学 位 論 文

Socio-cultural and Water, Sanitation, and Hygiene Factors Affecting Menstrual Health and Hygiene Among Nursing Students in Bangladesh
（社会文化、水・サニテーション・衛生が
バングラデシュにおける看護学生の月経保健衛生に及ぼす影響）

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ABSTRACT

Menstrual Health and Hygiene (MHH) is essential for women's health, dignity, education, and economic participation. However, many knowledge and support gaps still exist across different stages of women's lives. Adult women in workplaces and young women training to become health professionals often face significant MHH challenges. In Bangladesh, these issues are especially serious among nursing and midwifery students. Although global attention mostly focuses on adolescent girls, much less is known about the menstrual experiences of adult women and health-professional students. To address these gaps, this thesis had five goals. First, it reviewed global evidence on MHH challenges for adult women. Second, it examined how parents' education levels, embarrassment around menstruation, and the sanitation facilities affected menstrual product choices. Third, it explored menstrual information, product access, and disposal problems that lead to period poverty. Fourth, it identified gendered barriers through mixed-methods research on menstrual knowledge, product access, and Water, Sanitation and Hygiene (WASH) conditions. Fifth, it tested a participatory education program to improve menstrual Knowledge, Attitudes, and Practices (KAP). Together, these studies show the key factors, emotional burdens, and inequalities that shape MHH for nursing students in Bangladesh.

Five complementary methodological approaches were implemented. First, a narrative review of 205 publications (2015–2024) was conducted using systematic database searches and thematic analysis. Second, a cross-sectional questionnaire survey of 366 female nursing students from seven government nursing colleges across three

regions of Bangladesh used structured instruments and multivariable logistic regression. Third, a qualitative study with 35 female nursing students employed thematic analysis of focus group discussions and in-depth interviews. Fourth, a convergent mixed-methods study combined a quantitative survey of 370 female nursing students with six focus group discussions involving 21 male and 21 female students, applying multivariable logistic regression and thematic analysis. Fifth, a quasi-experimental pre–post six-month intervention study among 384 students (192 intervention, 192 control) evaluated a four-week participatory educational program adapted from WaterAid's training guide. Data were collected using validated KAP tools, and paired and independent t-tests assessed changes in KAP. Across all studies, ethical approval and informed consent procedures were ensured, with statistical significance set at $P < 0.05$.

The five studies reveal interconnected structural, social, economic, and gendered barriers to MHH at individual, institutional, and national levels. The narrative review, demonstrated persistent global gaps in knowledge, stigmatizing norms, unaffordable menstrual products, and inadequate WASH infrastructure throughout adulthood, notably within workplaces where inadequate privacy and disposal facilities in bathrooms contribute to absenteeism**.** The cross-sectional study, found that parental education levels, particularly maternal and paternal schooling, significantly influenced product choices, with lower parental education, embarrassment in purchasing pads, and poor bathroom privacy strongly predicting the use of unhygienic materials such as old cloths (AOR range 2.86–2.92). The qualitative inquiry, highlighted fear and confusion during menarche, persistent embarrassment in purchasing menstrual products, economic barriers, and widespread dissatisfaction with disposal facilities in educational institutions and outside home. Students reported hiding materials, restricting mobility, and experiencing emotional distress due to stigma and lack of supportive information. The

mixed-methods study, revealed significant disparities in MHH indicators by income level, maternal education, program level, and rural–urban background. Qualitative insights underscored gender-sensitive issues: male students expressed both limited awareness and empathy, while female students described ongoing shame, discomfort, and the burden of managing menstruation in inadequate WASH settings. The educational intervention, demonstrated substantial improvements among intervention participants: menstrual knowledge increased, attitudes shifted toward normalization of menstruation, and hygienic practices including pad use, timely product changes, and handwashing improved significantly. Overall, findings from this thesis both confirm international patterns and provide novel insights into the experiences of nursing students a group crucial to future healthcare delivery.

MHH is a multidimensional issue shaped by knowledge gaps, gendered social norms, economic inequalities, and systemic infrastructural deficiencies. Adult women in workplaces and young women in nursing colleges face overlapping challenges rooted in stigma, limited autonomy, and insufficient institutional support. The quantitative findings demonstrate the influence of socio-demographic determinants, especially parental education levels, embarrassment on product purchase, and sanitation facilities affects menstrual products such as single use pads and old clothes. The qualitative data illuminate lived experiences of menstrual shame, secrecy, and inadequate WASH infrastructure. Mixed-methods findings also highlights emotional burdens, gendered norms, and limited awareness. The educational intervention demonstrates that even within resource-constrained environments, structured, participatory learning can significantly strengthen menstrual knowledge, reduce stigma, and promote hygienic practices, reinforcing the cognitive–affective–behavioral model of learning. Integrating MHH into nursing curricula is essential not only for students' well-being but also for

preparing future health professionals who will educate communities, advocate for menstrual dignity, and contribute to gender-equitable health systems. Collectively, this thesis advances evidence-based recommendations for improving MHH through policy reform, parental and community engagement, infrastructure investment, and integration of MHH into health professional education.

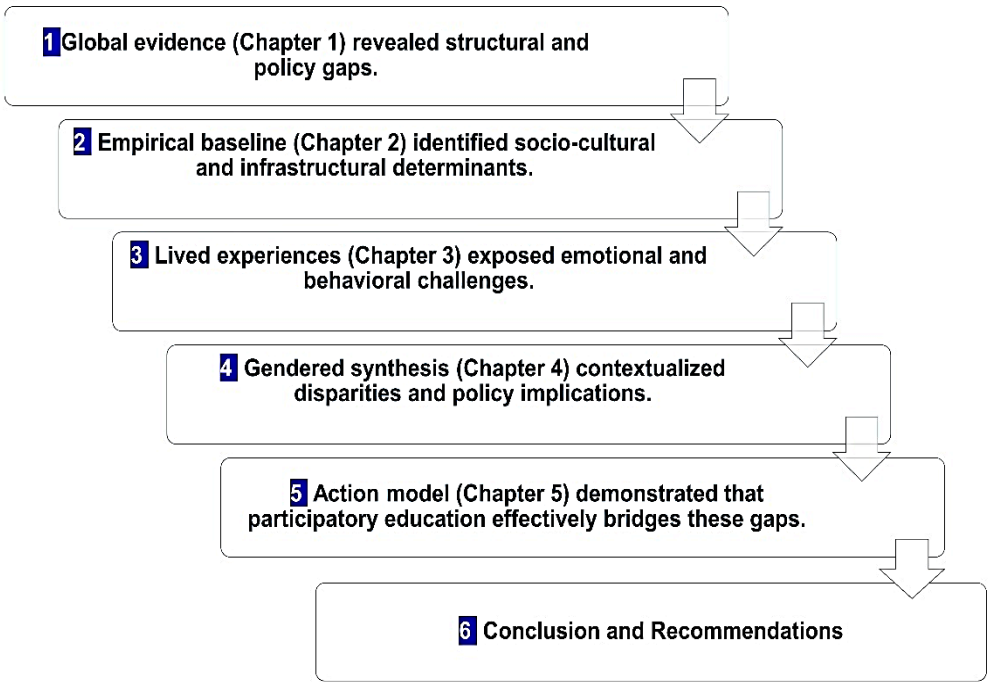
PREFACE

Menstrual Health and Hygiene (MHH) is a fundamental yet historically neglected aspect of women's health, particularly in low- and middle-income countries such as Bangladesh. As a nurse and young researcher working closely with nursing and midwifery students, I have witnessed firsthand how misinformation, stigma, infrastructural challenges, and gendered social norms continue to shape menstrual experiences in ways that compromise dignity, well-being, educational progress, and professional development. These observations, drawn from more than a decade of nursing and midwifery practice and academic engagement, inspired the work presented in this thesis. In this study, "nursing students" refers to both nursing and midwifery students.

My motivation to undertake this research grew from repeated encounters with students who struggled not because of illness but because of avoidable MHH challenges—limited access to appropriate products, inadequate WASH facilities in institutions, embarrassment in the presence of male colleagues, and a persistent culture of silence surrounding menstruation. The lack of structured MHH education within nursing and midwifery curricula further reinforced my commitment to explore this issue deeply. Nursing and midwifery students are not only learners but also future frontline providers and educators who can guide communities in matters of reproductive, maternal, and adolescent health. Ensuring their comprehensive MHH literacy is therefore essential for both personal empowerment and the enhancement of the nursing and midwifery profession in Bangladesh.

Conducting multi-site research in Bangladesh over several years required significant coordination, perseverance, and sensitivity. The study was conducted in four districts: Dhaka, Rajshahi, Naogaon, and Satkhira across three regions of Bangladesh: Dhaka, Rajshahi, and Khulna. We selected these three regions, including the capital city, to represent diverse social, cultural, and economic backgrounds. This work involved surveying and interviewing students across 07 (seven) government nursing colleges among these regions, collaborating with academic and institutional authorities, and navigating the ethical responsibilities inherent in research on menstruation—a topic still considered culturally sensitive. My professional background as a Registered Nurse provided access, trust, and contextual understanding, while my academic training guided rigorous methodology, reflexivity, and critical analysis. Ethical approval was obtained from relevant authorities in Japan and Bangladesh, and all participants contributed voluntarily with informed consent, ensuring respect, confidentiality, and empowerment throughout the research process.

Integrated Linkage Summary (Chapter 1 → 6)



quantitative analysis, qualitative exploration, mixed-methods inquiry, and an educational intervention—to provide a multidimensional understanding of MHH among nursing students. Chapter 1 presents a narrative review of MHH challenges encountered by adult women across the life course, including workplace barriers, psychosocial dimensions, and global WASH inequities. This review lays the conceptual foundation for the empirical chapters that follow. Chapter 2, based on quantitative analysis, investigates how parental education levels, embarrassment, sanitation facilities, and socio-demographic characteristics shape menstrual product choices among female nursing students. Chapter 3 provides a qualitative exploration of urban nursing students' experiences of period poverty, focusing on menstrual information, product access, and disposal challenges. Chapter 4 integrates both quantitative and qualitative data to examine gendered barriers to MHH, emphasizing knowledge gaps, economic constraints, and institutional WASH limitations. Finally, Chapter 5 presents a participatory educational intervention designed to improve MHH Knowledge, Attitudes, and Practices (KAP), demonstrating how structured learning can empower students and position them as advocates for MHH within academic and clinical settings. The thesis concludes with an overall synthesis of findings, limitations, new insights, and recommendations for policy and education reform.

This thesis contributes new knowledge to the field of MHH in several important ways. It is among the first comprehensive bodies of work focusing specifically on nursing and midwifery students in Bangladesh—a demographic uniquely positioned at the intersection of personal menstrual experience and future professional responsibility. The research highlights the multifaceted nature of menstrual challenges, from socio-economic constraints and cultural stigma to infrastructural barriers and gaps in formal education. Notably, the participatory intervention study provides evidence of how

structured, context-appropriate educational programs can significantly enhance students' KAP, potentially shaping the next generation of healthcare providers. These findings have direct implications for curriculum reform, institutional WASH planning, and national-level strategies aimed at advancing MHH equity.

While the detailed acknowledgements are provided in a later section, I would like to briefly express my gratitude here to the students who generously shared their experiences, to the faculty and administrators who supported the fieldwork, and my supervisors at Hokkaido University whose guidance shaped every step of this journey. Their trust and encouragement sustained this work through its many challenges and achievements.

I hope that this thesis will contribute to improving MHH research, policy, and practice within Bangladesh and beyond, and that it will serve as a resource for educators, policymakers, and researchers dedicated to gender equity, WASH improvement, and strengthening nursing education.

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List of Abbreviations

Abbreviation	Full form
AJOL	Africa Journals Online
Ajzen TPB	Ajzen's Theory of Planned Behavior
AOR	Adjusted Odds Ratio
B.Sc.	Bachelor of Science
BDT	Bangladesh Taka
Bloom's Taxonomy	Cognitive, Affective, and Psychomotor Domains
BMI	Body Mass Index
BSc	Bachelor of Science
CBT	Cognitive–Behavioral Theory
CI	Confidence Interval
CINAHL	Cumulative Index to Nursing and Allied Health Literature
COREQ	Consolidated Criteria for Reporting Qualitative Research
DGNM	Directorate General of Nursing and Midwifery
FGD	Focus Group Discussion
FGD(s)	Focus Group Discussion(s)
ICPD	International Conference on Population and Development
IDI(s)	In-Depth Interview(s)
IRIS	Institutional Repository for Information Sharing (WHO)
JMP	Joint Monitoring Programme (WHO/UNICEF)
JMP	JMP Pro – Statistical Software (SAS Institute)
KAP	Knowledge, Attitudes, and Practices
LILACS	Latin American and Caribbean Health Sciences Literature
LMIC(s)	Low- and Middle-Income Country/Countries
LMICs	Low- and Middle-Income Countries

Abbreviation	Full form
MAQ	Menstrual Attitude Questionnaire
MHH	Menstrual Health and Hygiene
MHM	Menstrual Hygiene Management
MPQ	Menstrual Practices Questionnaire
MRM	Menstrual Restrictions and Myths
MSc	Master of Science
NGO	Non-Governmental Organization
NGO(s)	Non-Governmental Organization(s)
NI	Nursing Institute
NIANER	National Institute of Advanced Nursing Education and Research
NMC	Nursing and Midwifery College
Ns	Not Significant
PAS	Proportional Allocation to Size
PRECEDE Model	Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMA-ScR	PRISMA Extension for Scoping Reviews
RCT(s)	Randomized Controlled Trial(s)
SANRA	Scale for the Assessment of Narrative Review Articles
SCT	Social Cognitive Theory (Bandura)
SD	Standard Deviation
SDG	Sustainable Development Goal
SDGs	Sustainable Development Goals
SOP	Standard Operating Procedure
SPSS	Statistical Package for the Social Sciences

Abbreviation	Full form
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
USD	United States Dollar
VAT	Value-Added Tax
WASH	Water, Sanitation, and Hygiene
WHO	World Health Organization
WHO/UNICEF JMP	WHO/UNICEF Joint Monitoring Programme for Water Supply, Sanitation and Hygiene

TABLE OF CONTENTS

CHAPTER 1

Menstrual Health and Hygiene Challenges Among Adult Women in the Workplace Across the Life Course: A Narrative Review

1.1 Abstract

Menstruation is a universal biological process with broad implications for health, education, gender equality, and economic participation. Although global attention to Menstrual Health and Hygiene (MHH) has grown in recent decades, most research and interventions remain centered on adolescent girls in school settings, leaving adult women especially those in workplaces and informal labor sectors underrepresented. This narrative review synthesizes evidence on MHH across the life course, emphasizing adult women and workplace challenges to identify key gaps and policy implications. A narrative review design was adopted due to the heterogeneity of study designs and disciplines engaged in MHH research. A curated corpus of 205 studies (2015–2024) was supplemented with systematic database searches (PubMed, Scopus, Web of Science, CINAHL, PsycINFO) through January 2025. Eligible studies included menstruating women aged ≥20 years and adolescent research informing adult trajectories, covering cross-sectional, qualitative, mixed-methods, intervention, and review designs. Findings were thematically synthesized across seven domains: knowledge, practices, determinants, psychosocial aspects, Water, Sanitation and Hygiene (WASH) infrastructure, interventions, and workplace considerations. Persistent knowledge gaps, stigma, affordability barriers, and inadequate WASH infrastructure were common across

contexts. Workplace studies reported one to two days of absenteeism per month per menstruating individual, primarily due to stigma and poor disposal facilities. The study concludes that significant policy and infrastructural barriers persist, notably in the affordability of menstrual products and the inadequacy of clean, private facilities, necessitating systemic inclusion of menstrual health in government and workplace policies.

