Access to Clean Water and Its Impact on Menstrual Hygiene Practices among Girls and Women: A Systematic Review Paper

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Abstract

Menstrual hygiene management (MHM) and menstrual health (MH) are increasingly recognized as critical determinants of the health, education, and empowerment of women and girls globally. Despite growing research attention, evidence on menstrual outcomes remains limited and fragmented. To synthesize quantitative research on MHM and MH, map the range of investigated outcomes, and identify gaps, priorities, and directions for future work. A systematic search was conducted in PubMed, JSTOR, Web of Science, and Google Scholar for studies published between January 2020 and September 2025. Eligible studies included peer-reviewed empirical research employing quantitative or mixed methods designs with inferential statistics. Excluded studies were qualitative-only, review papers, or non-peer-reviewed. Study populations included adolescent high school girls, school directors, and women of reproductive age. Marginalized groups (e.g., women in IDP camps and female sex workers) were rarely studied (<10%). The most frequently examined independent variables included socio-economic, demographic, and WASH-related factors (80%). The review followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Of the 40 screened articles, 23 met the inclusion criteria. Data were extracted on study design, theoretical framework, outcomes, populations, and geographic focus. Quality appraisal emphasized study design and reporting transparency. Most studies were cross-sectional studies (78.3%, n=18). The most frequently researched outcomes were MHM Practices and adequacy (39.1%, n=9), followed by socio-behavioral/experiential aspects and educational/empowerment outcomes (each at 21.74%, n=5). Health outcomes related to menstruation were least studied (17.4%, n=4). Studies were concentrated in India (55.6%, n = 10) and Ethiopia (44.4%, n = 8), with minimal representation from Nepal, Kenya, and Bangladesh (each 5.6%, n = 1). The majority lacked an explicit theoretical framework (77.8%). The most common independent variables were socio-economic, demographic, and WASH factors (80%), indicating that MHM is deeply embedded in broader societal contexts. Overreliance on cross-sectional designs, underrepresentation of marginalized populations and geographic regions, and inconsistent reporting of variables in abstracts hindered knowledge transfer. Failure to clearly report variables in abstracts also hinders knowledge transfer. Future research should prioritize theory-informed longitudinal research and the inclusion of vulnerable populations to strengthen evidence for equitable WASH interventions and policies. No external funding was reported for this review.

Keywords: Menstrual Hygiene, Water Access, Sanitation, Adolescent Girls, Menstrual Hygiene Management, Socio-behavioral Factors, Empowerment.

1.0 Introduction

Menstruation, despite being a universal biological process, continues to be enshrouded in social stigma, misconceptions, and gendered inequities that limit the capacity of women and girls to manage it safely and with dignity (Amnesty International, 2019; Hennegan & Montgomery, 2016). Across the globe, menstrual hygiene management (MHM) has increasingly been recognized as a critical public health, education and human rights issue, underscoring the understanding that effective management of menstruation is foundational to physical health, psychological well-being, educational engagement, and broader social participation (UNICEF, 2019; Phillips-Howard & Caruso, 2018). Globally, an estimated 1.9 billion women and girls experience menstruation, yet access to safe, affordable, and culturally acceptable menstrual products remains highly unequal, particularly in low- and middle-income countries (Benshaul-Tolonen, Näslund-Hadley, & Ahmed, 2020). Many girls and women face infrastructural challenges such as inadequate access to clean water and private sanitation facilities, limited availability of menstrual products, and insufficient education on menstrual health (World Health Organization, 2018). Compounding these physical barriers are deeply entrenched sociocultural norms and taboos, which discourage open conversation about menstruation and perpetuate shame, embarrassment, and exclusion from normal daily activities (Jewitt & Ryley, 2014).

These constraints not only affect physical health, leading to higher incidences of reproductive tract infections and urinary tract infections, but also limit educational participation, reduce workplace engagement, and negatively impact psychosocial well-being (Hennegan & Montgomery, 2016). Women and girls may miss school or work during menstruation due to lack of adequate facilities or fear of stigmatization, which cumulatively hinders academic achievement, career opportunities, and overall empowerment (Amnesty International, 2019). In this context, menstruation should not be viewed simply as a private health matter; it represents a key social determinant intersecting with gender equality, human development, and societal progress.

International organizations, including the World Health Organization (WHO), UNICEF, and UN Women, have highlighted that addressing menstrual hygiene is central to achieving multiple Sustainable Development Goals (SDGs), particularly those related to health and well-being (SDG 3), quality education (SDG 4), gender equality (SDG 5), and access to water and sanitation (SDG 6) (UNICEF, 2019; World Health Organization, 2018). Evidence from global research suggests that while some progress has been made in increasing the availability of menstrual products and improving sanitation facilities, persistent gaps remain in knowledge, social norms, and programmatic interventions (Hennegan & Montgomery, 2016; Benshaul-Tolonen et al., 2020). In many regions,

cultural restrictions, misinformation, and stigmatizing practices continue to undermine efforts to ensure menstrual equity, with girls and women frequently reporting fear of shame, social exclusion, and judgment for natural physiological processes (Jewitt & Ryley, 2014).

This complex interplay of infrastructural, social, and educational factors highlights that solutions to menstrual health challenges cannot be limited to providing sanitary products alone. Effective interventions require a holistic and context-specific approach that addresses structural inequalities, promotes comprehensive menstrual health education, challenges harmful societal norms, and fosters supportive environments in schools, communities, and workplaces (Phillips-Howard & Caruso, 2018). Globally, there is a growing recognition that advancing menstrual health is integral not only to improving individual well-being but also to promoting broader social and economic development, reducing gender-based disparities, and enabling women and girls to fully participate in society with dignity, confidence, and agency (Amnesty International, 2019).

In Sub-Saharan Africa, menstrual hygiene management (MHM) remains one of the most pressing public health and social challenges, shaped by a complex interplay of infrastructural deficits, economic constraints, and culturally entrenched norms (Phillips-Howard & Caruso, 2018). Across the region, millions of girls and women lack reliable access to safe, affordable, and acceptable menstrual products, a situation further complicated by inadequate water, sanitation, and hygiene (WASH) facilities in both rural and urban low-resource settings (World Health Organization, 2018). In many communities, toilets or latrines are insufficiently equipped to support menstrual management, often lacking privacy, water, or disposal mechanisms, which forces girls to improvise with unhygienic materials or skip school altogether (Jewitt & Ryley, 2014). Economic barriers also play a major role, as poverty limits the capacity of families to purchase disposable sanitary products, leaving menstruators dependent on makeshift alternatives that increase the risk of infection and discomfort (Hennegan & Montgomery, 2016).

Cultural beliefs, taboos, and myths surrounding menstruation reinforce stigma and secrecy and discourage open discussion or access to information (Amnesty International, 2019). Restrictions on movement, participation in social, religious, or community life, and even household chores during menstruation foster feelings of exclusion and marginalization (Benshaul-Tolonen et al., 2020). Empirical evidence from countries including Uganda, Ghana, Ethiopia, and Kenya indicates that girls frequently miss several days of school per month due to menstruation, cumulatively contributing to reduced educational attainment and diminished confidence in academic settings (Jewitt & Ryley, 2014).

Beyond education, women and girls may withdraw from community engagement or employment due to inadequate menstrual management resources or fear of embarrassment (Phillips-Howard & Caruso, 2018).

Despite growing awareness, socio-behavioral and experiential aspects of menstruation, such as the psychological burden of stigma, peer pressure, and fear of leakage, remain critically underexplored in quantitative research, leaving gaps in evidence about lived experiences and quality of life impacts (Hennegan & Montgomery, 2016).

In Kenya, menstrual health has increasingly been recognized as a critical determinant of girls' education, women's health, and broader gender equality (Jewitt & Ryley, 2014; Amnesty International, 2019). Despite significant government initiatives such as the provision of free sanitary pads to schoolgirls and the improvement of water, sanitation, and hygiene (WASH) facilities in schools, persistent barriers continue to hinder effective menstrual management across the country (Hennegan & Montgomery, 2016). Studies conducted in both rural and urban settings demonstrate that many girls lack reliable access to menstrual products, face poorly equipped or unsafe sanitation facilities, and are subject to cultural taboos that discourage open discussion of menstruation (Phillips-Howard & Caruso, 2018). These combined factors contribute to frequent school absenteeism, reduced classroom engagement, and emotional distress among menstruating girls (Amnesty International, 2019). Socio-cultural practices further exacerbate these challenges; restrictions on participation in domestic, religious, or community activities during menstruation reinforce notions of shame and secrecy, shaping the perceptions and behaviors of girls in ways that limit both physical and psychosocial well-being (Jewitt & Ryley, 2014).

