. Only 31% of mothers agreed with school sex education. Few mothers indicating receiving their own sexual and reproductive knowledge from their mother because there was more 'kunya' (modesty_ among unmarried women then. This has been replaced with 'Zamani' (modernity) and changes to traditional values of sex before marriage. Fulani ethnicity mothers do not contemplate discussing reproductive health with their daughters. 81% of daughters used pads whereas 66% of mothers did.	
Oche *et al*., 2012[23] *Menstrual health: the unmet needs of adolescent girls' in Sokoto, Nigeria*	Cross sectional descriptive study N = 122 girls	Descriptive study Assessed factors (age, education, religion, literacy of mother, source of information) associated with menstruation knowledge (>50% was good knowledge)	N/A	Age of menarche was 13.3 +-1.7 years. 65% of girls had high knowledge whereas 35% had low knowledge. 56.6% got their information from mothers or grandmothers, others from teachers and friends. Statistically significant relationship between religion and level of study of the girls and knowledge of menstruation. 87% used sanitary pads and 60% changed 3 times a day, 66% washed with soap and water and 53% burned pads after use. There was a significant statistically association between education of their mothers, religion, and occupation of respondent's mother with respect to the reported menstrual hygiene practices. 79% believed blood came from the womb When asked how they felt the first time the menstruated, the majority (53%) of the respondents' expressed fear or ashamed.	+Multi-stage sampling with random selection of girls +Raised issues about formal education and further studies -No males -Only secondary school girls aged 15-20 -Cross sectional -Small sample size relative to the population -Urban and well-educated families

Lawan *et al*, 2010[20] *Menstruation and Menstrual Hygiene amongst Adolescent School Girls in Kano, North-western Nigeria*	Cross-sectional N = 400	Exposure: demographic and educational factors Outcome: Knowledge and practices of MHM	Mean age was 14.4 years, 92% had reached menarche. Mean age of menarche was 12.9. Most girls knew that menstruation was a monthly flow of blood, and it came around age 11-16 years and lasted 2 to 7 days a month. Only one-third knew that a menstrual cycle extended from one period to the next and only 25% knew that they vary from 21 to 35 days (most said they last exactly 30 days). 94% knew sanitary products were available and half knew that poor management could lead to infection. 87.5% of girls had a fair knowledge score and 88.7% had good practices. The majority heard of menstruation from their parents, 14% from school. The various methods the students used for disposing used menstrual absorbents include disposal with domestic wastes (71.2%); burning (24.3%); burial (4.3%) and flushing in toilet (0.3%). 6.2% used alternatives to pads like old cloth because of the cost. Higher age gave rise to better knowledge and practices.	+ 100% response rate + Study designed for the research questions - Cross sectional - Only individual level factors

Table 3: systematic review of studies assessing the knowledge, attitudes, and practices surrounding menstrual hygiene management in other West African Countries from 2010-2022

Citation Study Setting	**Study Design Data Source(s) and Sample Size**	**Exposure(s) and Outcome(s)**	**Co-variables Examined**	**Results Conclusions**	**Strengths (+) & Limitations (-)**
Finlay *et al*., 2020[5] *Sexual and reproductive health knowledge among adolescents in eight sites across sub-Saharan Africa*	Cross sectional N = 7,116	Exposure: -social and demographic factors: age, sex, current enrolment in school at interview, whether the participant had worked for money in the past 12 months, whether the respondent's mother was alive, and self-reported sexual debut. -household wealth Outcome: -Menstruation knowledge, HIV knowledge, other STI knowledge	Social and demographic factors: age, sex, current enrolment in school at interview, whether the participant had worked for money in the past 12 months, whether the respondent's mother was alive, and self-reported sexual debut, household wealth	Only 14.3% (95% CI 10.6, 18.9) of 10-year-olds knew about menstruation Female adolescents were more knowledgeable about menstruation than male adolescents Participants aged 19, those in school, those who had worked, richer participants, and sexually active participants more likely to know about menstruation than their reference groups. Multivariate analysis: School attendance remains an important correlate of knowledge of menstruation	+ Large sample size + Many sites across SSA + Included males and females + Asked directly about menstruation and adjusted for many relevant covariates - Residual confounding or recall bias - Non validated questionnaire may lead to measurement error - Collected in households could lead to under-reporting (social desirability bias)
Ajong *et al*., 2020[15]	Cross sectional	Exposure(s): -residing rural/urban; age	Father's education and occupation; number of house occupants;	80.6% of rural participants had correct knowledge on menarche onset compared to 63.0% of urban participants.	+ Rural and urban participants