Keywords: menstrual health and hygiene; adult women; workplace; WASH; narrative review.

1.2 Introduction

Menstruation is a natural and essential biological process marking reproductive maturity in women and girls. Despite its universality, it continues to be surrounded by silence, stigma, and misinformation across many societies (Hennegan et al., 2021; Sommer et al., 2016). Globally, an estimated 1.9 billion individuals of reproductive age menstruate, yet more than 500 million lack access to adequate facilities, products, and support systems required for safe and dignified Menstrual Hygiene Management (MHM) (UNICEF, 2019). The implications of this neglect extend far beyond individual discomfort, with significant negative consequences for education, workplace participation, health outcomes, and gender equality (Phillips-Howard et al., 2016).

1.2.1 Historical Framing of Menstrual Hygiene

For centuries, menstruation has been constructed through cultural, religious, and gendered lenses. In many contexts, menstrual blood has been associated with impurity, resulting in restrictions on women's participation in religious ceremonies, dietary practices, and social activities (Fitzgerald et al., 1989; Mahon & Fernandes, 2010). Anthropological studies demonstrate that menstrual taboos are deeply entrenched across

both high-income and low- and middle-income countries (LMICs), albeit expressed differently(Crawford et al., 2014). Historically, menstrual hygiene was excluded from public health discourse, overshadowed by maternal and child health priorities (Sumpter & Torondel, 2013). It was not until the early 2000s that Menstrual Health and Hygiene (MHH) gained visibility as a development and education issue, largely due to advocacy linking menstruation with school absenteeism and gender parity in education (Sommer, 2010). More recently, discourse has expanded beyond adolescence to encompass a life-course perspective, recognizing the needs of adult women, marginalized groups, and persons with disabilities (Hennegan et al., 2023).

1.2.2 Global Health and Development Context

Menstrual health is increasingly recognized within the framework of the Sustainable Development Goals (SDGs), as it intersects with multiple dimensions of health, education, gender equality, sanitation, and economic participation (Mohd. Tohit & Haque, 2024). Under SDG 3 (Good Health and Well-being), menstrual health is directly linked to the prevention of reproductive tract infections, improved pain management, and attention to the psychosocial impacts of menstruation such as stress, stigma, and reduced well-being (Das et al., 2015). SDG 4 (Quality Education) highlights how inadequate MHH contributes to school absenteeism, early dropout, and diminished educational attainment, particularly for girls in LMICs (Sommer et al., 2016). Through SDG 5 (Gender Equality), menstruation is framed as a human rights and equity issue, emphasizing the urgent need to dismantle stigma, normalize menstrual discourse, and ensure equitable access to products and facilities (Babbar et al., 2022). SDG 6 (Clean Water and Sanitation) underscores the importance of providing safe, private, and dignified Water, Sanitation, and Hygiene (WASH) facilities, which remain insufficient in many schools, workplaces, and health centers (UNICEF & WHO, 2024). Finally, SDG

8 (Decent Work and Economic Growth) explicitly acknowledges menstruation as a workplace health and productivity concern, as inadequate facilities and limited menstrual product support contribute to absenteeism and reduced economic participation (Shannon et al., 2021). Despite these clear intersections, policy implementation remains inconsistent; many governments and institutions recognize menstrual health rhetorically but fail to embed it into education, health, labor, and WASH frameworks, leaving a critical gap between global advocacy and national practice (Hennegan et al., 2023; House et al., 2013).

1.2.3 Epidemiological Burden

Epidemiological data reveal persistent inequities in menstrual health. In South Asia, nearly half of girls reported being unprepared for menarche, with most learning about menstruation only after its onset (Hennegan et al., 2019). In Sub-Saharan Africa, only 37% of schools had gender-segregated, private toilets with locks (Buitrago-García et al., 2022). In India, approximately 23% of adolescent girls drop out of school after menarche, largely due to stigma, inadequate products, and poor infrastructure (van Eijk et al., 2016). Studies in Nepal, Ethiopia, and Bangladesh similarly report that over one-third of women rely on cloth or improvised materials, often without adequate washing or drying facilities, raising concerns about infections and reproductive tract morbidities (Amatya et al., 2018; Ha & Alam, 2022; Shumie & Mengie, 2022). Data on adult women are scarcer, but available evidence suggests significant workplace absenteeism among women in factories, markets, and informal sectors during menstruation, reflecting both infrastructural deficits and socio-cultural barriers (Hamada et al., 2024; Hennegan & Sol, 2020).

1.2.4 Psychosocial Dimensions of Menstruation

Menstruation is not only a hygienic or biomedical concern but also a deeply psychological and social experience. Studies consistently highlight that menstruation is accompanied by feelings of embarrassment, shame, and secrecy (Chandra-Mouli & Patel, 2017). Girls often hide menstrual products from male family members or peers, while adult women in workplaces avoid discussing their needs with supervisors (Crawford et al., 2014; Mahon & Fernandes, 2010). This culture of silence perpetuates misinformation, with adolescents frequently relying on peers for knowledge, reinforcing myths and misconceptions (Sommer et al., 2016). Among adults, stigma manifests in workplace discrimination, lack of rest accommodations, and limited policy provisions such as menstrual leave or flexible work options (Bobel et al., 2020). Consequently, the psychosocial burden compounds physical challenges, reducing quality of life and well-being.

1.2.5 Workplace and Adult Perspectives

Much of the literature emphasizes adolescent girls, yet adult women's menstrual health needs are equally critical and often overlooked (Hennegan & Sol, 2020). Women in formal employment may have access to better resources but continue to encounter challenges such as inadequate disposal facilities or private toilets. In informal sectors including agriculture, domestic work, and garment industries these barriers are even more acute (Kaur et al., 2018). Adult women must also manage menstruation alongside reproductive responsibilities, caregiving, and work pressures. However, limited research explores how these challenges intersect with productivity, mental health, and economic participation (Kuhlmann et al., 2017). Addressing this gap is crucial to advancing women's empowerment across the life course.

1.2.6 Theoretical and Rights-Based Perspectives

Recent scholarship increasingly frames menstruation as both a rights-based and gendered issue, moving beyond biomedical or hygienic perspectives to encompass broader questions of equity, justice, and social inclusion. From a human rights framework**,** access to safe, affordable, and culturally acceptable menstrual products, along with adequate WASH facilities, is understood as integral to the realization of fundamental rights to health, water, sanitation, education, and human dignity (Hennegan et al., 2021). The intersectionality framework emphasizes that menstrual experiences are not uniform; instead, they are shaped by overlapping axes of inequality, including socio-economic status, disability, geographic location, and cultural or religious norms. This means that women and girls in rural areas, informal labor sectors, or marginalized communities often face more severe challenges compared to their urban or wealthier counterparts (Bobel et al., 2020). Meanwhile, the life-course perspective stresses that menstruation is not confined to adolescence but continues to affect women throughout their reproductive years, necessitating sustained attention to menstrual health needs in adult and workplace contexts, rather than interventions that stop at school-based programs (Sommer et al., 2016). Collectively, these frameworks shift the responsibility for menstrual health away from individual women who are too often expected to cope silently and place it firmly on states, institutions, and policymakers. By doing so, they demand systemic policy and structural reforms, including embedding menstrual health into education, labor, and health systems, instead of relying on fragmented or donor-driven projects that fail to address underlying inequities.

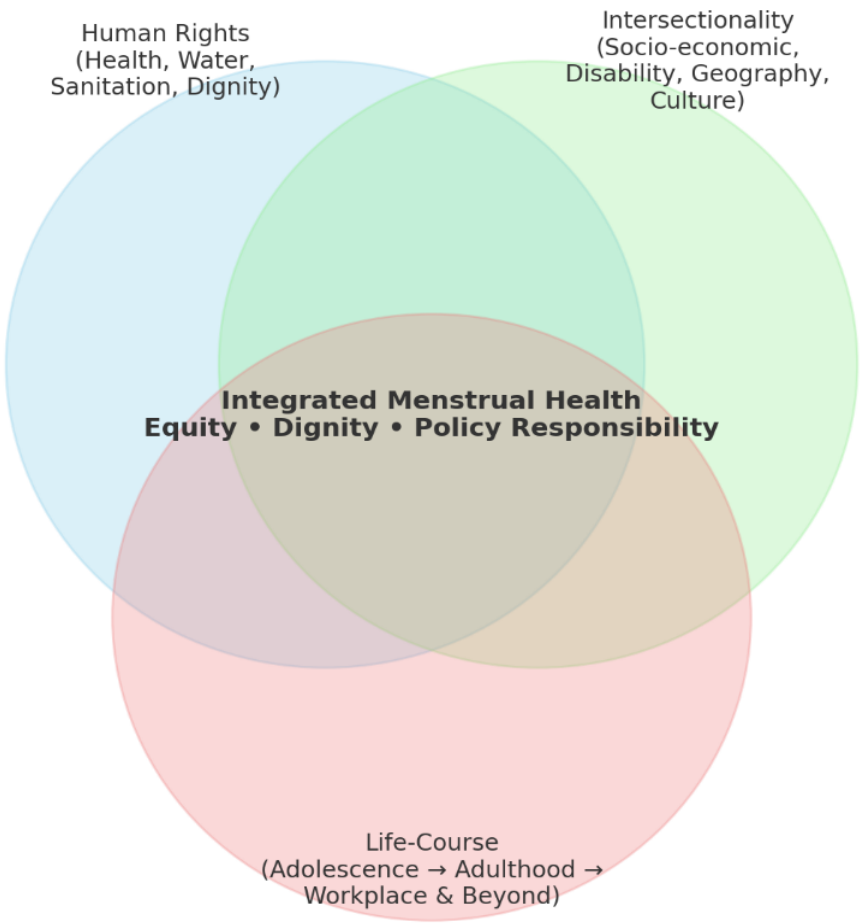

Figure 1 Conceptual Framework: Rights-based, Intersectional and life course perspective

1.2.7 Gaps in Existing Literature

Despite the growth of scholarship on menstrual health, several critical gaps remain evident. First, the experiences of adult women**,** particularly those employed in workplaces and marginalized occupations such as garment factories, agriculture, or informal labor, are severely under-researched compared to the extensive focus on adolescents. Second, while interventions such as school-based education programs or product distribution initiatives have demonstrated short-term success, they are rarely evaluated for long-term sustainability or cost-effectiveness**,** leaving uncertainties about their scalability and impact over time. Third, the mental health dimensions of menstruation including shame, anxiety, reduced self-esteem, and depression are poorly

quantified and insufficiently linked to validated psychological outcomes, despite consistent qualitative evidence of psychosocial burdens. Fourth, there are persistent policy–practice gaps**,** as governments and institutions increasingly acknowledge menstrual health rhetorically but often fail to embed it within systemic frameworks for education, health, labor, and WASH, resulting in fragmented or donor-driven efforts. Finally, there are notable geographic disparities in the literature, with the majority of studies concentrated in South Asia and Sub-Saharan Africa, while fewer investigations focus on Latin America, the Middle East, or inequities among vulnerable groups in high-income countries in the Global North. Together, these gaps underscore the need for broader, more inclusive, and sustained research and policy approaches to menstrual health across the life course.

1.2.8 Aim of the Review

This narrative review seeks to address these gaps by synthesizing literature published between 2015 and 2024, encompassing both adolescents and adults. By examining menstrual knowledge, practices, determinants, psychosocial aspects, WASH facilities, and interventions, this review provides a comprehensive picture of menstrual health challenges and opportunities across the life course. In particular, it emphasizes the often-overlooked perspectives of adult women, especially in workplace settings, thereby broadening the menstrual health discourse.

1.3 Methods

1.3.1 Review Design and Rationale

We conducted a narrative review to synthesize empirical evidence on MHH, with particular emphasis on adult women, while retaining relevant insights from adolescent studies that informed adult outcomes, policies, or life-course trajectories. A narrative approach was chosen because the topic spans multiple disciplines, including public health, gender studies, WASH, labor and occupational health, and education, and because the underlying evidence base is highly heterogeneous in design (quantitative, qualitative, mixed-methods, and intervention studies). Narrative reviews allow integration of contextual, mechanistic, and socio-cultural explanations, beyond the scope of meta-analysis of effect sizes (Ferrari, 2015; Green et al., 2006). To enhance rigor, we adhered to good-practice guidance for narrative reviews, including the Scale for the Assessment of Narrative Review Articles (SANRA) (Baethge et al., 2019). Where applicable, we integrated elements from the PRISMA and PRISMA-ScR guidelines, particularly in defining eligibility criteria, ensuring transparent reporting of study selection, and presenting a structured synthesis (Page et al., 2021; Tricco et al., 2018) (*Figure 2*).