Health outcomes are also directly impacted, with high incidences of reproductive tract infections, urinary tract infections, and menstrual discomfort reported among girls and women, particularly in low-income households or informal settlements where access to hygiene resources is limited (Phillips-Howard & Caruso, 2018). Beyond physical health, menstruation carries profound socio-behavioral and psychological consequences, including stress, anxiety, lowered self-esteem, and diminished confidence, all of which have tangible effects on school attendance, academic performance, and social participation (Hennegan & Montgomery, 2016). The intersection of these factors highlights menstruation as a multifaceted issue, where health, education, and social inclusion are closely interlinked, requiring interventions that address both practical needs and socio-cultural realities (Amnesty International, 2019).

Despite notable progress in policy and intervention programs, substantial gaps remain in Kenya's menstrual health landscape, particularly in terms of evidence and research (Benshaul-Tolonen et al., 2020). While national initiatives have prioritized access to sanitary products and the improvement of WASH facilities, empirical studies assessing the long-term impacts of these interventions on educational performance, health outcomes, and empowerment are still limited (Jewitt & Ryley, 2014). Even less understood are the experiences of marginalized groups, including girls with disabilities, out-of-school adolescents, and those living in remote or informal settlements, who may face compounded challenges due to intersecting vulnerabilities (Amnesty International, 2019).

2.0 Statement of Problem

Menstrual hygiene management (MHM) remains a critical public health, human rights, and gender equity issue. Despite global and regional interventions, access to safe menstrual products, adequate WASH facilities, and comprehensive education is still limited, particularly in low- and middle-income countries. Existing research is fragmented, focusing unevenly on health, psychosocial, educational, and empowerment outcomes. A systematic synthesis is required to consolidate this evidence base and identify gaps that hinder evidence-informed policy and programming. This study sought to conduct a systematic review of quantitative studies on menstrual hygiene management and menstrual health, with specific focus on mapping and categorizing the dependent variables examined across peer-reviewed journals. The review seeks to identify thematic trends, highlight under-investigated areas, and provide guidance for future research and interventions. The study sought to answer the question: What is the scope of outcomes reported in empirical quantitative literature on menstrual hygiene management and menstrual health, particularly with regard to access to water, sanitation, and menstrual products?

3.0 Methods

3.1 Search Strategy

A comprehensive and reproducible search strategy was developed to capture relevant studies published on MHM and MH, with a particular focus on quantitative research addressing dependent variables related to hygiene practices, health, socio-behavioral experiences, educational outcomes, and empowerment. The search was conducted across three major electronic databases PubMed/Medline, Google Scholar (first 10 pages), and the St. Paul's University (SPU) Library database, to ensure broad coverage across biomedical, public health, and social science literature. Search queries were carefully constructed using a combination of Medical Subject Headings (MeSH) terms (where applicable), keywords, and Boolean operators to enhance sensitivity while maintaining specificity.

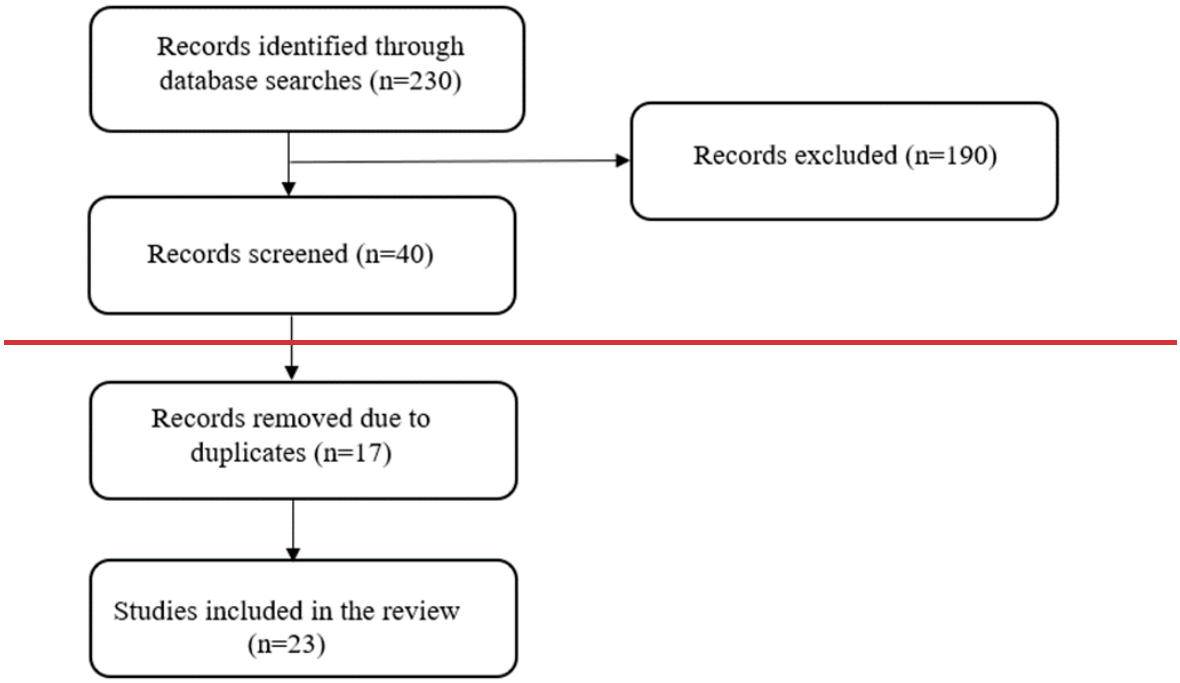
Key search terms included "menstrual hygiene practice," "menstrual hygiene management," "menstrual health," "adolescent girls," "period poverty," "water, sanitation, and hygiene (WASH)," and "Sub-Saharan Africa." Boolean operators such as "AND" and "OR" were employed to link these terms, enabling the retrieval of studies that addressed multiple dimensions of menstrual hygiene and health. For example, a representative PubMed search string was: ("menstrual hygiene practice" OR "menstrual hygiene management") AND ("adolescent girls" OR "school girls") AND ("Sub-Saharan Africa" OR "low- and middle-income countries").

The timeframe was restricted January 2020 and September 2025 to capture the most recent evidence, and only articles published in English were included. To supplement electronic searches, reference lists of all included studies were hand-searched (snowballing) to identify additional relevant publications. The search strategy yielded 230 initial records, which were exported to EndNote for duplicate removal before screening.

3.2 Study Selection and Eligibility Criteria

The study selection process followed a two-stage screening protocol. In stage one, titles and abstracts were independently screened by two reviewers against predefined eligibility criteria. Each record was assessed against a set of predefined eligibility criteria, with studies classified as either suitable for full-text review or excluded at this stage. In stage two, the full texts of potentially relevant articles were independently assessed by the same reviewers. Discrepancies were resolved by consensus or, when unresolved, by a third reviewer.

The process was documented in a PRISMA 2020 flow diagram as shown below to illustrate the records identified, screened, excluded, and included.



3.2.1 Inclusion Criteria

Studies were included in if they: (1) reported original quantitative data on MHM and MH; (2) targeted adolescent girls and/or women; (3) examined MHM practices, access to WASH, products use, socio-behavioral, educational, empowerment, or health outcomes; (4) were conducted in Sub-Saharan Africa; (5) were published in peer-reviewed journals; and (6) were written in English. Cross-sectional studies were the predominant eligible design.

3.2.2 Exclusion Criteria

Studies were excluded if they: (1) were non-original research (reviews, commentaries, editorials, case reports); (2) did not provide quantitative outcomes; (3) were conducted outside of Sub-Saharan Africa; (4) focused on populations other than adolescent girls and women; (5) were publications in languages other than English; and (6) exhibited methodological weaknesses (e.g., insufficient data reporting, lack of analytical rigor, or high risk of bias).

3.3 Data Extraction and Quality Appraisal

A standardized, piloted data extraction form was used to capture study characteristics (author, year, country, design, sample size, population), prevalence estimates, associated factors, and effect sizes (e.g., odds ratios, confidence intervals). Extraction was conducted independently by two reviewers, and inter-rater reliability was assessed using Cohen's kappa statistic.

Study quality and risk of bias were evaluated using the Joanna Briggs Institute (JBI) critical appraisal checklist for analytical cross-sectional studies. Studies were categorized as low, moderate, or high risk of bias, and sensitivity analyses were performed by excluding high-risk studies.