Knowledge of peri-menarcheal changes and a comparative analysis of the age at menarche among young adolescent schoolgirls in urban and rural Cameroon	N= 1,157 (570 urban and 587 rural)	at menarche; various demographic factors Outcome(s): -knowledge of puberty and menarche; knowledge of menstrual cycle; knowledge of pre-menstrual symptoms; mean age at menarche	number of parents alive; religion; BMI.	Rural dwellers knew less about the menstrual flow timeframe (78.4%) compared to urban dwellers (86.7%). The pre-menstrual symptoms were similar across rural and urban girls, the most common symptom being cramps. Also reported increased breast size, fever, nausea, vomiting, dizziness. Source of menstrual knowledge came mostly from TV/radio or school in urban setting and school or parents in rural setting. Mean age at menarche was higher in rural (13.03) than urban (12.48). When fully adjusted, participants in urban setting were 4.35 times (2.27-8.33) more likely to have early menarche than rural participants. Age of menarche was lower among those with two parents alive, parents with skilled occupations, watched TV more, and who had a higher BMI.	+ Random clustered sampling +Large sample size - Retrospective, self-reported data - Only menstruating females - Cross sectional - Only includes girls attending school
Shah *et al.*, 2019[12] *A rite of passage: a mixed methodology study about knowledge, perceptions, and practices of menstrual hygiene management in rural Gambia*	Mixed methods N = 13 IDIs; 20 focus groups; 331 survey respondents	Exposure: -taboos and secrecy surrounding menstruation Outcome: -views on menstruation, cultural beliefs, sources, and levels of knowledge, MHM practices	Age, religion, education level of HH household, education level of caregiver, material of walls and floors in the house, main source of income, water source, toilet facilities.	Knowledge of menstruation showed a mixture of knowing what menstruation was, but no one linked it to hormonal changes. Many males and females saw it as a disease (33%) or caused by cultural folklore. 9% did not know what menstruation was. Source of knowledge for menstruation information was teachers (78%) or mothers (28%). Most said men should not know about this kind of subject. They were told information in line with Islamic religion. 33% of girls did not know what menstruation was when they first saw it. 65% were scared when they first saw blood, even among half of those that knew what menstruation was.	+Included boys, girls, mothers, and teachers +Mixed methods - Only one Arabic school - Only girls attending schools with access to health care services

				Most girls wanted to use disposable pads if provided by the school, but they were too expensive to buy otherwise so rags were used. Reusable cloth was used Hid the pads when drying. Girls reported themselves as impure during their menstrual period and said they should not cook, attend crowded gatherings, or touch the Qur'an. Fears of infertility if they burned used pads.	
Chandra-Mouli and Patel, 2017[42] *Mapping the knowledge and understanding of menarche, menstrual hygiene, and menstrual health among adolescent girls in low- and middle-income countries*	Literature review of low- and middle-income countries N=81 papers from 2000-2015 across 25 countries (10 in West Africa)	Preparedness for menarche, knowledge of menstruation, sources of information, negative health, and social effects, what practices they develop	N/A	Adolescent girls are often uninformed and unprepared Information comes from mothers and female family members who often don't know much themselves Exclusion and shame lead to unhygienic practices during menstruation. Girls miss school, self-medicate and refrain from social interaction instead of asking for help. Teachers are not equipped to help.	+Large rage of countries +Many recommendations based on concurrent themes -Wide scope means fewer specific interventions for places -Many countries not represented may not be able to use results
Ssewanyana *et al*., 2017[24] *Menstrual hygiene management among adolescent girls in sub-Saharan Africa*	Literature review, overview of studies	N/A	N/A	11-15 years as average age of menarche, older among rural individuals. Girls are often unprepared at menarche, low knowledge (4-90%) that differs by SES. Dominant sources are female family members who are not often well-informed. Males in charge of resource allocation. Low priority to MHM in households. Access to materials and WASH facilities is a challenge, especially in some rural locations.	+Brief and informative overview of the current knowledge of MHM in SSA -Did not address the lack of external validity of studies but grouped together all SSA studies assuming they can relate to each individual

	Girls reported to not change in school because of lack of girl friendly latrines and lack of disposal. Poor MHM disrupts education due to missed days of school, low confidence, and shame. Unsafe alternatives can lead to infection and risky sexual behavior to gain access to pads in some places like Kenya.	community within each country. -Not a systematic literature review, just a general overview

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