1.3.2 Evidence Base and Seed Corpus

An initial "seed corpus" of studies was compiled from a curated Excel database ("NR" worksheet) developed prior to this review. This database included bibliographic and methodological fields for each record (author, year, title, journal, study design, sample, variables, methodology, research questions, results, recommendations, and lessons learned). After cleaning (removing rows without titles), the seed set contained 205 records published between 2015 and 2024. Study designs were heterogeneous, with the most frequent being cross-sectional, qualitative, and mixed-methods studies, alongside fewer intervention trials (including randomized controlled trials) and

systematic/narrative reviews. Because design labels were self-reported and occasionally overlapping (e.g., “systematic review” vs. “meta-analysis”), we normalized terminology during appraisal and synthesis for consistency (Grant & Booth, 2009).

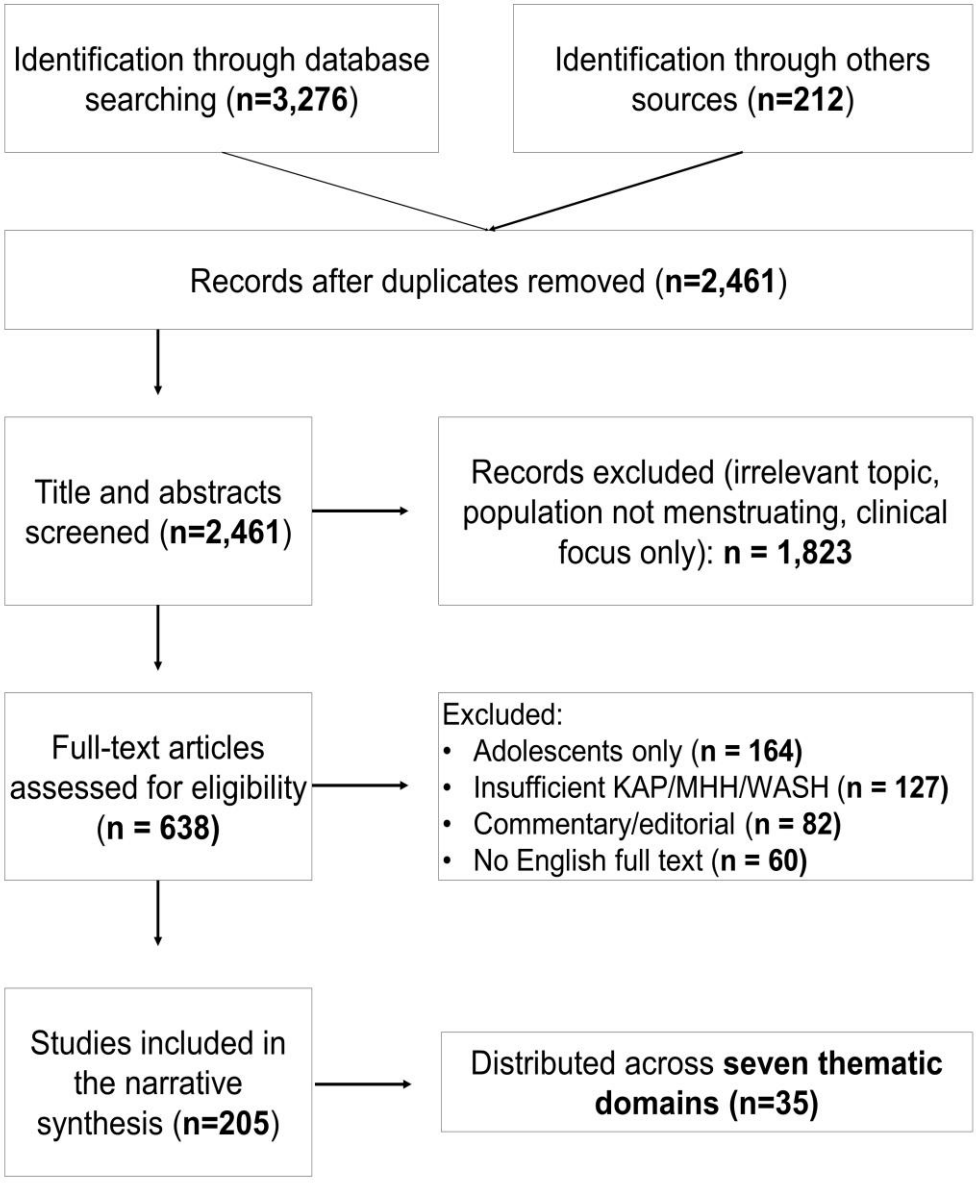

Figure 2 Distribution of Included Studies Across Thematic Domains

1.3.3 Supplementary Database Searches

1.3.3.1 Databases

To expand coverage beyond the initial seed corpus, systematic searches were conducted across a wide range of databases and portals to capture the multidisciplinary and global nature of menstrual health research. Major biomedical and multidisciplinary sources included MEDLINE (via PubMed), Scopus, and the Web of Science Core Collection. To ensure inclusion of evidence from nursing, psychology, and allied health disciplines, searches were extended to CINAHL Plus and PsycINFO. The global health domain was covered through Global Health (CAB Abstracts), the Cochrane Library, and WHO IRIS. To address geographic diversity, regional repositories were included, such as LILACS for Latin America, AJOL (Africa Journals Online), and IndMED for India. Finally, to capture evidence beyond peer-reviewed publications, policy and grey literature sources were searched, including UNICEF, UNFPA, UNESCO, WHO/UN-Water portals, as well as selected government reports and documents from large NGOs actively engaged in menstrual health and WASH programming.

1.3.3.2 Timeframe and Language

The primary analytic window matched the seed corpus (January 1, 2015–December 31, 2024). To capture recent developments, we extended searches to January 2025. Only studies available in English were included. Non-English records with English abstracts were screened at the abstract level; however, full-text inclusion required English availability due to resource limitations.

1.3.3.3 Search Concepts and Strategy

The search strategy combined controlled vocabulary terms (e.g., MeSH and Emtree) with free-text keywords, organized into concept blocks and connected using Boolean operators to maximize sensitivity and specificity. For example, an illustrative PubMed search included a menstruation concept (“Menstruation”[Mesh] OR menstru*

OR “period” OR “menstrual health” OR “menstrual hygiene” OR “menstrual hygiene management” OR “MHM”), a practice/WASH/product concept (hygiene* OR sanitation OR WASH OR disposal OR “sanitary pad*” OR tampon* OR “menstrual cup*”), a knowledge/attitudes/psychosocial concept (“Health Knowledge, Attitudes, Practice” [Mesh] OR stigma OR shame OR psychosocial OR embarrassment), and an adult/workplace context concept (adult* OR women OR workplace OR “occupational health” OR factory OR industry OR labor policy). These were combined as 1 AND 2 AND (3 OR 4) with filters applied for studies published between 2015 and 2024 in English. Equivalent strategies were adapted for other databases such as Scopus and Web of Science using free-text operators. For grey literature, similar concept blocks were applied but tailored to site-specific functionalities, for instance, using queries such as “menstrual health” + “workplace” within UNICEF and WHO portals to capture relevant policy and programmatic documents.

1.3.3.4 Hand-Searching and Citation Chaining

We hand-searched the reference lists of key reviews and highly cited empirical studies for additional records. Citation chasing (forward and backward) was conducted to minimize omissions. Institutional and donor reports repeatedly cited in peer-reviewed articles were retrieved in full to avoid reliance on secondary citations.

1.3.4 Eligibility Criteria

Eligibility criteria were established a priori. We focused primarily on adult women (≥20 years) who menstruate across community and workplace settings (formal and informal), while including adolescents (10–19 years) only when their findings informed adult outcomes (e.g., stigma socialization, workplace readiness, or policy lessons). Studies involving transgender and non-binary menstruators were eligible where participants were ≥20 years. Eligible concepts encompassed knowledge, attitudes, and

practices (KAP); product access and affordability; WASH infrastructure (privacy, water, soap, disposal); stigma and psychosocial outcomes; workplace policies; health outcomes explicitly linked to MHH; and interventions or policies. We considered studies conducted in community, workplace, health facility, or education settings where relevant to life-course trajectories. Eligible designs included observational (cross-sectional, cohort), qualitative (interviews, focus groups, ethnography), mixed-methods, intervention (quasi-experimental, randomized controlled trials), and systematic or scoping reviews. We excluded editorials, commentaries, opinion pieces, and purely clinical studies unrelated to MHH practices or WASH. Outcomes of interest were knowledge and awareness, practices, access, stigma and psychosocial metrics, absenteeism and productivity, policy adoption, health outcomes, and intervention effects. Only peer-reviewed articles and high-quality organizational reports available in English were included.

1.3.5 Synthesis Approach

We adopted a thematic, configurative synthesis approach (Thomas & Harden, 2008), whereby findings were first mapped to pre-specified domains (knowledge, practices, WASH, stigma, workplace, health outcomes, interventions), and studies were then grouped according to whether they focused on adults, mixed populations, or adolescents with adult relevance. Qualitative data were integrated through framework synthesis to compare themes across different settings, while quantitative data were narratively summarized by reporting effect directions and prevalence ranges. Intervention evidence was examined through an implementation lens, considering reach, fidelity, adoption, and sustainability. To strengthen the rigor of the synthesis, greater weight was given to higher-quality, adult-centric studies, while reliance on lower-certainty evidence was explicitly acknowledged.

1.3.6 Ethics and Registration

This review synthesized publicly available literature and did not require ethics approval. No protocol was prospectively registered.

1.4 Results

This review synthesized evidence from 205 studies published between 2015 and 2024 from the seed corpus. The included studies were heterogeneous in design, context, and population, but seven thematic domains consistently emerged: (1) knowledge and awareness, (2) menstrual practices and product use, (3) socio-demographic and cultural determinants, (4) physical, emotional, and psychosocial dimensions, (5) WASH and disposal infrastructure, (6) interventions and innovations, and (7) workplace and adult considerations.

1.4.1 Knowledge and Awareness

Across the majority of studies, inadequate knowledge prior to menarche was a recurring finding. In Nepal, only 67% of adolescent girls demonstrated fair knowledge, with widespread misconceptions linking menstruation to impurity or illness (Yadav et al., 2018). Similarly, an Ethiopian survey found that 35% of respondents had poor awareness despite attending school (Shumie & Mengie, 2022). Knowledge gaps persisted into adulthood. In Nigeria, more than 40% of women, including adults, held at least one major misconception (Umahi Nnennaya et al., 2021). Maternal education consistently emerged as a critical determinant: daughters of literate mothers were two to three times more likely to have accurate menstrual knowledge in developing countries (Kaur et al., 2018). Conversely, reliance on peer communication often reinforced myths, perpetuating secrecy and misinformation (Table 1).

Table 1. Representative studies on menstrual knowledge and awareness

Author, Year	Country	Population	Key Findings
Yadav et al., 2017	Nepal	276 adolescents	67% had fair knowledge; myths common
Shumie & Mengie, 2022	Ethiopia	441 schoolgirls	35% had poor awareness; socio-demographic factors were highly influential
Nnennaya et al., 2021	Nigeria	297 adolescents & adults	>40% held misconceptions
Kaur et al., 2018	Developing countries	Review	Maternal education strongly predicted accurate knowledge
Sommer et al., 2016	Global	Multiple	40–50% of girls unprepared for menarche worldwide

1.4.2 Menstrual Practices and Product Use

Disposable sanitary pad use varied widely, exceeding 80% in urban South Asia but falling below 30% in rural Sub-Saharan Africa. Menstrual product affordability was a persistent barrier. In Nepal, 42% of adolescents continued to rely on cloth because they could not afford disposable pads (Yadav et al., 2018), and in rural Bangladesh, 86% of schoolgirls reused cloth without adequate drying, elevating infection risks (Alam et al., 2017). Among adult women, financial trade-offs were evident. In Uganda, 65% of workers used cloth because using sanitary pads would consume up to 20% of their monthly income (Hennegan et al., 2020). In informal settlements in Kenya, girls resorted to unsafe materials such as newspapers due to cost barriers (Phillips-Howard et al., 2016). Trials of menstrual cups and reusable pads in Uganda, South Africa, and India demonstrated high acceptability following training, with continuation rates above 70% after one year (Beksinska et al., 2015). However, cultural resistance and stigma have limited their large-scale uptake (Mohd. Tohit & Haque, 2024). (Table 2)

Table 2. Representative studies on menstrual practices and product use

Author, Year	Country	Population	Key Findings
Yadav et al., 2017	Nepal	276 adolescents	42% relied on cloth
Alam et al., 2017	Bangladesh	2332 schoolgirls	86% reused cloth without adequate drying
Hennegan et al., 2020	Uganda	35 working women	65% used cloth; affordability was the main barrier
Phillips-Howard et al., 2016	Kenya	751 girls	Unsafe materials (e.g., newspapers) commonly used
Beksinska et al., 2015	South Africa	124 women	Reusable pads acceptable; >70% continuation after 1 year
Mohd. Tohit & Haque, 2024	Multi country	review	Period poverty and cultural stigma

1.4.3 Socio-Demographic and Cultural Determinants

Socio-economic status strongly influenced menstrual practices. Wealthier and urban households reported higher sanitary pad use, while rural and low-income groups faced greater reliance on cloth and unsafe alternatives (Umahi Nnennaya et al., 2021). Cultural taboos also restricted women's participation in daily life. In rural Nepal, despite the legal ban, approximately 30% of adolescents still practiced *chhaupadi* (menstrual seclusion) (Amatya et al., 2018). In Ethiopia, diet restrictions such as avoiding milk and vegetables during menstruation were commonly reported (Shumie & Mengie, 2022). Religious norms further shaped practices: for example, prayer and fasting restrictions in Muslim-majority regions (Bangladesh, Indonesia) and temple exclusion in Hindu contexts (Kaur et al., 2018) (Table 3).

Table 3. Socio-demographic and cultural determinants of menstrual practices

Author, Year	Country	Population	Key Findings
Nnennaya et al., 2021	Nigeria	297 adolescents & adults	Urban women 3× more likely to use pads
Amatya et al., 2018	Nepal	107 adolescent	30% practiced *chhaupadi* (restriction form family activities) despite ban
Shumie & Mengie, 2022	Ethiopia	441 schoolgirls	Diet restrictions during menstruation
Alam et al., 2017	Bangladesh	2332 schoolgirls	Maternal education strongly predicted safe practices
Kaur et al., 2018	Developing Countries	Review	Religion and tradition reinforced menstrual taboos

1.4.4 Physical, Emotional, and Psychosocial Dimensions

Menstruation was consistently associated with shame, secrecy, and reduced confidence. Adolescents reported fear of teasing in schools, while adult women avoided discussing menstrual needs in workplaces. Stigma also affected mental health outcomes, contributing to stress, reduced self-esteem, and in some cases, depression (Hennegan et al., 2019). Dysmenorrhea was widely reported affecting over 70% of women in South Asia yet often unmanaged due to stigma around seeking medical help, further exacerbating absenteeism and productivity loss (Alam et al., 2017) (Table 4).