3.4 Data Synthesis

A narrative synthesis was undertaken to summarize study findings thematically, supported by a quantitative meta-analysis where appropriate. Dependent variables were categorized into four domains: (1) MHM practices and adequacy, (2) socio-behavioral and experiential aspects, (3) educational and empowerment outcomes, and (4) health outcomes.

Where studies reported sufficient homogeneity, random-effects meta-analyses were conducted to pool prevalence or effect sizes. Statistical heterogeneity was assessed using the I^2 statistic, with thresholds of 25%, 50%, and 75% indicating low, moderate, and high heterogeneity, respectively. Publication bias was evaluated visually via funnel plots and statistically using Egger's regression test.

4.0 Results and Discussion

4.1 Scope of outcomes investigated

The analysis of 23 included quantitative empirical articles revealed a total of 23 distinct dependent variables related to menstrual hygiene and health. These variables were organized into four overarching themes. The distribution of outcomes is summarized in Table 1.

Table 1: Frequency distribution of outcomes investigated

Theme	**Frequency (Count of Variables)**	**Percentage**
Menstrual Hygiene Management (MHM) Practices & Adequacy	9	39.13%
Socio-behavioral and Experiential Aspects of Menstruation	5	21.74%
Educational and Empowerment Outcomes	5	21.74%
Health Outcomes Related to Menstruation	4	17.39%
Total	**23**	**100.00%**

4.1.1 MHM Practices and Adequacy

MHM practices and adequacy were the most frequently researched theme (n=9; 39.1%). Examples of dependent variables included "safe vs. unsafe menstrual hygiene practices," "access to adequate menstrual health resources," "menstrual friendliness of public toilets," and "use of household sanitation for menstrual management." The dominance of this category is unsurprising, as MHM practices are observable, measurable, and directly tied to WASH infrastructure and policy

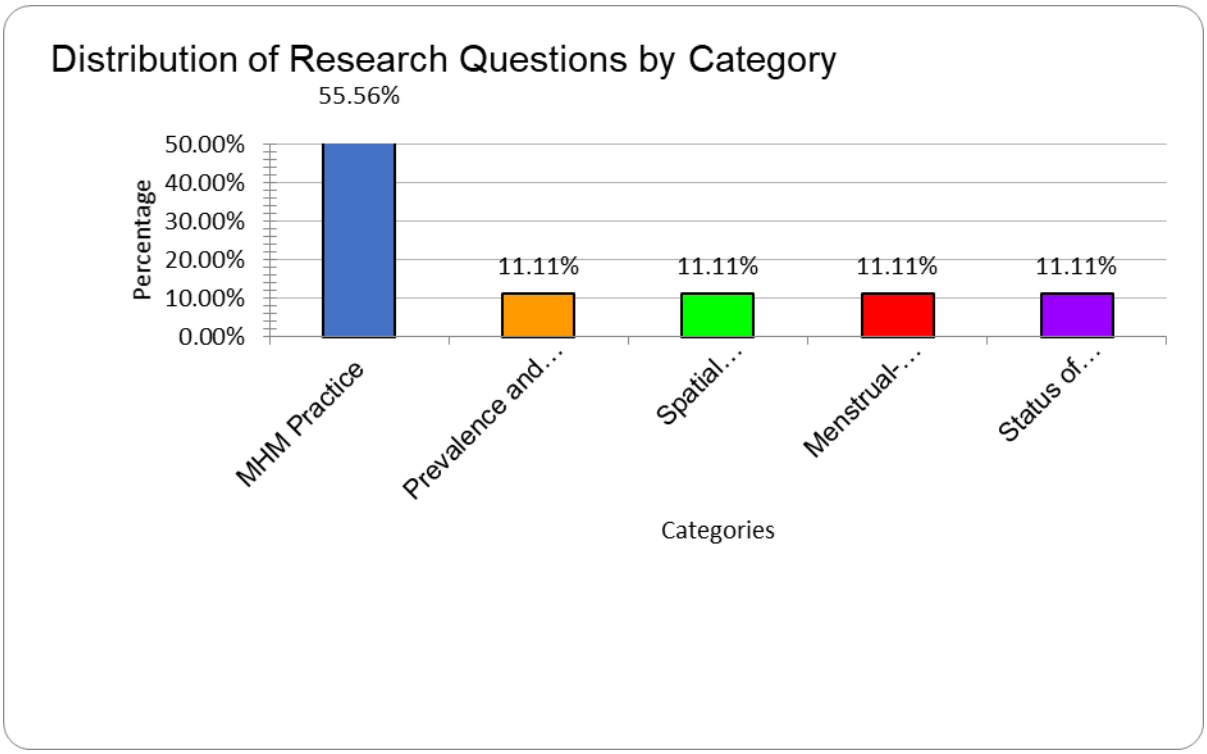
interventions. Variables such as type of absorbents, frequency of changing, access to soap and water, and disposal methods are relatively easy to assess via surveys and provide critical baseline data for program evaluation.

4.1.2 Geographical Distribution of Studies

The largest share of studies was conducted in India (n=10; 43.5%) and Ethiopia (n=8; 34.8%). Smaller contributions came from Nepal (n=1; 4.3%), Kenya (n=1; 4.3%), and Bangladesh (n=1; 4.3%).
A key limitation is that Indian studies were drawn from populous regions (Odisha, Karnataka) while Ethiopian studies were localized (Dessie City, Lasta district). Treating these contexts as statistically equivalent risks underestimating representativeness in India and overstating findings from Ethiopia.

4.1.3 Research Questions and Contexts

The dominant focus was on general MHM practices (>50% of dependent variables). Other specialized contexts, each represented in a single study, included: (1) MHM in IDP camps (displaced populations); (2) Sex work venues in Kisumu, Kenya; (3) Public toilets across global cities; and (4) Spatial disparities across Indian districts. While these contexts highlight critical vulnerabilities, their equal representation (~11% each) may oversimplify differences in urgency and complexity. For example, MHM in IDP camps requires urgent humanitarian interventions, while urban toilet design reflects broader infrastructure planning.



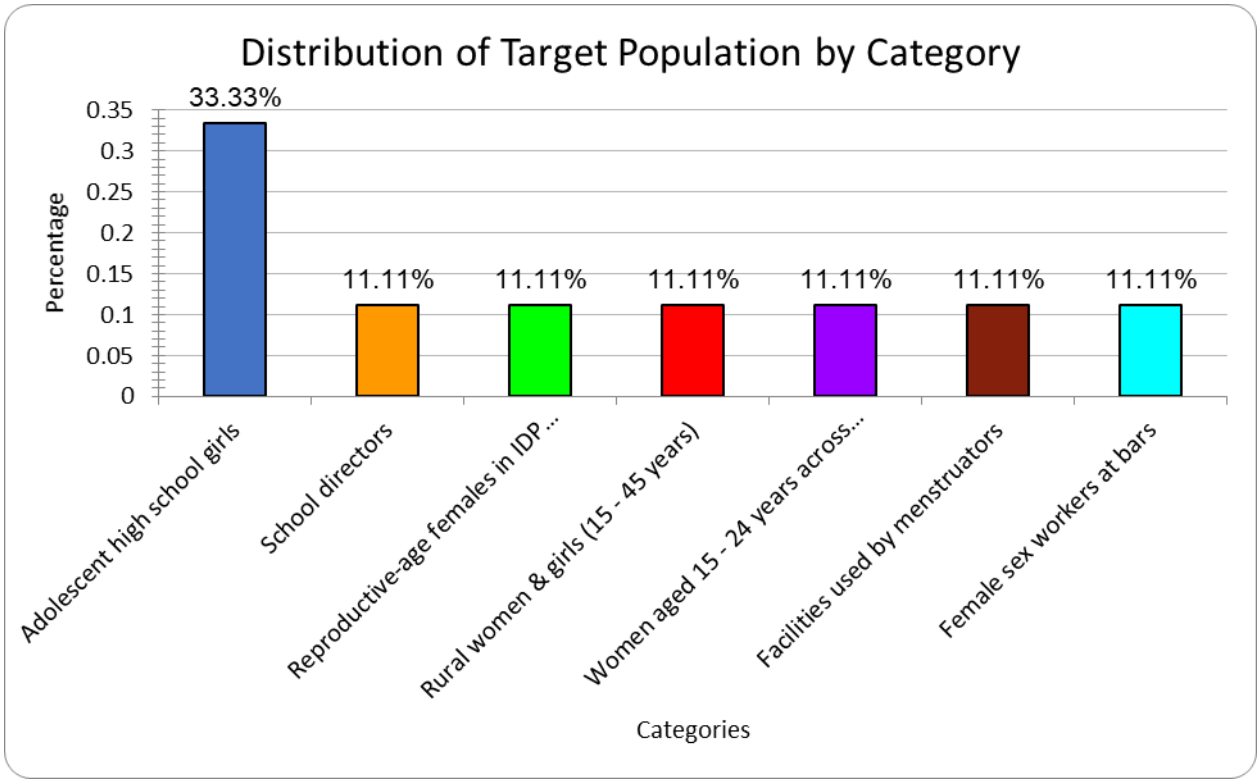
4.1.4 Theories Informing Empirical Work

No study explicitly applied a theoretical or conceptual framework (0/23). This indicates an overreliance on descriptive or practice-oriented designs, with limited engagement with frameworks such as the Health Belief Model, Social Ecological Model, or rights-based perspectives.