Table 4. Physical, emotional, and psychosocial aspects of menstruation

Author, Year	Country	Population	Key Findings
Hennegan et al., 2019	Multi-country	Adolescents & adults	Stigma linked to absenteeism across settings
Alam et al., 2017	Bangladesh	2332 schoolgirls	68% reported shame; 45% avoided male interaction
Yadav et al., 2017	Nepal	276 adolescents	30% feared teasing in school
Phillips-Howard et al., 2016	Kenya	751 girls	Stigma and leakage fears reduced social confidence
Zaman et al., 2024	Bangladesh	366 Nursing students	Embarrassment and menstrual shy

1.4.5 WASH and Disposal Infrastructure

WASH deficiencies were a structural barrier in nearly all settings. Globally, less than 40% of schools in LMICs had private, functional toilets with locks for girls(Hennegan et al., 2023). In developing countries, more than 70% of toilets lacked disposal bins(Chace Dwyer et al., 2022). In Nepal, inadequate disposal and WASH facilities were reported, posing challenges that affected both women and girls (Budhathoki et al., 2018). Disposal practices included open dumping, burning, and burying, contributing to both environmental pollution and heightened shame (Zaman et al., 2024) (Table 5).

Table 5. WASH and disposal-related findings

Author, Year	Country	Population	Key Findings
Hennegan et al., 2023	Global	Adolescents	<40% schools had private, functional toilets
Chace et al., 2022	Bangladesh	Women	>70% of toilets lacked disposal bins
Budhathoki et al., 2018	Nepal	Female & Adolescents	Inadequate disposal for female and adolescents
Phillips-Howard et al., 2016	Kenya	Girls	Unsafe disposal practices widespread
Zaman et al., 2024	Bangladesh	366 Nursing students	Inadequate sanitation and disposal facilities

1.4.6 Interventions and Innovations

Educational programs improved knowledge and reduced stigma: in India, structured menstrual education increased knowledge scores by more than 40% (Parasuraman et al., 2022). Product subsidies and distribution reduced absenteeism: in Kenya, an RCT showed that pad provision decreased school absence by 25%, though sustainability declined after donor withdrawal (Zulaika et al., 2023). School pilots in Bangladesh that introduced subsidized pads and disposal bins generated positive feedback but lacked rigorous evaluation (Ha & Alam, 2022). Innovative products (menstrual cups, reusable pads) showed strong acceptability after initial training, with continuation rates above 70% (Beksinska et al., 2015) (Table 6).

Table 6. Interventions and innovations in MHH

Author, Year	Country	Intervention Type	Key Findings
Parasuraman et al., 2022	India	School-based education	Knowledge improved >40%
Zulaika et al., 2023	Kenya	Free pad provision (RCT)	Absenteeism reduced by 25%; sustainability limited
Ha & Alam, 2022	Bangladesh	Schools' subsidy pilot	Access to menstrual materials and bin used improved
Beksinska et al., 2015	South Africa	Menstrual Cup (RCT)	Access to more diverse menstrual products

1.4.7 Workplace and Adult Considerations

Workplace-focused evidence was notably scarce: only 15 studies explicitly addressed adult women in employment contexts. Across South Asia and Africa, an average absenteeism of one to two workdays per month per menstruating individual was common. Many women in the workplace struggled to afford menstrual products and were often forced to choose between purchasing food and menstrual products (Hennegan et al., 2020). Workplace stigma discouraged open discussion with supervisors, resulting in silent suffering (Table 7).

Table 7. Workplace and adult considerations

Author, Year	Country	Workplace Setting	Key Findings
Hennegan et al., 2020	Uganda	Different places	65% used cloth; 1–2 days absenteeism per month
Kaur et al., 2018	Developing countries	Multiple	>70% toilets lacked disposal bins
Budhathoki et al., 2018	Nepal	Household	Lacked private facilities; stigma limited reporting
Phillips-Howard et al., 2016	Kenya	Informal markets	Unsafe practices and absenteeism common

1.5 Discussion

This narrative review synthesized evidence from 205 studies published between 2015 and 2024, with searches updated through 2025, to examine MHH across the life course. Findings demonstrate that MHH remains a multidimensional public health challenge encompassing knowledge deficits, socio-cultural taboos, affordability barriers, infrastructural inadequacies, psychosocial burdens, and limited policy prioritization (Babbar et al., 2022; Hennegan et al., 2021; Sommer et al., 2016). Despite global progress in integrating menstrual health into educational and policy frameworks, adult women particularly those in workplaces and informal labor sectors remain largely overlooked

(Chace Dwyer et al., 2022; Hennegan et al., 2019; UNICEF, 2019). The findings underscore those menstrual inequities are not confined to adolescence but persist throughout adulthood, affecting well-being, dignity, and productivity. This discussion interprets key thematic domains, emphasizing the interconnectedness between individual agency, structural constraints, and cultural norms across life stages.

1.5.1 Knowledge and Awareness Across the Life Course

Persistent knowledge gaps underscore the lifelong implications of inadequate menstrual education. Girls who experience menarche unprepared often internalize shame and misinformation that persist into adulthood, perpetuating stigma and secrecy (Chandra-Mouli & Patel, 2017; Yadav et al., 2018). Evidence from South Asia and Sub-Saharan Africa shows that many adult women continue to associate menstruation with impurity or illness, reflecting enduring cultural scripts (Marni Sommer, 2012; Shumie & Mengie, 2022; Yadav et al., 2018). Maternal education consistently emerges as a determinant of accurate menstrual knowledge and safe practices, reinforcing the intergenerational transmission of health literacy (Alam et al., 2017; Kaur et al., 2018). This trajectory highlights those interventions during adolescence alone are insufficient to address the cumulative knowledge deficit that shapes women's lifelong menstrual experiences.

Adult women, particularly those in workplaces, require continuous education through health promotion and community outreach programs. Workplace-based menstrual education can play a critical role in correcting misconceptions and fostering supportive environments (Chace Dwyer et al., 2022; Hennegan et al., 2020). Integrating menstrual literacy into occupational health policies may empower women to discuss menstrual issues without fear of stigma or discrimination. Community health workers can also serve as trusted educators to bridge generational knowledge gaps and encourage

open dialogue among women of reproductive age (Babbar et al., 2022; Mahon & Fernandes, 2010). Hence, menstrual education should be positioned not as a one-time intervention but as a continuum across the life course.

1.5.2 Menstrual Practices and Product Affordability

Menstrual product use reflects structural inequities rather than mere personal choice. In LMICs, cloth remains the predominant material, particularly among rural and low-income women lacking access to affordable commercial products (Alam et al., 2017; Umahi Nnennaya et al., 2021). While cloth can be hygienic under proper washing and drying conditions, many women lack access to water, soap, or privacy for adequate maintenance, increasing infection risks (Das et al., 2015; Zaman et al., 2025). Studies from Bangladesh's garment sector revealed that sanitary pads may consume up to 20% of women's monthly income, forcing reliance on cloth or unsafe substitutes such as paper and rags (Chace Dwyer et al., 2022). These economic constraints link menstrual hygiene directly to income insecurity and gendered poverty.

Recent innovations, including menstrual cups and reusable pads, present promising alternatives that are cost-effective and environmentally sustainable (Beksinska et al., 2015; Phillips-Howard et al., 2016; Zulaika et al., 2023). However, their uptake is often hindered by cultural resistance, limited awareness, and inadequate user training. Evidence from Uganda and South Africa suggests that when comprehensive instruction and peer support are provided, continuation rates for reusable products exceed 70% (Beksinska et al., 2015). Public–private partnerships that subsidize initial product costs and promote peer advocacy could accelerate adoption in resource-poor contexts. Thus, affordability interventions must address both economic and sociocultural dimensions to achieve equitable menstrual product access.

1.5.3 Socio-Cultural Determinants and Stigma

Cultural and religious norms continue to profoundly shape menstrual experiences across societies. Practices such as *chhaupadi* in Nepal, dietary prohibitions in Ethiopia, and temple exclusion in India illustrate how menstruation is constructed as pollution requiring isolation (Amatya et al., 2018; Kaur et al., 2018; Shumie & Mengie, 2022). Even in urban and professional contexts, women often conceal menstrual products or avoid disclosing menstrual discomfort to male colleagues, reflecting enduring stigma (Hennegan et al., 2020; Zaman et al., 2025). Such socio-cultural constraints not only restrict women's autonomy but also exacerbate mental stress and feelings of inferiority (Bobel et al., 2020; Shannon et al., 2021). These findings highlight that material interventions alone cannot dismantle stigma without parallel cultural and behavioral change efforts.

Stigma manifests in subtle forms even within modernized societies where menstrual discussions remain taboo in workplaces and public discourse (Hennegan & Sol, 2020; Zaman et al., 2025). Educational programs that include men and boys can disrupt gendered silence and normalize menstruation as a shared human experience (Mahon & Fernandes, 2010; Sommer et al., 2016). Faith-based and community leaders can be instrumental in reframing menstruation from a symbol of impurity to a marker of health and womanhood. Media representation also holds transformative potential in challenging myths and fostering positive attitudes (Babbar et al., 2022; Bobel et al., 2020). Tackling menstrual stigma, therefore, requires multisectoral approaches integrating education, gender advocacy, and social norm transformation.

1.5.4 WASH and Disposal Infrastructure

Inadequate WASH facilities remain among the most persistent structural barriers to menstrual health. Global monitoring data reveal that fewer than half of schools in

LMICs provide gender-segregated toilets with privacy and disposal facilities (UNICEF & WHO, 2024). Studies from Bangladesh and Nepal found that over 70% of workplace and institutional bathrooms lacked disposal bins, forcing unhygienic practices or open dumping (Budhathoki et al., 2018; Zaman et al., 2025; Zaman et al., 2024). For adult women, especially in health facilities and factories, the absence of clean toilets and safe disposal options contributes to absenteeism, discomfort, and environmental pollution. These infrastructural deficiencies reflect systemic neglect of women's sanitation needs beyond domestic spaces.

Integrating MHH into national WASH strategies is therefore essential (House et al., 2013; Mahon & Fernandes, 2010). Workplace and community toilets should incorporate private washing areas, reliable water access, and disposal mechanisms such as incinerators or waste-segregation systems. Environmental concerns arising from plastic pad waste further necessitate sustainable disposal innovations (Kaur et al., 2018; Kuhlmann et al., 2017). Collaboration among government agencies, employers, and environmental organizations can ensure continuity of services across schools, homes, and workplaces. A holistic WASH approach recognizing menstruation as a sanitation priority is critical to advancing health, dignity, and gender equality.

1.5.5 Psychosocial Dimensions

Psychosocial burdens remain pervasive yet under-researched in menstrual health literature. Women frequently report embarrassment when purchasing products, fear of leakage, and anxiety related to menstrual accidents, especially in mixed-gender environments (Hennegan & Sol, 2020; Zaman et al., 2025). These anxieties are compounded by restrictive social norms that equate menstruation with weakness or uncleanliness (Bobel et al., 2020; Hennegan et al., 2019). In workplaces, women often conceal menstrual needs to avoid professional judgment, thereby internalizing stigma

that undermines self-confidence. Addressing psychosocial dimensions requires shifting from purely biomedical models toward dignity-centered frameworks that prioritize emotional well-being.

Emerging evidence suggests that stigma and secrecy are universal phenomena transcending cultural and economic boundaries (Bobel et al., 2020; Shannon et al., 2021). Even in high-income countries, women report discomfort discussing menstruation with supervisors or peers, underscoring the persistence of global menstrual inequity. Incorporating psychosocial support within MHH interventions such as peer discussion groups and counseling—can enhance self-efficacy and menstrual confidence. Research tools capturing psychosocial indicators should be standardized to inform policy and monitoring frameworks (Babbar et al., 2022; Hennegan et al., 2023). Ultimately, fostering positive menstrual identity is essential for achieving holistic menstrual health across the life course.

1.5.6 Interventions and Their Limitations

Educational interventions have demonstrated consistent success in improving menstrual knowledge and hygiene practices, particularly among adolescents (Hamada et al., 2024; Parasuraman et al., 2022; Sommer et al., 2016). However, adult women especially those in workplaces remain underrepresented in intervention design and evaluation. Limited pilot programs in Bangladesh's garment factories showed improved satisfaction following installation of disposal bins and product subsidies, but these lacked rigorous impact assessment (Chace Dwyer et al., 2022). Similarly, free product distribution initiatives in Kenya yielded short-term benefits such as reduced absenteeism yet struggled with long-term sustainability once external funding ended (Phillips-Howard et al., 2016; Zulaika et al., 2023). These limitations emphasize the need for institutionalized, policy-driven interventions rather than donor-dependent initiatives.

Ensure sustainability, Menstrual health programs should integrate fiscal and governance mechanisms such as value-added tax (VAT) exemptions for menstrual products, employer co-funding, and local manufacturing support (Babbar et al., 2022; Mohd. Tohit & Haque, 2024). Embedding menstrual health indicators into workplace safety and occupational health standards can enhance accountability and continuity. Participatory approaches that engage women in intervention co-design increase cultural acceptability and ownership (Hennegan et al., 2020; Shannon et al., 2021). Evaluations must also incorporate qualitative insights to capture lived experiences beyond quantitative outcomes. A shift from charity-based to rights-based programming is essential for achieving equity and sustainability in menstrual health interventions.

1.5.7 Workplace and Adult Women: The Neglected Frontier

The most critical gap identified is the persistent neglect of adult women and workplace contexts in MHH research and policy (Chace Dwyer et al., 2022; Hennegan et al., 2019, 2020). Across South Asia and Africa, menstruation-related challenges contribute to absenteeism ranging from one to two days per month, translating into significant productivity losses (Chace Dwyer et al., 2022; Hennegan et al., 2019). Despite the existence of progressive policies, such as menstrual leave provisions, implementation remains limited due to fear of discrimination or job insecurity (Bobel et al., 2020). The lack of infrastructural support such as private toilets, disposal systems, and product subsidies further marginalizes working women. These findings reveal the intersection of gender, labor, and health inequities that remain unaddressed in global health agendas.

Future initiatives must recognize menstrual health as integral to occupational safety, gender equality, and economic productivity. Incorporating MHH into workplace health audits and corporate social responsibility programs can promote both employee welfare and institutional image. Evidence suggests that modest interventions—

subsidized products, flexible leave policies, and workplace education can improve morale and reduce turnover (Chace Dwyer et al., 2022; Hennegan et al., 2020). Cross-sector collaboration among governments, employers, unions, and NGOs is vital to institutionalizing workplace MHH programs. Ultimately, integrating menstrual health into labor rights frameworks represents a transformative step toward gender-equitable and inclusive workplaces worldwide.

1.5.8 Policy Implications

The findings of this review carry several important policy implications. First, MHH should be fully integrated into national WASH and health strategies, with explicit consideration for schools, workplaces, and health facilities (House et al., 2013; Sommer et al., 2016). Affordability barriers must be addressed through tax exemptions and subsidies to promote menstrual equity and ensure access to essential products(UNICEF, 2019). In addition, workplace policies should go beyond the provision of menstrual leave and prioritize private toilets, disposal facilities, and affordable products, while simultaneously working to reduce stigma so that such policies can be adopted without fear or discrimination. Public discourse on menstruation also needs to be normalized through awareness campaigns directed at men, supervisors, and policymakers, thereby dismantling entrenched taboos and fostering inclusive environments (Chandra-Mouli & Patel, 2017). Finally, interventions should adopt a life-course approach, recognizing menstruation not as an issue limited to adolescence but as one that spans the entire reproductive lifespan, with implications for health, dignity, and gender equality throughout adulthood.

1.5.9 Research Gaps and Future Directions

Several critical research gaps emerged from this review, highlighting important directions for future inquiry. Current literature remains disproportionately focused on

adolescents, with limited attention to adult women, particularly those in informal labor sectors. The sustainability of interventions is also underexplored, as few studies rigorously assess cost-effectiveness or long-term impact. Moreover, the psychosocial dimensions of menstruation, including links to anxiety, depression, and broader mental health outcomes, have received little attention. Intersectional perspectives are notably lacking, with scarce research on the menstrual experiences of women with disabilities, displaced populations, and transgender or non-binary individuals (Hennegan et al., 2020). Even in high-income contexts, menstrual inequities persist among marginalized groups, such as the homeless, refugees, and low-income populations (Kuhlmann et al., 2017). Addressing these gaps will require mixed-methods and longitudinal designs that can capture the complex realities of menstruation across the life course, with a particular emphasis on adult women and workplace contexts.

1.6 Limitations

As a narrative review, this work carries inherent limitations. Although systematic elements were incorporated such as database searches, explicit eligibility criteria, and thematic synthesis; this review did not conduct a formal meta-analysis. The interpretive nature of narrative synthesis risks introducing subjectivity, although steps such as double screening and independent appraisal were taken to minimize this. Furthermore, the heavy reliance on the curated Excel seed database, while providing breadth, may inadvertently overrepresent certain regions or study types included in that dataset. Finally, although efforts were made to foreground adult perspectives, the available evidence limited the depth of adult-specific conclusions.

1.7 Conclusion

Across the life course, despite growing attention to menstrual health, big gaps still exist in knowledge, product access, cost, and stigma. Many girls start menstruation without proper information, carrying myths into adulthood. Adult women often struggle to afford products, lack privacy at work, and face shame about their needs. Few programs focus on workplace menstrual health, and poor WASH facilities cause discomfort and missed work. Emotional stress and stigma add to physical and financial problems. Achieving MHH requires the systemic inclusion of menstrual health in government and workplace policies to overcome policy and infrastructural barriers, such as the affordability of products and inadequacy of clean facilities and to address stigma through a collaborative strategy encompassing education, gender rights promotion, and shifts in social perceptions.

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CHAPTER 2

Parental education, embarrassment, and sanitation facilities influence menstrual product choices among female nursing students in Bangladesh

(Zaman, M. N. U., Sai, A., Nyambe, S., & Yamauchi, T. (2024). Parental education, embarrassment, and sanitation facilities influence menstrual product choices among female nursing students in Bangladesh. *Journal of Water, Sanitation and Hygiene for Development, 14(10),* 1003–1016. https://doi.org/10.2166/washdev.2024.226**)**

2.1 Abstract

Understanding the factors that shape menstrual product choices is crucial for improving menstrual health and hygiene practices among young women in low-resource settings. This study investigates the influence of parental education, embarrassment, and sanitation facilities on the choice between hygienic menstrual products, like single-use pads, and unhygienic options, such as old clothes. A structured questionnaire was used to interview 366 nursing students in Bangladesh, with an average age of 23.3 ± 4.3 years. Descriptive statistics, Pearson's chi-square test, and multivariable logistic regression were performed using JMP Pro 17. The major products were single-use pads (61%) and old clothes (32%). Participants' family was the primary source of menstrual information and product choices were influenced by both fathers' ($p < 0.05$) and mothers' ($p < 0.05$) education level. Additionally, the participants reported negative perceptions of the sanitation facilities, citing issues such as lack of privacy, cleanliness, and availability of water and soap. Embarrassed of buying (AOR: 2.86, [1.16-7.07]) and privacy of bathroom facilities (AOR: 2.92, [1.12-7.63]) increased the odds of old clothes, while fear of staining blood (AOR: 2.95, [1.53-5.68]) increased the odds of having single-use pads.

This underlines not only the complex interplay between parental education, embarrassment, and sanitation facilities but also with menstrual product choices. Overall, better practice of MHH requires improved parental education, reduced embarrassment, and better sanitation facilities.

Keywords: menstrual health and hygiene; menstrual hygiene products; women's health; nurses; Bangladesh

2.1.1 Highlights

- We assess menstrual products preferences among nursing students.
- Parental education influenced menstrual products choices
- The embarrassment of purchasing products influenced the use of old clothes.
- Sanitation facilities influenced products choices.

2.1.2 Graphical abstract

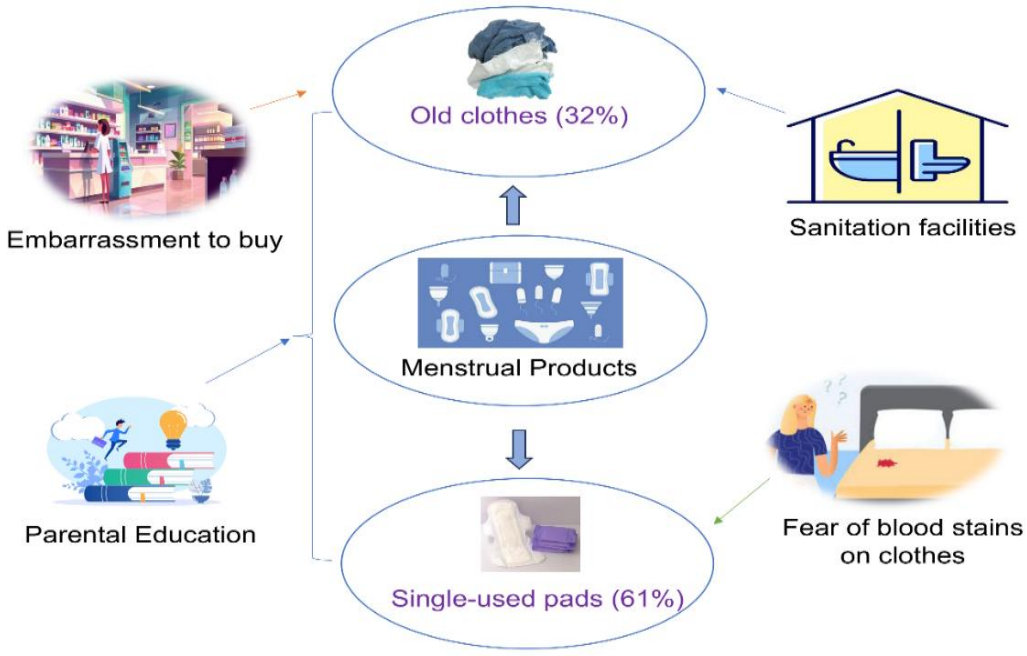

Figure 3 Graphical summary of the study's key findings

2.2 Introduction

Menstruation is a physiological process that usually occurs periodically in a cycle between 21 and 35 days and lasts for approximately 2 to 7 days, resulting in a blood flow of around 25–80 mL (Agampodi & Agampodi, 2018). Although menstruation is a natural returning event in the life of a woman or girl child, occurring between the ages of 12 and 50, more often than not, it is a subject that has been neglected the world over. However, recent movements have propelled menstrual health to the forefront as an essential public health concern and a fundamental right to achieve the Sustainable Development Goals (SDGs) by 2030 (Babbar et al., 2022; Sommer et al., 2021). Hennegan and colleagues defined menstrual health as the absence of ailments and the overall state of physical, mental, and social well-being concerning the menstrual cycle (Hennegan et al., 2021).

It is of paramount importance that women and girls, particularly those residing in low- and middle-income countries (LMICs) and conflict zones, are empowered to manage their menstrual cycles privately, safely, and with dignity. This not only affects their health, both physically and mentally, but also their contribution to community development (Plesons et al., 2021). Poor Menstrual health and hygiene (MHH) may lead to adverse health outcomes and adversely affect many parts of life, including education, social involvement, and psychological health (Balakrishnan et al., 2022). Every individual who is menstruating should be able to experience menstruation in a safe and dignified manner. Further, gender equality, women's health, empowerment, education, and general well-being align with menstruation as factors that bring out the importance of menstrual hygiene management (MHM) in public health (UNICEF, 2019). It, therefore, follows that the issue of menstruation has a strong bearing on the academic performance, class attendance, and general participation of the students in functions within the college or particularly in the university set-up (Munro et al., 2021).

MHH are crucial factors that significantly contribute to the physical, emotional, and empowerment well-being of adolescent girls and women (World Bank Group, 2021). Effective MHM comprises the use of hygienic materials to collect or absorb menstrual blood, access to facilities safe for disposing of and changing materials, and information distribution to raise awareness about menstruation and the use of menstrual hygiene (UNICEF, 2019). The quality and safety of menstrual products are essential because they come into direct contact with the body repeatedly each month over a woman's lifetime, which on average spans about 40 years (Choi et al., 2021). Most of these girls and women lack access to high-quality, appropriate, hygienic, and absorbent materials to manage menstruation (WHO/UNICEF Joint Monitoring Programme (JMP), 2012). Menstrual hygiene products include one-time use products such as disposable pads and tampons, as well as reusable products such as clothes, menstrual cups, and washable cloth pads (Pednekar et al., 2022). Due to high costs and limited knowledge, many women resort to using old clothes as menstrual products (Meher & Sahoo, 2023). However, these reusable materials can be unhygienic because they are often cleaned without soap and with unclean water, and social taboos and restrictions further complicate matters by forcing women to dry these clothes indoors, away from sunlight and fresh air (Das et al., 2015).

In Bangladesh, a densely populated South Asian country, there is commendable development in infrastructure related to water, sanitation, and hygiene (WASH). However, the country has a huge gap in the extensive literature on the practice of menstrual hygiene in the country (Ministry of Health and Family Welfare, 2019; Ministry of Local Government, 2021). According to the Bangladesh National Hygiene Survey, only 41% of females aged 15-49 practiced hygienic menstrual management, with a mere 39% having access to sanitary pads (Bangladesh Bureau of Statistics, 2020). Most studies have focused exclusively on adolescent girls, offering a gendered perspective on

menstruation. They largely emphasize societal stigma, including embarrassment, misconceptions about menstruation, inadequate facilities in educational institutions, and familial restrictions that contribute to school absenteeism.(Alam et al., 2017; Hennegan & Sol, 2020). Most extant studies have concentrated on needs and practices concerning menstruation (Ha & Alam, 2022; Hunter et al., 2022). However, limited studies have been undertaken on MHM among adult women, particularly those in specialised sectors such as nursing. Women in these fields are essential members of the female population and future healthcare professionals who tackle women's health concerns. This implies, therefore, these MHH practices among women have to be well inculcated into the nursing programmes.

Based on literature, many factors contribute to MHM, which play a vital role in the health, social involvement and overall well-being of women. Despite progress in understanding MHH, there still a notable gap in research that specifically addresses the factors influencing menstrual product choices among nursing students. Their choices and practices are shaped not only by personal preferences but also by the surrounding environment. This study thus sought to identify the parental education, embarrassment, and sanitation facilities that affect nursing students' choices of menstrual hygiene products in Bangladesh.

2.3 Methods and participants

2.3.1 Study design and setting

A cross-sectional quantitative study of a descriptive nature was conducted among nursing students from four districts, named Dhaka, Rajshahi, Naogaon, and Satkhira in three regions of Bangladesh (Figure 4). We selected these three regions including capital city that represent diverse social, cultural and economic backgrounds. Seven government

nursing colleges within these regions were chosen: National Institute of Advanced Nursing Education and Research (NIANER), Dhaka; College of Nursing (CoN), Mohakhali, Dhaka; Dhaka Nursing College (DNC), Dhaka; CoN, Sher-E-Bangla Nagar, Dhaka; Rajshahi Nursing College (RNC), Rajshahi; Nursing Institute (NI), Naogaon; and Nursing and Midwifery College (NMC), Satkhira. The government nursing colleges were chosen as a significant representative of the women for sensitive issues like menstruation because they are more accessible than other institutions for the researchers, allowing for easier data collection and engagement with participants.