The absence of theory is a major gap, as it restricts explanatory depth, reduces potential for generalization, and limits guidance for policy.

4.1.5 Target Populations Investigated

The most common target group was adolescent high school girls and school directors (n=14; 60.9%). Other less frequently studied groups included: (1) Reproductive-age women in IDP camps; (2) Female sex workers; (3) Rural women and girls, (4) Women aged 15–24 in India. This suggests a research agenda dominated by school settings, while marginalized and high-vulnerability groups remain underrepresented (<10%).



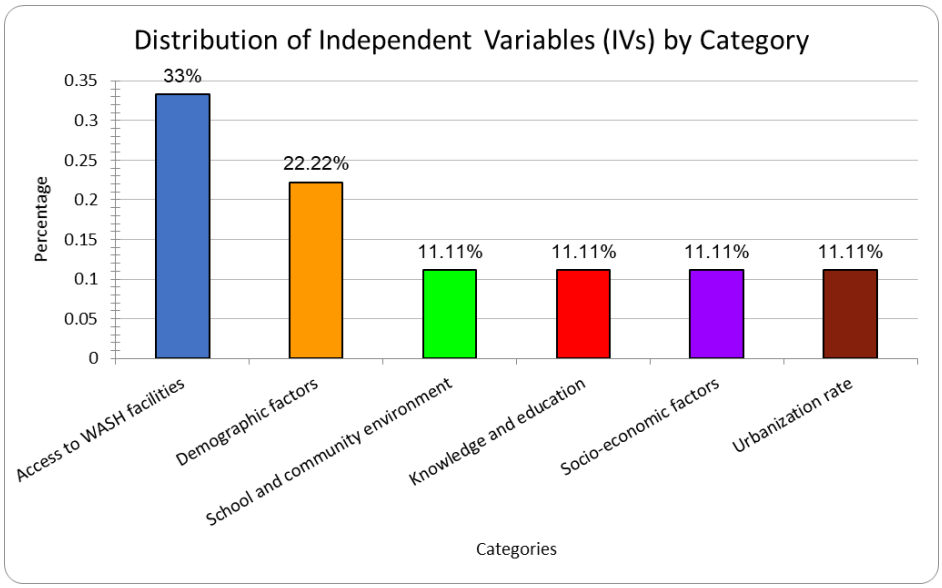
4.1.6. Research Designs

All included studies were cross-sectional (n=23; 100%). Although some variation existed (school-based surveys, observational audits, spatial analyses), the lack of longitudinal or experimental designs restricts causal inference. This reliance on cross-sectional data means associations (e.g., between inadequate WASH facilities and poor MHM) cannot establish temporal or causal relationships.

4.1.7 Independent Variables

The most commonly investigated independent variables were access to WASH facilities (33%), socio-demographics (age, education, SES) (27%), and knowledge/awareness (20%).

While these factors are foundational, other determinants (e.g., stigma, cultural taboos, enabling environments) were understudied. A more balanced agenda is needed to capture the interplay of social, structural, and behavioral factors.



4.18 Mediating Variables

None of the 23 studies examined mediating variables. This means research has remained descriptive and correlational, without unpacking mechanisms.

For instance, hygiene education could mediate the relationship between WASH access and improved MHM, but such pathways were not investigated. This omission limits understanding of "how" and "why" associations exist.

4.1.9 Moderating Variables

Similarly, no studies assessed moderating effects (0/23). This omission means findings were reported as average effects, without exploring variation across subgroups (e.g., rural vs. urban, income groups). Failure to include moderators reduces policy utility, since interventions may work differently across contexts.

4.2 Education and Empowerment and Socio-behavioral and Experiential Aspects of Menstruation

Themes related to educational and empowerment outcomes and socio-behavioral and experiential aspects of menstruation were the second most frequently researched outcomes, each investigated in 5 of the 23 dependent variables (21.7%).

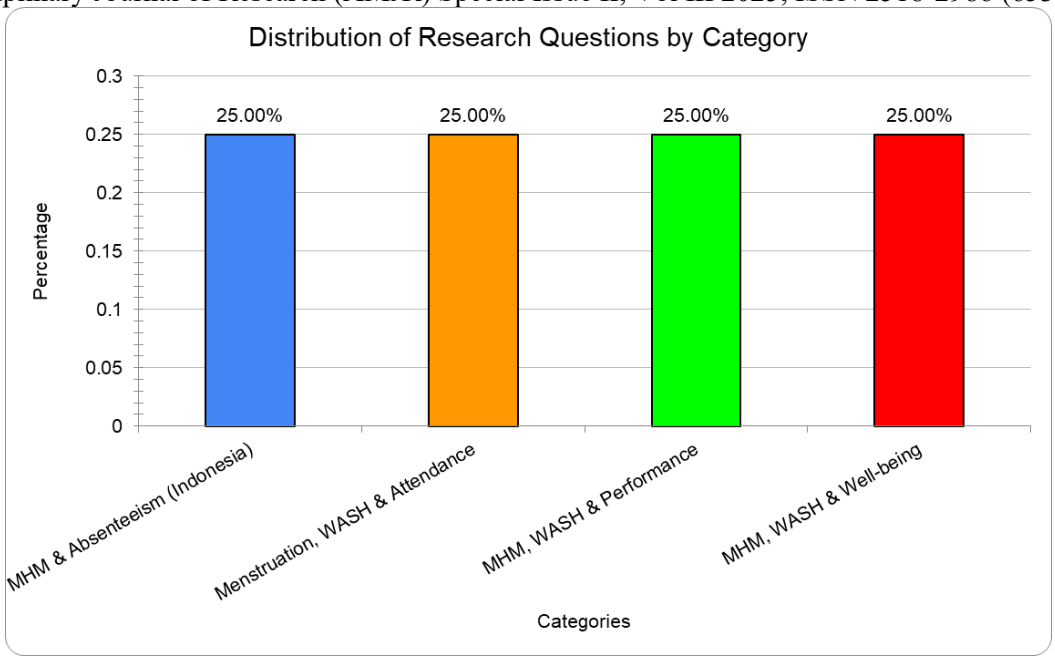
4.2.1 Education and Empowerment Outcomes

Educational and empowerment outcomes constitute a critical dimension of menstrual hygiene management (MHM) research, as they focus on how menstruation impacts individuals' school attendance, classroom participation, self-confidence, and broader empowerment trajectories. This line of inquiry addresses both direct (e.g., absenteeism) and indirect (e.g., reduced engagement, limited social participation, decreased opportunities for development) consequences of menstruation.

Education and empowerment emerged as the second most researched outcome, with studies distributed across Indonesia (Central Java and East Nusa Tenggara) and three Ethiopian contexts (Northwest Ethiopia, unspecified Ethiopian regions, and Lasta district in Amhara). However, three-quarters of the studies (n=3; 75%) originated from Ethiopia, while only one-quarter (n=1; 25%) came from Indonesia. This concentration raises concerns about external validity and generalizability, as outcomes such as school absenteeism or empowerment are socially and contextually embedded.

While Ethiopia offers a diverse research setting (urban–rural differences, ethnic variation, WASH constraints), the geographical skew risks overemphasizing Ethiopia-specific challenges (e.g., climate-induced water scarcity) at the expense of insights from other low- and middle-income countries. Findings may therefore reflect region-specific realities rather than globally transferable lessons.

Four distinct themes were identified: school absenteeism, WASH service availability, school performance, and overall well-being. Each theme accounted for 25% of studies, suggesting breadth but also lack of cumulative evidence-building. The limited number of studies per theme impedes longitudinal synthesis and hinders the formulation of robust, evidence-based policy recommendations.