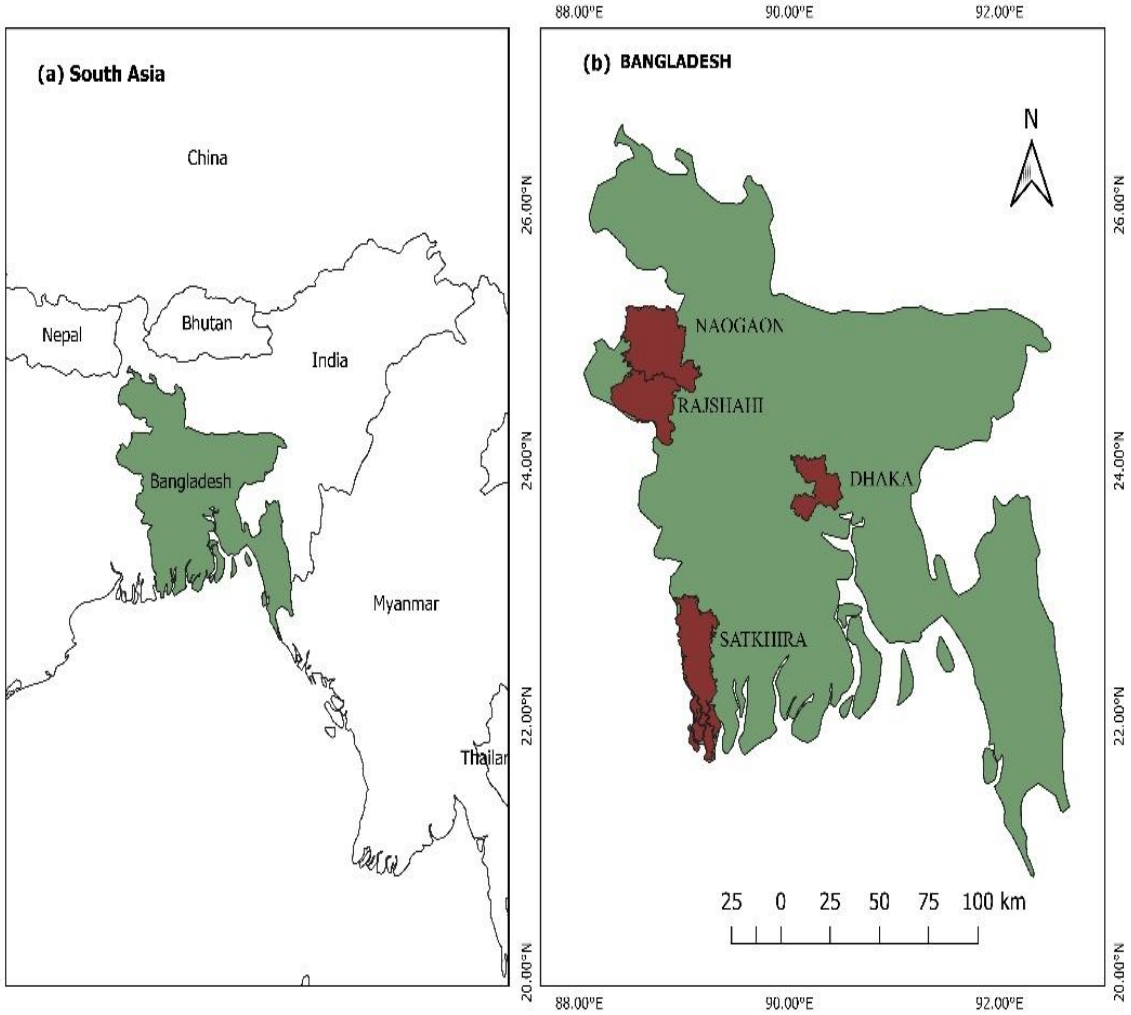

Figure 4 Geographic distribution of study site

2.3.2 Participants and sample size

All menstruating nursing students at these colleges were eligible to participate. The colleges comprised a total of 2495 nursing students, among which 120 were found in NIANER, 290 in CoN, Mohakhali, 550 in DNC, 475 in CoN, Sher-E-Bangla Nagar, 550 in RNC, 225 in NI, Naogaon, and 285 in NMC, Satkhira. The sample size was calculated employing a single population proportion formula (Cochran WG, 1977), considering specific assumptions as follows:

$$n_o = \frac{z^2 \times pq}{e^2} \quad (1)$$

Where no = expected sample size, z = 1.96 for a confidence level of 95%, p = 0.50 (expressed as 50% in decimal form), q = 1-p, and e = 0.05 (representing a 5% margin of error).

$$n_o = \frac{(1.96)^2 \times 0.5\,(1-0.5)}{(0.05)^2} \quad (2)$$

$$n_o = 384 \quad (3)$$

The final sample size (n) was determined using the correction formula, where no represents the initial sample size (384), and N represents the number of women at these colleges (2495):

$$n = \frac{n_o}{[1 + \{(n_o - 1)/N\}]} \quad (4)$$

$$n = \frac{384}{[1 + \{(384 - 1)/2495\}]} \quad (5)$$

$$n = 333 \quad (6)$$

Accounting for a nonresponse rate of 10%, the total sample size was calculated.

$$n = 333 + 33 = 366 \quad (7)$$

Therefore, 366 nursing students were included in this study after the sample size was calculated. Following the allocation of students from seven selected nursing colleges using proportional allocation to size (PAS), the participants were chosen through simple random sampling.

2.3.3 Instruments and data collection

The research instrument was a rigorously structured questionnaire that contained 64 questions from the Menstrual Health Questionnaire (Hassan et al., 2023; Medina-

Perucha et al., 2020) and a recent study about confidence in managing menstruation (Munro et al., 2022). The research instrument underwent translation into Bangla and subsequent revision by the research team. The questionnaire gathered data on socio-demographic and menstrual characteristics, menstrual information and education, menstrual hygiene products and supplies, and perceptions of the sanitation facilities. The questionnaire included multiple-choice questions, yes/no questions, and Likert scale items. For example, one question asked, "Are you embarrassed to buy menstrual products?" with response options on a Likert scale ranging from 1 (I do not know) to 5 (Always). The data were gathered through face-to-face interviews held on campus every weekday, except Friday, spanning from June to July 2023. The data collection process was facilitated by the first author and six trained research assistants, all of whom are professional nurses and midwives.

2.3.4 Data analysis

Numbers and percentages were utilised for the analysis of categorical variables. Pearson's chi-square was employed to evaluate the bivariate relationships between types of sanitary products and socio-demographic factors. Multivariable logistic regression analysis was employed to ascertain the potential factors linked to using single-use pads and old clothes. We created dummy variables for Likert scale data (e.g., lacked money to buy menstrual products) to input our regression models. Responses to items with 'always', 'sometimes', and 'few times' response options were recorded as '1' meaning yes and 'never', and the 'I don't know' response option was recorded as '0' meaning no. We similarly treated responses to each item on the perception of sanitation facilities, with 'always', 'most of the time', and 'sometimes' response options recorded as '1' meaning good and 'rarely', and 'never' response options recorded as '0' meaning poor conditions. The stepwise regression technique was used to select the best predictive model. In the

stepwise regression variable selection, the bivariate odds ratio was calculated between each dependent and independent variable. Only those with an odds ratio less than 0.25 were incorporated into the multilevel model (Sun et al., 1996).For entry and removal into the adjusted odds ratio model, the respective p-value thresholds were set at 0.25 and 0.1. The significance level was established at $p<0.05$, maintaining a confidence interval of 95% using JMP version 17 Pro (SAS Institute Inc., Cary, NC, USA).

2.3.5 Ethical considerations

Ethical approval was obtained from the Directorate General of Nursing and Midwifery, Dhaka (45.03.0000.008.14.097.2021-354), NIANER, Dhaka (NIA-OS-2023-09), and the Ethical Review Committee of the Faculty of Health Sciences, Hokkaido University in Japan (23-52). An information sheet was provided to the participants before the survey, explaining in clear terms the voluntary nature of their participation and their ability to withdraw from participation at any point. We got consent by affirming their willingness to participate with a response of 'yes'.

2.4 Results

2.4.1 Socio-demographic characteristics

The mean age of participants was recorded as 23.3±4.3 years (Table 8), and the average age at menarche was 13.2±2.3 years. The majority of participants were first-year (54.1%) and 37.7% were enrolled in the B.Sc. in Nursing (04 years) course. Notably, 35.8% of participants' mothers had received a secondary education while 29.9% of participants' fathers had received a higher secondary education. Additionally, it revealed that most of the participants' religions were Islam (86.1%), they were born in rural areas (75.7%), they lived in hostels (74.6%) and their monthly family income was between 10000 and 20000 BDT (36.6%).

Table 8. Socio-demographic characteristics.

Characteristics		**n**	**%**
Current age		366	Mean = 23.3 (SD = 4.3)
Age of menarche		366	Mean = 13.2 (SD = 2.3)
Category of studentship	Master's in nursing	18	4.9
	BSc in Midwifery (Post Basic)	33	9
	B.Sc in Nursing (4 years)	138	37.7
	B.Sc in Nursing (Post Basic)	35	9.6
	Diploma in Midwifery	87	23.8
	Diploma in Nursing Science and Midwifery	55	15
Year of college	First year	198	54.1
	Second year	115	31.4
	Third year	35	9.6
	Fourth year	18	4.9
Religion	Islam	315	86.1
	Hinduism	45	12.3
	Buddhism	1	0.3
	Christian	5	1.4
Fathers Education level	Graduate or above	63	17.3
	Higher Secondary	109	29.9
	Secondary	94	25.8
	Primary	78	21.4
	Illiterate	21	5.8
Mothers Education level	Graduate or above	28	7.7
	Higher Secondary	84	23
	Secondary	131	35.8
	Primary	104	28.4
	Illiterate	19	5.2
Birthplace status	Rural	277	75.7
	Urban	89	24.3
Resident status	Hostel	273	74.6
	Own house	93	25.4
Monthly Family Income	Below 10000/- BDT	55	15
	10000-20000/- BDT	134	36.6
	20000-30000/- BDT	93	25.4
	More than 30000/- BDT	84	23

SD = standard deviation

BDT= the currency symbol for the Bangladesh taka

2.4.2 Menstrual characteristics and sources of menstrual information and education

The research revealed that 15.8% of the participants had irregular menstrual periods (Table 9). Over half of the participants (51.9%) reported fear about blood leakage, which is a proxy for the severity of bleeding. The participants expressed a combination of favorable and unfavorable emotions while menstruating. The unfavorable emotions reported by participants were tired (54.9%), sensitivity (31.4%), anger (40.2%), sadness (32.5%), dirty (21.6%), and embarrassed (22.4%). Some participants reported feeling happy (1.1%) and relaxed (1.4%) during their periods. The key information source about menstruation for the participants was their family (80.6%), followed by school (24.9%) and friends (25.4%). More than half of the participants (58.7%) did not have any knowledge about menstruation before they experienced their first period. Most participants (83.6%) expressed a need for more information on different topics related to menstruation. The majority (71.5%) of the participants experience feelings of embarrassment while discussing menstruation (always 15.8%, sometimes 54.6%).

2.4.3 Menstrual hygiene product choices

61% of participants preferred single-use pads, which are considered hygienic, while 32% relied on old clothes, deemed unhygienic due to improper cleaning and drying practices. A small portion (3%) used toilet paper, also considered unhygienic. Additionally, 2% used nappies, and another 2% opted for more hygienic alternatives like tampons, menstrual cups, or menstrual underwear (Figure 5).

Table 9. Menstrual characteristics and sources of menstrual information and education

Characteristics	**n**	**%**
Is your menstrual cycle regular? (N=366)		
The same every month	160	43.7
Varies each month slightly	148	40.4
Never the same each month	58	15.8
Fear of staining clothes with blood when menstruating? (N=366)		
Yes	190	51.9
No	176	48.1
Do you suffer from menstrual pain? (N=366)		
Always	81	22.1
Sometimes	226	61.7
Very few times	39	10.7
Never	20	5.5
How do you feel during menstruation? ‡N=366 (for each choice, multiple response)		
Tired	201	54.9
Sensitive	115	31.4
Angry	147	40.2
Sad	119	32.5
Dirty	79	21.6
Embarrassed	82	22.4
Happy	4	1.1
Relaxed	5	1.4
Sources of menstrual information ‡N=366 (for each choice, multiple response)		
Family	295	80.6
School	91	24.9
Friends	93	25.4
Internet	23	6.3
Social network	20	5.5
College	13	3.6
Magazine/Books	22	6
Others	9	2.5
Did you know about menstruation before its first onset? (N=366)		
Yes	151	41.3
No	215	58.7
When you got your first period, did you feel ready for it? (N=366)		
Yes	71	19.4
No	276	75.4
I do not know	19	5.2
Do you need more information on menstruation? (N=366)		
No, I have enough information/not interested	60	16.4
Yes	306	83.6
Menstrual delays†	169	55.2
Impact of menstruation on daily life†	179	58.5
Menstrual products†	80	26.1
What is menstruation? †	29	9.5
Menstruation duration†	40	13.1
Do you feel embarrassed talking about menstruation? (N=366)		
Always	58	15.8
Sometimes	200	54.6
Never	108	29.5

‡The total adds up to more than 100 because this was a multiple-response question.

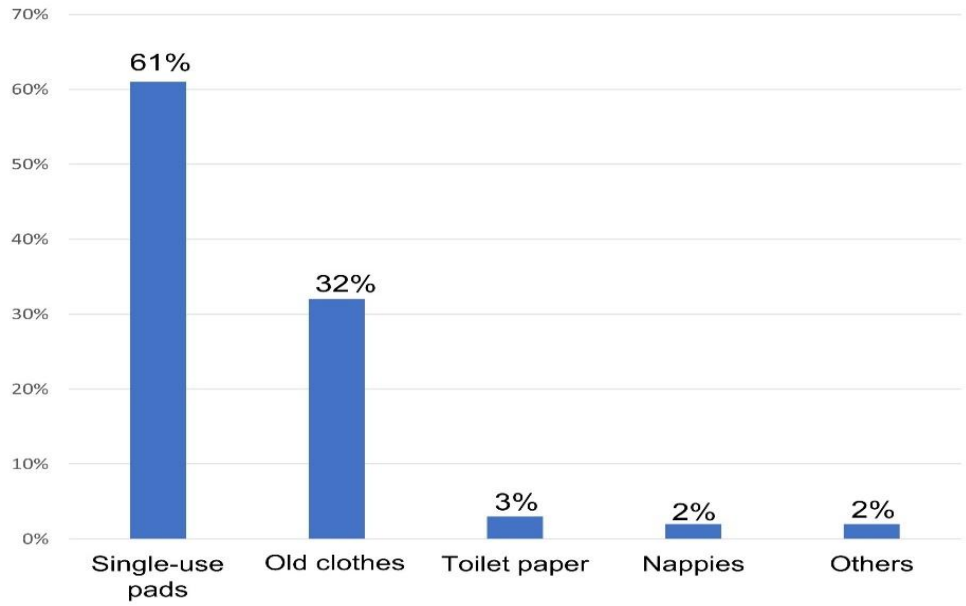

Figure 5 Types of menstrual hygiene products reported to be used by women (N=366). Other includes- tampons, menstrual cups, and menstrual underwear.

2.4.4 Access to menstrual hygiene products and supplies

Almost all participants (98.9%) reported being unable to get free menstrual hygiene products in hostels (Table 10). Most of them (85%) reported that menstrual hygiene products were expensive. Most of them (86.6%) stated that they obtain their menstrual products from pharmacies while on campus. The pharmacy was identified as the most preferred location for purchasing menstrual products due to comfort (71.3%). A large majority (86.3%) of those surveyed mentioned using menstrual products for an extended duration beyond recommendations due to inadequate access to suitable washing facilities. Among them, 5.8% answered ‘always’, while 64.8% replied ‘sometimes’, and 15.7% answered ‘few times’. More than two-thirds (76.5%) of the participants also reported experiencing embarrassment when purchasing menstrual products. Among them, 10.1% answered ‘always’, 57.9% replied "sometimes", and 8.5% answered ‘few times’.

Table 10. Access to menstrual hygiene products and supplies.

Characteristics			**n**	**%**
Cost	Do you think menstrual products are expensive? (N=366)	Yes	311	85
		No	47	12.8
		I do not care	8	2.2
	Have you ever lacked any money to buy menstrual products? (N=366)	Always	43	11.7
		Sometimes	209	57.1
		Never	64	17.5
		Few times	48	13.1
		I do not know	2	0.5
	Have you ever had to use menstrual products that you do not like because the ones you like are too expensive? (N=366)	Always	58	15.8
		Sometimes	208	56.8
		Never	49	13.4
		Few times	50	13.7
		I do not know	1	0.3
	Can you get free menstrual products in the college? (N=366)	Yes	0	0
		No	362	98.9
		I do not care	4	1.1
Source	From where you get menstrual products at college? (N=366)	Home	33	9
		Cafeteria	3	0.8
		Pharmacy	317	86.6
		Faculty club	5	1.4
		Friend	8	2.2
	It is comfortable to get menstrual products from: ‡N=366 (for each choice, multiple response)	College	54	14.8
		Pharmacy	261	71.3
		Supermarket	39	10.7
		Sport club	4	1.1
		Not comfortable at all	47	12.8
Others	Have you ever used a menstrual product for longer than it is recommended because you did not have a replacement? (N=366)	Always	18	4.9
		Sometimes	234	63.9
		Never	55	15
		Few times	56	15.3
		I do not know	3	0.8
	Have you ever used a menstrual product for longer than it is recommended because you could not find appropriate washing facilities? (N=364*)	Always	21	5.8
		Sometimes	236	64.8
		Never	49	13.5
		Few times	57	15.7
		I do not know	1	0.3
	Are you embarrassed to buy menstrual products? (N=366)	Always	37	10.1
		Sometimes	212	57.9
		Never	85	23.2
		Few times	31	8.5
		I do not know	1	0.3

‡The total adds up to more than 100 because this was a multiple-response question.

*Totals are less than 366 because of missing data.

2.4.5 Perception of sanitation facilities

A minimal proportion (15.3%) always noted the presence of disposal bins for menstrual products in their regular bathrooms (Table 11). Slightly more (15.6%) confirmed the consistent availability of clean running water and soap always for handwashing. Participant reported 'always' when asked if they had consistent privacy (22.1%), functional toilets (13.9%), cleanliness (13.4%), functional door locks (30.1%), and toilet paper availability (9.3%) in the bathrooms.

Table 11. Participant's perceptions of the sanitation facilities

Characteristics		**n**	**%**
Bathrooms have enough privacy so they can change their menstrual product if they use one (N=366)	Always	81	22.1
	Most of the time	69	18.9
	Sometimes	142	38.8
	Rarely	48	13.1
	Never	26	7.1
Bathrooms have functional toilets (not clogged, able to flush, toilet seats are not broken) (N=366)	Always	51	13.9
	Most of the time	59	16.1
	Sometimes	131	35.8
	Rarely	83	22.7
	Never	42	11.5
Bathrooms are clean and sanitary (N=366)	Always	49	13.4
	Most of the time	53	14.5
	Sometimes	126	34.4
	Rarely	94	25.7
	Never	44	12
Bathrooms have functional locks on doors so they can use the toilet in privacy (N=366)	Always	110	30.1
	Most of the time	41	11.2
	Sometimes	97	26.5
	Rarely	75	20.5
	Never	43	11.7
Bathrooms have a bin in each toilet where they can dispose of their used menstrual product (N=366)	Always	56	15.3
	Most of the time	37	10.1
	Sometimes	89	24.3
	Rarely	80	21.9
	Never	104	28.4
Bathrooms have enough supply of toilet paper so they can clean/wipe their genitals (N=366)	Always	34	9.3
	Most of the time	21	5.7
	Sometimes	72	19.7
	Rarely	82	22.4
	Never	157	42.9
Bathrooms have clean running water and soap for hand washing (N=366)	Always	57	15.6
	Most of the time	36	9.8
	Sometimes	106	29
	Rarely	87	23.8
	Never	80	21.9

2.4.6 Socio-demographic characteristics of types of menstrual hygiene products

Table 12 shows the association between different menstrual hygiene products and socio-demographic backgrounds. Statistically noteworthy variations existed in the selection of menstrual hygiene products among the categories of studentship (p = <0.0001), father education level (p = 0.0307), mother education level (p = 0.0050) and monthly family income (p = < 0.0001). Interestingly, there were no statistically significant differences in types of menstrual hygiene products between the year of college (p = 0.5687), religion (p = 0.3419), birthplace status (p = 0.9615), and resident status (p = 0.9562).

2.4.7 Factors associated with the use of single-used pads and old clothes

Table 13 presents the multivariable logistic regression analysis for assessing the factors affecting single-use pads and old clothes. These were significantly predicted by menstrual characteristics, access to menstrual hygiene products, and perceptions of sanitation facilities. However, the utilisation of single-use pads and old clothes did not show significant prediction by menstrual information and education. The significant independent predictors that increased odd for single-use pads feared staining clothes with blood (AOR: 2.95; 95% CI: 1.53-5.68), bathroom clean and sanitary (AOR: 3.17; 95% CI: 1.20-8.39) and the bathroom having functional locks on doors (AOR: 4.45; 95% CI: 1.67-11.85). The odds of having single use pads were less for those who lacked the money to buy menstrual products (AOR: 0.26, 95% CI: 0.09-0.68), were embarrassed to buy menstrual products (AOR: 0.37, 95% CI: 0.16-0.86) and had privacy in their bathroom (AOR: 0.33, 95% CI: 0.14-0.77). Therefore, the significant independent predictors that increased odds for old clothes were being embarrassed to buy menstrual products (AOR: 2.86, 95% CI: 1.16-7.07) and having privacy in their bathroom (AOR: 2.92, 95% CI: 1.12-7.63). The significant independent predictors that had reduced odds

Table 12. Association between socio demographic characteristics with types of menstrual hygiene products.

Characteristics	Types of menstrual hygiene products					P-value
	Nappies n (%)	Other n (%)	Old clothes n (%)	Single use pad n (%)	Toilet paper n (%)	
Category of studentship						
Master's in nursing	1 (0.27	1 (0.27)	2 (0.55)	14 (3.83)	0 (0.00)	
B.Sc. in Midwifery (Post Basic)	0 (0.00)	0 (0.00)	4 (1.09)	25 (6.83)	4 (1.09)	
B.Sc. in Nursing (4 years)	4 (1.09)	3 (0.82)	43 (11.75)	84 (22.95)	4 (1.09)	
B.Sc. in Nursing (Post Basic)	1 (0.27)	5 (1.37)	7 (1.91)	21 (5.74)	1 (0.27)	<0.0001*
Diploma in Midwifery	2 (0.55	0 (0.00)	21 (5.74)	64 (17.49)	0 (0.00)	
Diploma in Nursing Science and Midwifery	1 (0.27)	0 (0.00)	39 (10.66)	14 (3.83)	1 (0.27)	
Year of college						
First year	5 (1.37	7 (1.91)	62 (16.94)	119 (32.51)	5 (1.37)	
Second year	3 (0.82)	0 (0.00)	34 (9.29)	74 (20.22)	4 (1.09)	0.5687
Third year	1 (0.27)	2 (0.55)	15 (4.10)	16 (4.37)	1 (0.27)	
Fourth year	0 (0.00	0 (0.00)		13 (3.55)	0 (0.00)	
Religion						
Islam	6 (1.64)	9 (2.46)	94 (25.68)	198 (54.10)	8 (2.19)	
Hinduism	3 (0.82)	0 (0.00)	20 (5.46)	20 (5.46)	2 (0.55)	0.3419
Buddhism	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	
Christian	0 (0.00)	0 (0.00)	1 (0.27)	4 (1.09)	0 (0.00)	
Fathers Education level						
Graduate or above	0 (0.00)	3 (0.82)	11 (3.01)	48 (13.15)	1 (0.27)	
Higher Secondary	5 (1.37)	1 (0.27)	43 (11.78)	55 (15.07)	5 (1.37)	
Secondary	2 (0.55)	2 (0.55)	33 (9.04)	55 (15.07)	2 (0.55)	0.0307*
Primary	0 (0.00)	3 (0.82)	21 (5.75)	52 (14.25)	2 (0.55)	
Illiterate	2 (0.55)	0 (0.00)	8 (2.19)	11 (3.01)	0 (0.00)	
Mothers Education level						
Graduate or above	2 (0.55)	3 (0.82)	3 (0.82)	20 (5.46)	0 (0.00)	
Higher Secondary	3 (0.82)	1 (0.27)	36 (9.84)	41 (11.20)	3 (0.82)	
Secondary	2 (0.55)	0 (0.00)	41 (11.20)	83 (22.68)	5 (1.37)	0.0050*
Primary	1 (0.27)	3 (0.82)	31 (8.47)	67 (18.31)	2 (0.55)	
Illiterate	1 (0.27)	2 (0.55)	5 (1.37)	11 (3.01)	0 (0.00)	
Birthplace status						
Rural	7 (1.91)	6 (1.64)	89 (24.32)	167 (45.63)	8 (2.19)	0.9615
Urban	2 (0.55)	3 (0.82)	27 (7.38)	55 (15.03)	2 (0.55)	
Resident status						
Hostel	6 (1.64)	7 (1.91)	88 (24.04)	164 (44.81)	8 (2.19)	0.9562
Own house	3 (0.82)	2 (0.55)	28 (7.65)	58 (15.85)	2 (0.55)	
Monthly Family Income						
Below 10000/- BDT	1 (0.27)	0 (0.00)	25 (6.83)	28 (7.65)	1(0.27)	
10000-20000/- BDT	5 (1.37)	0 (0.00)	51 (13.93)	75 (20.49)	3 (0.82)	<
20000-30000/- BDT	1 (0.27)	1 (0.27)	29 (7.92)	61 (16.67)	1 (0.27)	0.0001*
More than 30000/- BDT	2 (0.55)	8 (2.19)	11 (3.01)	58 (15.85)	5 (1.37)	

Significance level *p < 0.05.

Table 13. Multivariable logistic regression analysis of factors associated with single-use pads and old clothes.

		Single-use pad			Old clothes		
		n (%)	**AOR (95% CI)**	**p-value**	**n (%)**	**AOR (95% CI)**	**p-value**
Menstrual characteristics							
Fear of staining blood	No	89 (24.32)	Ref	-	68 (18.58)	Ref	-
	Yes	133 (36.34)	2.95 (1.53 to 5.68)	0.0012*	48 (13.11)	0.62 (0.30 to 1.27)	0.1906
Access to menstrual hygiene products and supplies							
Lacked money	No	170 (46.45)	Ref	-	105 (28.69)	-	-
	Yes	52 (14.21)	0.26 (0.09 to 0.68)	0.0064*	11 (3.01)		
Expensive	No	39 (10.66)	Ref	-	7 (1.91)	-	-
	Yes	183 (50)	3.06 (0.74 to 12.66)	0.1235	109 (29.78)		
Washing facilities	No	41 (11.20)	Ref	-	8 (2.19)	-	-
	Yes	181 (49.45)	0.51 (0.18 to 1.46)	0.2111	108 (29.51)		
Embarrassed to buy	No	67 (18.31)	Ref	-	15 (4.10)	Ref	-
	Yes	155 (42.35)	0.37 (0.16 to 0.86)	0.0218*	101 (27.60)	2.86 (1.16 to 7.07)	0.0230*
Perceptions of sanitation facilities on campus							
Privacy	Poor	45 (12.30)	Ref	-	23 (6.28)	Ref	-
	Good	177 (48.36)	0.33 (0.14 to 0.77)	0.0101*	93 (25.41)	2.92 (1.12 to 7.63)	0.0286*
Clean and sanitary	Poor	53 (14.48)	Ref	-	77 (21.04)	Ref	-
	Good	169 (46.17)	3.17 (1.20 to 8.39)	0.0198*	39 (10.66)	0.20 (0.07 to 0.58)	0.0032*
Functional door locks	Poor	38 (10.38)	Ref	-	74 (20.22))	Ref	-
	Good	184 (50.27)	4.45 (1.67 to 11.85)	0.0028*	42 (11.48	0.21 (0.07 to 0.67)	0.0080*
Toilet paper	Poor	140 (38.25)	-	-	85 (23.22)	Ref	-
	Good	82 (22.40)			31 (8.74)	1.96 (0.59 to 6.52)	0.2719
Water and soap	Poor	75 (20.49)	Ref	-	81 (22.13)	Ref	-
	Good	147 (40.16)	2.29 (0.99 to 5.33)	0.0536	35 (9.56)	0.23 (0.07 to 0.77)	0.0167*

CI: confidence interval.

Significance level *p < 0.05.

Ref: Reference

for old clothes were the bathroom being clean and sanitary (AOR: 0.20, 95% CI: 0.07-0.58), the bathroom having functional door locks (AOR: 0.21; 95% CI: 0.07-0.67) and the bathroom having a supply of water and soap (AOR: 0.23; 95% CI: 0.07-0.77).