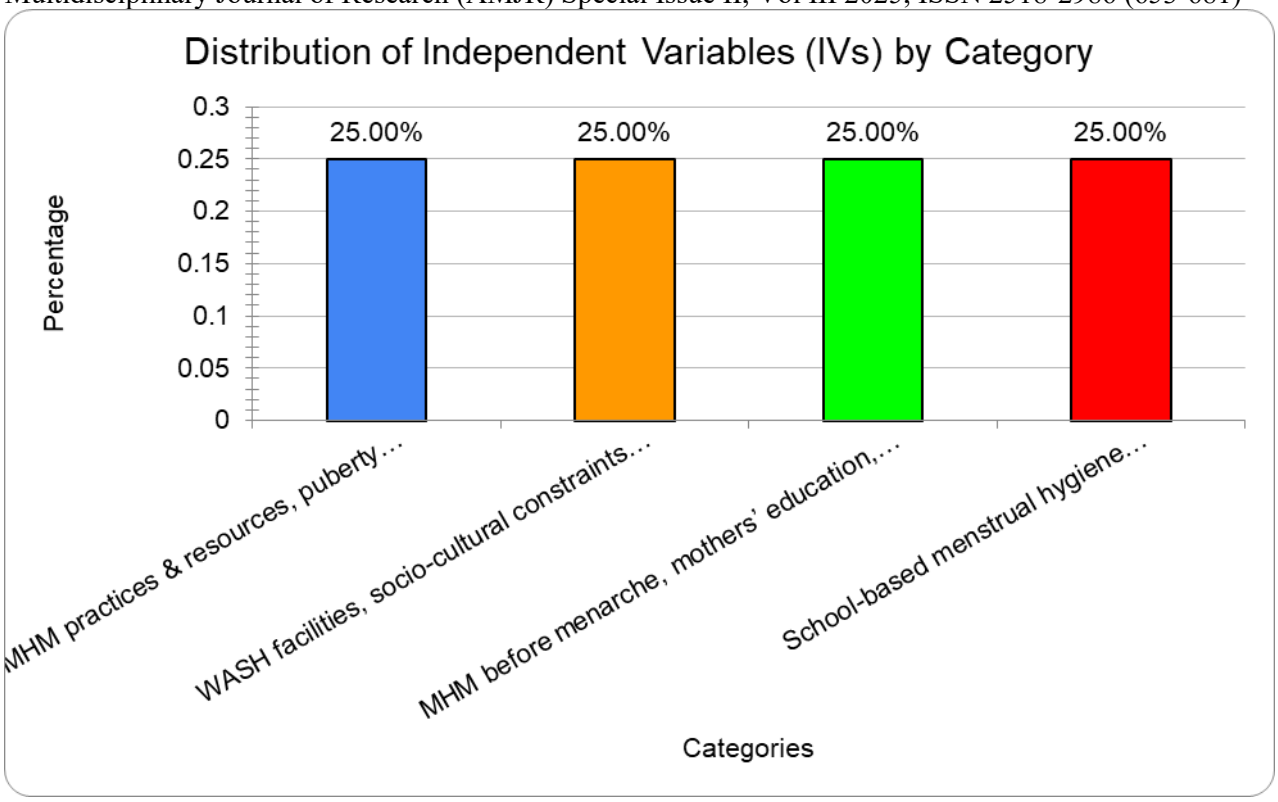


The None of the included studies explicitly employed a theoretical or conceptual framework. (0/5; 100%). This represents a major weakness, as theory-informed approaches (e.g., Social Ecological Model, Health Belief Model) could clarify mediating and moderating mechanisms linking MHM to empowerment outcomes.

Reported categories included adolescent students, schoolgirls, public schoolgirls (~16 years in 37 schools), and menstruating girls, each representing 25% of the dataset. However, these categories overlap conceptually, raising concerns about definitional precision and comparability. The apparent "balanced representation" may mask redundancies rather than indicate genuine diversity.

All studies used cross-sectional designs (n=5; 100%). While cost-effective and descriptive, this reliance limits causal inference and impedes understanding of temporal relationships between MHM and empowerment outcomes. The absence of longitudinal or experimental designs restricts the evidence base for scalable interventions.

Independent variables investigated included MHM resources, socio-cultural influences, maternal education, WASH infrastructure, and targeted interventions. Each accounted for 25% of the studies. While this diversity acknowledges multiple influences, the dispersion prevents accumulation of evidence in any single area, hindering comparability and meta-analysis.



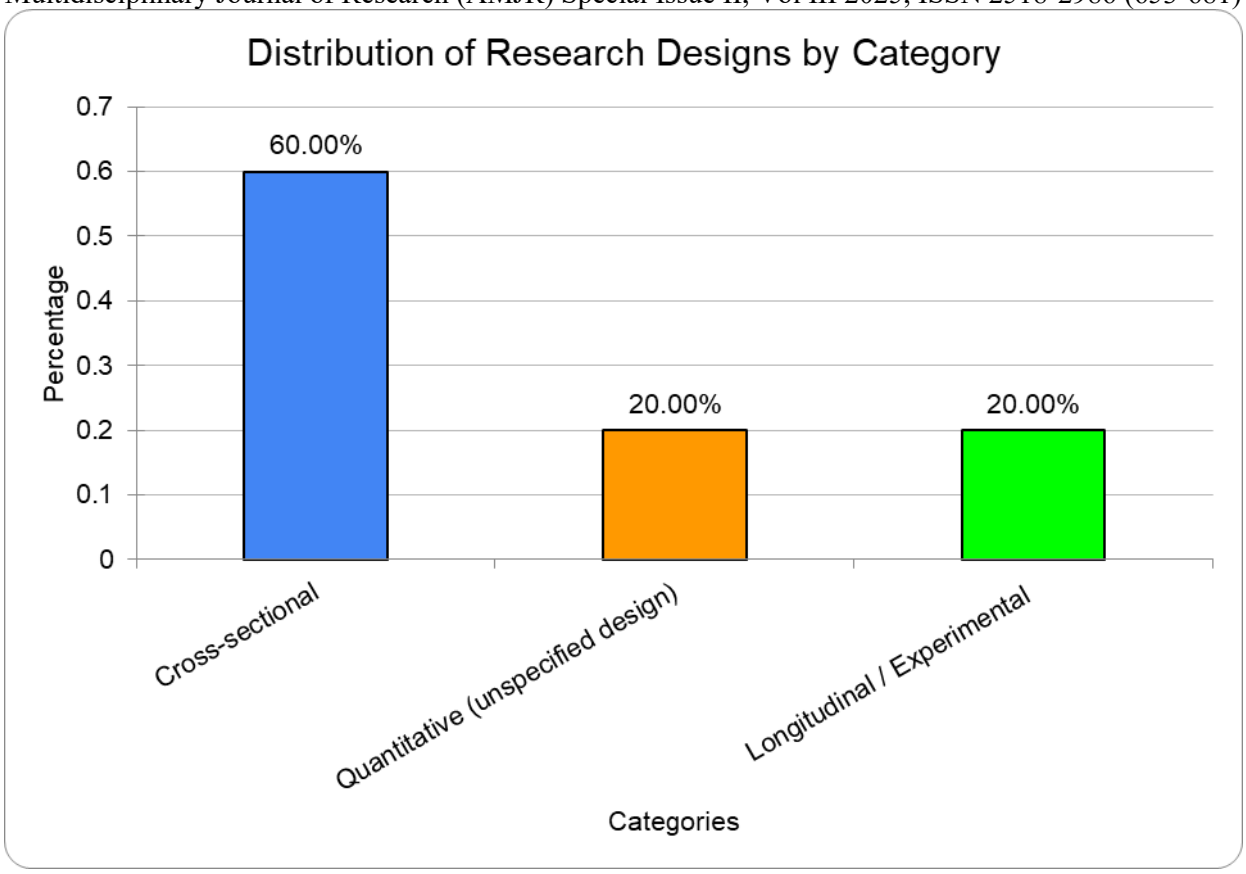
None of the reviewed studies investigated mediating (0/5; 100%) or moderating (0/5; 100%) variables. This omission restricts understanding of mechanisms and subgroup variations, thereby limiting practical guidance for program design.

4.2.2 Socio-behavioral and Experiential Aspects of Menstruation

This theme was also represented by 5 dependent variables (21.7%). The emphasis on MHM practices underscores the field's attention to resource access and behaviors, yet the scarcity of health outcome studies reflects a major evidence gap. Studies were distributed across Nigeria (Kaduna), Bangladesh (Bandarban Hill District), India (Odisha: Bhadrak, Koraput, Balangir), and rural Western Kenya, each contributing 25% of cases. This shows relatively better geographical spread compared with education/empowerment outcomes.

Most studies (60%) examined household sanitation, hygiene location, and personal experience, while others addressed indigenous adolescent girls during seasonal water scarcity (20%) and WASH adequacy in schools (20%). No theoretical frameworks were reported (0/5; 100%). 60% of studies focused on broad female age ranges, while 40% investigated specific vulnerable groups (indigenous adolescents, rural primary schoolgirls).

Contrary to the education/empowerment subset, studies here employed a range of designs (cross-sectional surveys, qualitative inquiries, observational audits), each constituting 20%. This methodological diversity strengthens the evidence base.



Most studies (80%) examined socio-demographic and WASH factors, while 20% assessed intervention effects. None of the studies examined mediators. 60% did not assess moderators, 20% explicitly included age/education/materials, and 20% implied moderators but did not clearly report them.

4. 3 Health outcomes related to menstruation

Health Health outcomes were the least investigated theme, comprising 4 of the 23 dependent variables (17.4%). This category included outcomes such as "presence of urogenital infections," "self-reported reproductive tract infections (RTIs)," "menstrual morbidities," and "MHM practices associated with urogenital infection symptoms." This indicates a paucity of empirical evidence directly linking MHM to measurable health outcomes.

The limited attention to health outcomes may reflect the methodological and ethical challenges inherent in such research. Measuring health effects requires clinical diagnosis, longitudinal follow-up, or the collection of sensitive self-reported data, all of which are prone to recall bias, stigma, or underreporting. In addition, ethical and logistical barriers (e.g., biological sample collection, privacy concerns) complicate data gathering. Finally, the causal pathway between MHM practices and definitive health outcomes is complex, influenced by confounding factors such as sexual activity, general hygiene, healthcare access, and pre-existing conditions.

The four studies were equally distributed across India and Ethiopia (n=2 per country; 25% each by region). Locations included Odisha and North Karnataka (India) and Dessie City and Lasta district, Amhara (Ethiopia). While this suggests balanced representation, the small sample size (n=4) limits external validity. Findings from single-region studies cannot be generalized to entire countries, particularly large and heterogeneous ones such as India.

The included studies addressed four research questions: (1) What is the prevalence of menstrual morbidities and urogenital infections among adolescent girls aged 10-19 years? (2) How do MHM practices influence the risk of urogenital infections? (3) What is the association between WASH access and the prevalence of self-reported RTIs? And (4) To what extent do MHM education and WASH facilities enhance well-being? These questions emphasize the centrality of WASH as the primary independent variable. However, equal weighting of other determinants such as knowledge, education, and socio-economic factors (11.1% each) risks underestimating their role. For example, access to facilities alone is insufficient if users lack knowledge or face socio-cultural barriers.

None of the studies employed a theoretical or conceptual framework (0/4; 100%). This absence reduces explanatory power and limits the ability to connect findings to established models of health behavior (e.g., Health Belief Model, Social Ecological Model). Consequently, studies remain descriptive and correlational, identifying associations without explaining mechanisms or informing intervention design.

Target groups included adult women in Odisha (India), women in urban Dessie City (Ethiopia), adolescent schoolgirls in North Karnataka (India), and menstruating girls in Lasta district (Ethiopia). This distribution appears balanced but, given the small number of studies, the categories are too narrow to support strong cross-context conclusions.

All studies focused on a combined construct of "MHM practices, WASH access, and sociodemographic factors" (4/4; 100%). This integrated approach is valuable, as it recognizes interdependencies, but it also suggests limited exploration of other potential determinants such as cultural taboos, health system factors, or intervention effects.

6.0 Discussion

5.0 Introduction

This study sought to systematically synthesize quantitative evidence on menstrual hygiene management (MHM) and menstrual health (MH), with a particular focus on mapping the range and distribution of dependent variables examined in relation to access to water, sanitation, and hygiene (WASH) conditions. The review aimed not only to consolidate fragmented empirical findings but also to identify structural gaps in the literature that constrain evidence-informed policy and intervention design. The findings reveal a field that is heavily concentrated on observable and measurable aspects

of MHM, particularly hygiene practices and adequacy, while comparatively less attention is given to health outcomes, socio-behavioral dimensions, and empowerment-related effects. Furthermore, the evidence base is characterized by methodological homogeneity, notably the dominance of cross-sectional designs, and a near-total absence of explicit theoretical frameworks, mediating pathways, and moderating influences. These patterns suggest that while the literature provides valuable descriptive insights into menstrual practices and their correlates, it remains limited in its capacity to explain causal mechanisms or to generate context-sensitive and scalable interventions.

5.1 Dominance of MHM Practices

The predominance of menstrual hygiene management practices and adequacy within the reviewed literature aligns closely with existing global research trends, which have historically emphasized measurable, behavior-oriented indicators such as the type of absorbents used, frequency of changing materials, access to soap and water, and availability of sanitation facilities (Hennegan & Montgomery, 2016; UNICEF, 2019). This focus reflects both practical and methodological considerations, as such variables are relatively efficient to quantify through survey-based instruments and are directly linked to WASH infrastructure, which remains a central pillar of international development agendas, particularly under the Sustainable Development Goals (SDGs) (World Health Organization, 2018; UNICEF, 2019). Moreover, the prioritization of MHM practices is consistent with programmatic interventions that have largely centered on improving access to sanitary products and enhancing school-based WASH facilities, thereby reinforcing a feedback loop between research, policy, and implementation (Phillips-Howard & Caruso, 2018).

However, while this alignment underscores the relevance of existing research to policy priorities, it simultaneously reveals a critical limitation in the scope of inquiry. The disproportionate emphasis on observable practices risks reducing menstrual health to a set of technical and behavioral indicators, thereby obscuring its broader social, psychological, and health-related dimensions. As noted by Hennegan and Montgomery (2016), menstruation is not merely a matter of hygiene management but is deeply embedded in socio-cultural norms, gendered power relations, and individual lived experiences. By privileging what is easily measurable, the literature inadvertently marginalizes less tangible yet equally consequential outcomes, such as stigma, emotional distress, social exclusion, and long-term health effects. This imbalance is further reinforced by the absence of theoretical frameworks in the reviewed studies, which limits the capacity to conceptualize MHM as a multidimensional construct shaped by interacting structural and behavioral factors.

Critically, this narrow focus also constrains the development of comprehensive interventions. While improvements in WASH infrastructure and access to menstrual products are undoubtedly necessary, they are insufficient in isolation to address the complex realities faced by women and girls. Empirical evidence has demonstrated that even in contexts where facilities are available, socio-cultural barriers,

such as taboos, misinformation, and gender norms, continue to inhibit effective menstrual management (Jewitt & Ryley, 2014; Benshaul-Tolonen et al., 2020). Therefore, the dominance of MHM practices within the literature, while methodologically convenient and policy-relevant, reflects an underlying tendency toward what may be termed "infrastructural reductionism," wherein complex social phenomena are interpreted primarily through the lens of physical resources. Addressing this limitation requires a deliberate shift toward more integrative research frameworks that capture the interplay between material conditions, social contexts, and individual agency.

5.2 Limited Focus on Health Outcomes

Despite the centrality of health within the broader discourse on menstrual hygiene management, the review reveals a striking underrepresentation of studies examining direct health outcomes, such as reproductive tract infections (RTIs), urogenital infections, and menstrual morbidities. This finding stands in contrast to a substantial body of literature that posits a strong association between inadequate menstrual hygiene practices and adverse health conditions (Hennegan & Montgomery, 2016; Phillips-Howard & Caruso, 2018). International organizations, including the World Health Organization, have consistently highlighted the potential health risks associated with poor MHM, particularly in low-resource settings where access to clean water and sanitation is limited (World Health Organization, 2018). However, the empirical evidence supporting these claims remains comparatively weak and fragmented, as reflected in the small proportion of studies that directly measure health outcomes within the reviewed sample.

This discrepancy between widely accepted assumptions and limited empirical validation can be attributed to several methodological and ethical challenges inherent in studying menstrual health outcomes. First, the accurate measurement of conditions such as RTIs and urogenital infections often requires clinical diagnosis or laboratory testing, which may be logistically complex and resource-intensive, particularly in low-income settings. Second, reliance on self-reported data introduces the risk of recall bias and underreporting, especially given the stigma and sensitivity surrounding menstruation and reproductive health (Jewitt & Ryley, 2014). Third, establishing causal relationships between MHM practices and health outcomes is complicated by the presence of multiple confounding factors, including sexual behavior, general hygiene practices, access to healthcare, and pre-existing health conditions. These complexities are difficult to disentangle within the predominantly cross-sectional designs employed in existing studies, which further limits the ability to draw robust causal inferences.

The implications of this evidence gap are significant for both research and policy. Without strong, causally robust evidence linking MHM practices to specific health outcomes, policy interventions may be based on assumptions rather than empirically validated pathways. This not only weakens the scientific foundation of menstrual health initiatives but also limits the ability to prioritize interventions

based on their demonstrated impact on health. As noted by McMichael (2019), effective WASH interventions require a clear understanding of how infrastructural improvements translate into health benefits, a linkage that remains insufficiently explored in the context of menstrual hygiene. Consequently, there is an urgent need for more rigorous, theory-informed, and longitudinal research designs that can capture the complex and dynamic relationships between MHM practices, WASH conditions, and health outcomes. Strengthening this evidence base is essential for advancing menstrual health as a credible and actionable public health priority, rather than a domain characterized by well-intentioned but empirically under-supported claims.

5.3 Socio-Behavioral and Empowerment Outcomes

The findings of this review indicate that socio-behavioral and empowerment-related outcomes constitute an important, albeit comparatively underdeveloped, domain within the MHM literature, with evidence pointing to significant impacts of menstruation on school attendance, classroom participation, psychosocial well-being, and broader dimensions of agency and self-confidence. This aligns with a growing body of research demonstrating that menstruation, when inadequately managed, can disrupt educational trajectories through increased absenteeism, reduced concentration, and diminished engagement in school activities (Hennegan & Montgomery, 2016; Phillips-Howard & Caruso, 2018). Empirical studies across Sub-Saharan Africa and South Asia have consistently reported that girls may miss several days of school each month due to lack of adequate WASH facilities, fear of leakage, or menstrual-related stigma, thereby reinforcing gender disparities in educational attainment (Jewitt & Ryley, 2014; UNICEF, 2019). Beyond education, socio-behavioral outcomes such as embarrassment, anxiety, and social withdrawal have been identified as critical yet often overlooked dimensions of menstrual health, shaping how girls and women navigate both private and public spaces during menstruation (Benshaul-Tolonen et al., 2020).

However, despite this recognition, the evidence base remains fragmented, non-cumulative, and geographically skewed, limiting its explanatory depth and generalizability. The reviewed studies tend to examine isolated outcomes, such as absenteeism, self-efficacy, or well-being, without building a coherent body of knowledge that systematically links these dimensions or tracks them over time. This lack of cumulative research is further exacerbated by the predominance of context-specific studies concentrated in a small number of countries, particularly Ethiopia, which, while offering valuable insights into localized dynamics, risks overrepresenting context-bound findings at the expense of broader applicability. As noted by Sommer et al. (2021), the absence of standardized indicators and longitudinal data has hindered the development of a robust evidence base capable of informing large-scale interventions. Moreover, the limited integration of theoretical perspectives means that socio-behavioral outcomes are often reported descriptively rather than analytically, leaving critical questions regarding the mechanisms through which menstruation influences empowerment unresolved.

Consequently, while the literature acknowledges the multidimensional impacts of menstruation, it falls short of providing a cohesive and theoretically grounded understanding of how these effects unfold across different social and cultural contexts.

5.4 Centrality of WASH

The centrality of water, sanitation, and hygiene (WASH) as a determinant of menstrual hygiene management emerges consistently across both the reviewed studies and the broader literature, reinforcing the position of WASH as a foundational component of menstrual health interventions. Access to clean water, private sanitation facilities, and appropriate disposal mechanisms has been widely recognized as essential for enabling safe and dignified menstrual management, particularly in low- and middle-income settings (World Health Organization, 2018; UNICEF, 2019). Empirical evidence demonstrates that inadequate WASH infrastructure, characterized by lack of privacy, insufficient water supply, and absence of disposal systems, directly constrains the ability of girls and women to manage menstruation effectively, often leading to the use of unhygienic materials, increased risk of infection, and withdrawal from school or social activities (Jewitt & Ryley, 2014; Phillips-Howard & Caruso, 2018). In this regard, the findings of the present review are consistent with a well-established body of research that positions WASH as a critical enabling environment for menstrual health.

Nevertheless, while the importance of WASH is unequivocal, the literature reveals a tendency toward over-reliance on infrastructural solutions, often at the expense of addressing the broader socio-cultural and behavioral determinants of menstrual health. This "infrastructural determinism" assumes that improvements in physical facilities will automatically translate into improved MHM outcomes, an assumption that is increasingly challenged by empirical evidence. Studies have shown that even in contexts where WASH facilities are available, factors such as cultural taboos, lack of knowledge, gender norms, and social stigma continue to impede effective menstrual management (Hennegan & Montgomery, 2016; Benshaul-Tolonen et al., 2020). For instance, girls may avoid using school toilets due to fear of being seen or judged, or may lack the knowledge required to utilize available resources effectively, highlighting the limitations of infrastructure-focused interventions. As McMichael (2019) argues, WASH interventions must be understood within a broader socio-ecological framework that accounts for the interplay between physical environments, social norms, and individual behaviors.

In light of these considerations, there is a growing consensus that addressing menstrual health requires integrated, multi-sectoral approaches that go beyond the provision of infrastructure to include comprehensive education, community engagement, and efforts to challenge harmful norms and practices. Such approaches are better aligned with the multidimensional nature of MHM, recognizing that access to resources is a necessary but not sufficient condition for achieving menstrual equity.

By situating WASH within a broader systems perspective, future research and policy can more effectively address the complex and interrelated factors that shape menstrual experiences, thereby enhancing the effectiveness and sustainability of interventions.

5.5 Methodological Limitations

The methodological profile of the reviewed studies reveals significant limitations that constrain the robustness, interpretability, and policy relevance of the existing evidence base. Foremost among these is the overwhelming reliance on cross-sectional research designs, which, while useful for identifying associations and generating descriptive insights, are inherently limited in their capacity to establish causal relationships or to capture temporal dynamics. This dominance of cross-sectional studies is consistent with broader trends in public health research in low-resource settings, where logistical and financial constraints often preclude the use of longitudinal or experimental designs (Hennegan & Montgomery, 2016). However, in the context of MHM, this limitation is particularly consequential, as it prevents the disentanglement of complex causal pathways linking WASH conditions, behavioral practices, and health or educational outcomes. As a result, much of the existing literature is confined to reporting correlations without establishing whether, how, and under what conditions improvements in WASH or MHM practices lead to meaningful changes in outcomes.

Equally significant is the near-total absence of explicit theoretical or conceptual frameworks across the reviewed studies, a finding that underscores a broader epistemological weakness within the field. The lack of engagement with established models such as the Health Belief Model or the Social Ecological Model limits the ability of researchers to move beyond descriptive analysis toward explanatory and predictive understanding. Theoretical frameworks are essential for identifying key constructs, specifying relationships between variables, and guiding the interpretation of findings within a coherent analytical structure. Their absence not only reduces the explanatory depth of individual studies but also hinders the accumulation of knowledge across studies, as findings are not anchored within a shared conceptual foundation (Sommer et al., 2021).

Furthermore, the complete omission of mediating and moderating variables represents a critical gap in the analytical sophistication of the literature. Mediators are necessary for elucidating the mechanisms through which independent variables exert their effects on outcomes, while moderators are essential for identifying variation in these effects across different populations and contexts. Without these analytical components, studies are unable to answer fundamental questions regarding how and for whom interventions work, thereby limiting their practical applicability. For example, while access to WASH facilities may be associated with improved MHM practices, the pathways through which this occurs, such as increased knowledge, reduced stigma, or enhanced privacy, remain unexplored. Similarly, the effectiveness of such interventions may vary significantly across socio-economic, cultural, or geographic contexts, yet these variations are rarely examined. Collectively,

these methodological limitations contribute to an evidence base that is descriptively informative but analytically shallow, underscoring the need for more rigorous, theory-driven, and methodologically diverse research approaches.

5.6 Population and Geographic Bias

The distribution of study populations and geographic contexts within the reviewed literature reveals a pronounced bias toward school-based samples and a limited number of countries, raising important concerns regarding the representativeness and equity relevance of existing research. The predominance of adolescent schoolgirls as the primary study population reflects both the accessibility of school settings for data collection and the policy emphasis on education as a key domain of intervention (UNICEF, 2019). While this focus has generated valuable insights into the challenges faced by school-going girls, it has also resulted in the relative neglect of other populations who may experience equal or greater vulnerability, including out-of-school adolescents, adult women, individuals in informal settlements, and marginalized groups such as those in internally displaced persons (IDP) camps or engaged in informal or stigmatized occupations.

This imbalance is further compounded by geographic concentration, with a significant proportion of studies conducted in a small number of countries, particularly India and Ethiopia. While these contexts provide important case studies, their dominance within the literature raises questions about the generalizability of findings to other settings with different socio-cultural, economic, and infrastructural conditions. As highlighted by Phillips-Howard and Caruso (2018), menstrual experiences are highly context-dependent, shaped by local norms, environmental conditions, and institutional arrangements. Consequently, an evidence base that is geographically narrow risks producing conclusions that are not transferable across diverse contexts, thereby limiting its utility for global policy formulation.

From an equity perspective, the underrepresentation of marginalized and high-risk populations is particularly concerning. These groups often face intersecting vulnerabilities, including poverty, limited access to services, social exclusion, and heightened exposure to stigma, all of which can exacerbate the challenges associated with menstrual management (Amnesty International, 2019). The failure to adequately capture their experiences not only perpetuates gaps in knowledge but also risks reinforcing inequities in policy and practice, as interventions are designed based on incomplete or unrepresentative evidence. Addressing this limitation requires a deliberate reorientation of research priorities toward more inclusive and context-sensitive approaches, ensuring that the voices and experiences of the most vulnerable are systematically incorporated into the evidence base. In doing so, future research can better support the development of equitable and effective menstrual health interventions that are responsive to the diverse realities of women and girls globally.

5.7 Reconceptualizing Menstrual Hygiene Management (MHM)

The findings of this review underscore the need to reconceptualize menstrual hygiene management as a fundamentally multi-dimensional phenomenon that extends beyond the narrow confines of hygiene practices and infrastructural provision. While access to WASH facilities remains a critical enabling condition, the evidence consistently demonstrates that menstrual experiences are shaped by a complex interplay of social norms, economic constraints, cultural beliefs, educational access, and institutional environments. This perspective aligns with broader scholarship that situates menstruation within intersecting systems of gender, health, and development, emphasizing that effective menstrual management cannot be reduced to the availability of sanitary products or physical infrastructure alone (Hennegan & Montgomery, 2016; Phillips-Howard & Caruso, 2018). Rather, MHM must be understood as embedded within a socio-ecological system in which individual behaviors are influenced by interpersonal relationships, community norms, structural inequalities, and policy frameworks.

The prevailing orientation of many interventions toward product-based solutions, such as the distribution of sanitary pads, reflects a tendency to frame menstrual challenges as primarily material deficits. While such interventions are important in addressing immediate needs, they are insufficient in isolation to produce sustainable improvements in menstrual health outcomes. Empirical evidence indicates that even where products and facilities are available, socio-cultural barriers, including stigma, misinformation, and restrictive gender norms, continue to constrain effective use and limit participation in daily activities (Jewitt & Ryley, 2014; Benshaul-Tolonen et al., 2020). This highlights the necessity of shifting toward a systems-based understanding of MHM, one that integrates material, social, behavioral, and institutional dimensions. Such a reconceptualization not only enhances analytical clarity but also provides a more robust foundation for designing interventions that are responsive to the lived realities of women and girls across diverse contexts.

5.8 Policy and Practice Implications

The limitations identified within the existing evidence base have significant implications for the design and implementation of menstrual health policies and programs. Current interventions, which are often centered on the provision of sanitary products and the improvement of WASH infrastructure, reflect the dominant focus of the literature on measurable and tangible aspects of MHM. While these approaches address critical barriers, their effectiveness is frequently constrained by a lack of attention to the broader socio-cultural and behavioral factors that shape menstrual experiences. As highlighted in prior research, interventions that fail to engage with issues such as stigma, gender norms, and knowledge gaps are unlikely to achieve sustained impact, even in contexts where physical resources are available (UNICEF, 2019; Sommer et al., 2021).

Furthermore, the absence of context-specific evidence limits the ability of policymakers to tailor interventions to the diverse needs of different populations. One-size-fits-all approaches, often derived

from evidence generated in a narrow set of geographic contexts, risk overlooking important variations in cultural practices, environmental conditions, and institutional capacities. This is particularly problematic in low- and middle-income countries, where heterogeneity within and across communities is substantial. As McMichael (2019) argues, effective WASH and health interventions require a nuanced understanding of local contexts, including the social and environmental determinants of behavior. Consequently, there is a pressing need for integrated, multi-sectoral strategies that combine infrastructure development with education, community engagement, and efforts to challenge harmful norms. Such approaches are more likely to address the root causes of menstrual inequities and to promote sustainable improvements in health, education, and well-being.

5.9 Future Research Directions

The findings of this review point to several critical priorities for advancing the field of menstrual hygiene management research. Foremost among these is the need for greater methodological diversity, particularly the adoption of longitudinal and experimental study designs that can establish causal relationships and capture changes over time. Cross-sectional studies, while valuable for descriptive purposes, are insufficient for understanding the dynamic and multifaceted nature of menstrual health, especially in relation to interventions and long-term outcomes. Longitudinal research would enable the examination of how improvements in WASH infrastructure, education, or policy translate into sustained changes in behavior, health, and empowerment, thereby providing a stronger evidence base for decision-making (Hennegan & Montgomery, 2016).

Equally important is the integration of theoretical frameworks into empirical research. The application of models such as the Health Belief Model or the Social Ecological Model can enhance the explanatory power of studies by clarifying the mechanisms through which various determinants influence menstrual outcomes. This is closely linked to the need to incorporate mediating and moderating variables into analytical frameworks, thereby moving beyond simple associations to a more nuanced understanding of causal pathways and contextual variation. For instance, future studies could examine how knowledge, attitudes, or social support mediate the relationship between WASH access and MHM practices, or how factors such as socio-economic status or geographic location moderate these relationships.

In addition, there is a critical need to expand the scope of research to include marginalized and underrepresented populations. Current evidence is heavily skewed toward school-based samples, leaving significant gaps in understanding the experiences of out-of-school girls, adult women, individuals in informal settlements, and other vulnerable groups. Addressing these gaps is essential for ensuring that research findings are both inclusive and relevant to those most in need of intervention. Finally, greater geographic diversity in research is necessary to enhance the generalizability of findings and to capture the wide range of cultural and environmental contexts in which menstrual

health is experienced. Collectively, these priorities highlight the need for a more rigorous, theory-driven, and inclusive research agenda that can support the development of effective and equitable menstrual health interventions.

5.10 Strengths and Limitations of the Review

This review possesses several notable strengths that enhance its contribution to the field of menstrual hygiene management research. The use of a systematic review methodology, guided by PRISMA standards, ensures a transparent and replicable process for identifying, screening, and synthesizing relevant studies. By focusing specifically on quantitative and mixed-methods research with inferential statistical analysis, the review provides a structured and rigorous assessment of the empirical evidence, enabling the identification of patterns and gaps in the types of outcomes investigated. Additionally, the categorization of dependent variables into thematic domains, MHM practices, socio-behavioral outcomes, educational and empowerment outcomes, and health outcomes, offers a comprehensive framework for understanding the scope of existing research and for highlighting areas of imbalance.

However, the review is not without limitations. The restriction to English-language publications may have resulted in the exclusion of relevant studies conducted in other languages, thereby introducing potential language bias. The relatively small number of included studies further limits the ability to draw broad generalizations, particularly in relation to underrepresented outcomes such as health effects. Moreover, the geographic concentration of studies in a limited number of countries, notably India and Ethiopia, raises concerns regarding the external validity of the findings. These limitations reflect broader constraints within the existing literature and underscore the need for more diverse and inclusive research efforts. Despite these challenges, the review provides valuable insights into the current state of MHM research and identifies critical areas for future investigation.

5.11 Conclusion

In conclusion, this review highlights a field that, while expanding in scope and visibility, remains characterized by significant conceptual, methodological, and empirical limitations. The existing evidence base is heavily skewed toward measurable aspects of menstrual hygiene practices and WASH infrastructure, with comparatively limited attention to health outcomes, socio-behavioral dynamics, and empowerment processes. This imbalance is compounded by the dominance of cross-sectional study designs, the absence of theoretical frameworks, and the lack of analytical attention to mediating and moderating mechanisms, all of which constrain the ability to generate robust and actionable insights. Furthermore, the concentration of research within specific populations and geographic contexts limits the generalizability and equity relevance of findings, raising important questions about whose experiences are represented within the evidence base.

Addressing these limitations requires a fundamental shift in how menstrual hygiene management is conceptualized and studied. Future research must move toward more theory-informed,

methodologically rigorous, and inclusive approaches that capture the complexity of menstrual health as a multidimensional and context-dependent phenomenon. By strengthening the empirical and analytical foundations of the field, such efforts can better inform the design of policies and interventions that are not only effective but also equitable and responsive to the diverse needs of women and girls. In doing so, menstrual health can be more fully integrated into broader agendas of public health, education, and gender equality, contributing to the realization of sustainable and inclusive development goals.

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