2.5 Discussion

Family is the primary source of menstrual information, and choices of menstrual hygiene products are significantly influenced by parental education, as given by Pearson's chi-square test. In other related studies carried out in different nations, the family was the primary source of information on menstruation: Egypt (53%-92.2%) (Chandra-Mouli & Patel, 2017), Saudi Arabia (66.8%) (Alharbi et al., 2018), India

(50.3%) (Tshomo et al., 2021), and Indonesia (almost half) (Assa et al., 2024). This suggested the importance of family as an educational resource for girls who are menstruating and the need for proper menstrual hygiene practices. The resulting lack of information about menstruation can lead to the use of unhygienic materials, which have significant implications for women's health, including an increased risk of infections and other health issues. The unique educational and professional context of the participants as nursing students does not directly affect their product choices, as these decisions are often influenced more by their surrounding environment than by personal preference. This indicated that not only are menstrual information and education important, but parental education is also significant for the participants.

Most participants experienced embarrassment both in discussing menstruation and purchasing menstrual products. This embarrassment significantly increased the likelihood of using old clothes rather than single-use pads in multivariable logistic regression. Similar levels of embarrassment were observed in studies from Bangladesh, India, and Australia (Hennegan & Sol, 2020; Kumar et al., 2024; Munro et al., 2022), in contrast to Palestine, which had lesser embarrassment (Hassan et al., 2023). This indicates that the issue of embarrassment during menstruation is not dependent on the country's affluence but is a relatively sensitive topic. The embarrassment nursing students feel about menstruation is particularly troubling, as they are future healthcare providers who will need to educate and support patients. It could hinder their ability to properly educate and care for patients, leading to missed opportunities for effective menstrual education and potentially perpetuating misinformation. Researchers recommend further investigations, including qualitative research to see the reasons behind this embarrassment.

The fear of blood stains on clothes was significantly associated with menstrual product choices. A high proportion of the participants (51.9%) feared staining clothes with blood, and this fear was associated with increased odds of using single-use pads than old clothes in multivariable logistic regression. These findings differ from another study where 85.3% found fear of staining clothes with blood, but no association was measured (Hassan et al., 2023). The fear of this blood is mental, not physical, as the participants are aware that they menstruate every month. The concern, therefore, is to avoid washing the menstrual products. From the preferences of single-use pads, it follows that the fear of staining clothing with blood from menstruation would guide the choice of menstrual products and the demand for proper sanitation facilities.

The participants had a poor perception of sanitation facilities for practicing menstrual hygiene. These findings indicated privacy (22.1%), cleanliness (13.4%), and functional door locks (30.1%) were always reported as poor in the bathrooms. These findings align with previous research demonstrating inadequate menstrual hygiene facilities on college campuses, schools and community (Bhakta et al., 2024; Hennegan & Sol, 2020; Munro et al., 2021, 2022). A possible cause is the lack of prioritisation of sanitation facilities within both these institutions and the community. A good perception of the need for privacy, cleanliness, and functionality of sanitation facilities points to a significant need for the priority of infrastructure development for sanitation for improved menstrual hygiene and sanitation conditions.

Decisions were based on the sanitation facilities, either single-use pads or old clothes. The multivariable logistic regression of the above-indicated user showed that privacy was a predictor for reduced odds of using single-use pads and an increased likelihood of using old clothes, while the functionality of door locks was one of the predictors for increasing the odds of using single-use pads but decreasing old clothes use.

Similar findings include students using menstrual products longer than advised without water, privacy, and sanitary waste bins (Munro et al., 2021), latrine types (Mudi et al., 2023) and sanitation facilities influencing menstruation management (Sambo et al., 2024; Sato et al., 2023; Shannon et al., 2021). The preference for using old clothes in private bathrooms, despite less sanitary conditions, likely stems from a strong cultural emphasis on privacy and avoiding stigma, which outweighs concerns about the bathroom's cleanliness or functionality. Thus, the physical environment is critical in MHM. It becomes clear that menstrual hygiene product choices are not only a matter of individual choice but are deeply connected with parental education, embarrassment, and sanitation facilities. Addressing these factors can lead to better health outcomes and empower women to manage their menstruation with hygienic products.

2.6 Limitations

This study was confined to government nursing colleges and focused solely on nursing students, which may limit the generalizability of the findings to a broader population of women. The use of proportional sampling might help reduce biases that could affect the representation of the entire student population. Secondly, the study relied on self-reported data, which could be subject to response bias. Participants' answers might have been influenced by recall bias or the desire to present themselves in a socially desirable manner. The use of self-reporting also allows for the collection of nuanced personal experiences and perceptions, which are invaluable for understanding subjective phenomena like menstruation. Thirdly, this study's use of multivariate logistic regression allowed for the identification of statistically significant factors associated with product choices. Due to the complex and multifaceted nature of MHM, some factors that were not statistically significant in our model may still have important social and personal

influences that were not fully captured. Future research should consider qualitative approaches to explore these nuanced contributions further. Lastly, the sanitation facilities considered in this study were limited to perceptions of bathrooms and access to menstrual hygiene products. Other potential WASH influences, such as exposure to menstrual health education outside of formal schooling, broader community support systems, and household conditions, were not explored. Concentrating on these specific aspects of WASH facilities allowed for a detailed exploration of core environmental and resource-based factors, directly impacting menstrual hygiene practices.

2.7 Conclusion

This study provides important insights into MHH among nursing students, as well as crucial future healthcare professionals. The participants had minimal knowledge of menstruation before menarche and that family was a main source of menstrual information. Single-use pads and old clothes were major menstrual products used among the participants. The inhibition of the menstrual product choices was influenced by parental education, not participant knowledge level. The use of single-use pads and old clothes influenced by embarrassment to purchase products, fear of blood staining clothes, water and soap availability, privacy of bathrooms, functional door locks of bathrooms. Better practice of MHH requires improved parental education, reduced embarrassment, and better sanitation facilities.

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CHAPTER 3

Period poverty: menstrual information, product selection, and disposal among urban female nursing students in Bangladesh

(Zaman, M. N. U., Takashima, R., Sai, A., & Yamauchi, T. (2025). Period poverty: Menstrual information, product selection, and disposal among urban female nursing students in Bangladesh. *Health & Place, 93*, 103467. https://doi.org/10.1016/j.healthplace.2025.103467)

3.1 Abstract

Period poverty, the lack of access to menstrual hygiene products, sanitation facilities, and education, remains a pressing issue in low- and middle-income countries. This study explored the emotional and practical challenges faced by nursing students, focusing on menstrual education, product accessibility, and disposal practices. A qualitative approach was adopted, involving 35 female nursing students (aged 26 ± 3.3 years) from seven government nursing colleges across three regions of Bangladesh. Data was collected from June to July 2023 through Focus Group Discussions (FGDs) and In-Depth Interviews (IDIs). Purposive sampling was employed for FGDs, while convenience was sampling used for IDIs. Thematic analysis, facilitated by MAXQDA2023 software, identified key themes and subthemes related to menstrual experiences. Three major themes emerged: (1) fear and confusion during first menstruation, (2) barriers to menstrual product accessibility, and (3) challenges in MHH. Many students reported fear and confusion during their first menstruation, largely due to inadequate information from female family members, especially mothers. Sanitary pads were the preferred menstrual product, but the embarrassment of buying products in front of men often made purchasing them difficult and they used old clothes. Additionally, a

lack of proper disposal facilities and embarrassment in managing menstruation in public were significant concerns. This study underscores the need for comprehensive menstrual education and improved Water, Sanitation and Hygiene (WASH) infrastructure in educational institutions. Addressing these issues is critical to promoting safe and dignified menstrual management, reducing stigma, and enhancing health outcomes for menstruators.

Keywords: *Menstrual health & hygiene, menstrual product, nursing and midwifery, qualitative, Bangladesh.*

3.2 Introduction

Period poverty is a lack of access to safe and hygienic menstrual products, basic sanitation services, and sufficient menstrual hygiene education (Carneiro, 2021). Although menstruation is a natural physiological process, it is considered by many societies as something unclean or impure wrapped in different misconceptions, taboos, and stigma (Sommer, Hirsch, et al., 2015; Thakur et al., 2014; Winkler, 2014). Menstruation is a private issue and is taken as an awkward issue to discuss, so generally, it is not discussed. Girls' little knowledge or information about menstruation is due to the lack of open conversation with their mother or other female family members. Especially in both rural and urban regions in south Asia, girls grow up with little knowledge about menstruation (Aziz et al., 2024; Nimbhorkar et al., 2023). This research suggests that within many families in these regions, menstruation is discussed only between mothers and daughters. As a result, most girls are unprepared and caught by surprise when they experience their first menstruation. They often lack knowledge about the physiological processes of sexual development and manage menstruation properly.

Proper Menstrual Health and Hygiene (MHH) is essential to the health and well-being of the menstruating girl and woman. Effective hygiene management requires access to hygienic absorbent materials, water, soap, and private toilet facilities (Meher & Sahoo, 2023; World Bank Group, 2021). The selection and utilization of menstrual products are critical in effectively managing a menstruation. Research has shown that the variation in the way women handle their menstruation also includes when product changes are made and bathing routines (Chandra-Mouli & Patel, 2020). According to the World Health Organization (WHO), an estimated 1.7 billion people lack access to basic sanitation services (WHO/UNICEF JMP for WASH, 2024). In slums, the high cost of menstrual products and low levels of awareness force a considerable number of women to adopt unhygienic alternatives, such as old clothes, to absorb the menstrual flow, may increase their risk of serious health complications, such as infections and cervical cancer (Singh et al., 2023). Poor menstrual hygiene is associated with limitations on daily activities, which lead to psychological stress (Handy et al., 2022). Again, access to facilities, socio-cultural norms, and knowledge about menstruation are large determinants of the practice of hygiene during menstruation (Karout, 2015; Lawan et al., 2010; Mahon & Fernandes, 2010). Socioeconomic and demographic factors also play a vital role in this context (Garg et al., 2022; Sarkar et al., 2017), and in many developing countries, especially in rural regions, a considerable proportion of women tend to follow unhygienic menstrual practices (Kuhlmann et al., 2017).

In Bangladesh, a South Asian country, limited menstrual education, cultural beliefs and inadequate sanitation facilities create barrier for women and girls in managing MHH. A national hygiene survey reported that 30% of women in this country had no prior knowledge of menstruation before their first menstruation, and only 6% of schools provide menstrual hygiene education (Bangladesh Bureau of Statistics, 2020). In the

wake of these challenges, following the hygiene surveys in 2014 and 2018, Bangladesh has made giant strides in addressing MHH education through policy initiatives (Jahan et al., 2024; Khan et al., 2023; Murshid et al., 2023). The inclusion of MHH in the National Curriculum 2016, besides the Water and Sanitation Sector Development Plan (2011-2025), shows commitment from the country to better menstrual hygiene education and Water, Sanitation and Hygiene (WASH) facilities (World Bank, 2015). These initiatives enhance menstrual education, reduce school absenteeism, and promote proper hygiene management (Jahan et al., 2024). However, despite these achievements, cultural beliefs surrounding menstruation often viewing as a private and taboo topic leads to secrecy and embarrassment, making many women and girls feel uncomfortable discussing it openly (Alam et al., 2017; Castro & Czura, 2025; E. C. Hunter et al., 2022; Khan et al., 2023; Zaman et al., 2024). Washing genital area after menstruation, urination, or defecation is deeply rooted in cultural norms, with most people using water for cleansing rather than toilet paper, both at home and in public facilities (Sultana et al., 2022). However, our previous study found that the choice of menstrual products among nursing students is influenced by parental education, as well as embarrassment and sanitation facilities (Zaman et al., 2024). Limited access to affordable and hygienic menstrual products lead to poor menstrual hygiene (Chandra-Mouli & Patel, 2020). For example, the inexistence of gender sensitive sanitation facilities, even at the school and public spaces levels, only adds up to what stands in the way of the required safe menstrual management. This forces many women and girls to manage their menstrual blood in unsafe ways. Most research on menstruation has predominantly focused on adolescent girls, offering a gendered perspective that highlights societal stigma, including embarrassment, misconceptions, inadequate facilities in educational institutions, and familial restrictions that contribute to school absenteeism (Alam et al., 2017; Hennegan & Sol, 2020).

There is a significant gap in research on MHH among adult women, particularly those in specialized fields such as nursing students. Nursing students receive formal education and training in reproductive health, equipping them with structured knowledge about MHH. This sets them apart from the general population of young women, as they hold a dual role—not only as learners but also as future healthcare providers. With the potential to become advocates and educators in menstrual health, their perspectives offer valuable insights into how their education shapes their understanding of MHH. However, despite their medical training, cultural norms and personal experiences may still influence their perceptions and practices, creating gaps between learned knowledge and lived experiences. Exploring these gaps is crucial to identifying areas for improvement in both nursing education and menstrual health programs. Additionally, understanding their views can provide a foundation for enhancing MHH education and advocacy efforts in healthcare and community settings, ultimately strengthening menstrual health support systems. It will look at both the emotional and practical challenges concerning MHH that nursing students experience and is, thus, concentrated on menstrual education, product selection, and disposal practices.

3.3 Methods

3.3.1 Study design

An exploratory and descriptive research design was employed in the study (D. J. Hunter et al., 2019). This approach allowed for a thorough exploration of the lived experiences and perceptions (Churchill, 2022) of nursing students' regarding MHH. The exploratory nature of the research was crucial in revealing the wide range of experiences and perspectives, while the descriptive component ensured a detailed and nuanced account of these experiences (Shorey & Ng, 2022). This approach further enriched the

study by focusing on the essence of these experiences, uncovering the deeper meanings. that nursing students experience MHH. Both Focus Group Discussions (FGDs) and In-Depth Interviews (IDIs) were utilized to collect data. The use of FGDs facilitated interactive discussions among participants, enabling them to share and reflect upon their experiences collectively. This group setting helped uncover shared norms, beliefs, and social dynamics within the student community. On the other hand, IDIs offered a private and confidential environment for participants to delve deeper into personal or sensitive issues they might be reluctant to discuss in a group. Combining FGDs and IDIs ensured a comprehensive understanding of the research topic from collective and individual perspectives.

3.3.2 Study setting

The study was conducted in four districts, Dhaka, Rajshahi, Naogaon, and Satkhira across three regions of Bangladesh: Dhaka, Rajshahi, and Khulna. We selected these three regions, including the capital city, representing diverse social, cultural, and economic backgrounds. Each district in these regions has a nursing college. Seven government nursing colleges among thirty-eight colleges within these regions were purposefully chosen to represent the nursing students living in improvised urban circumstances refer to low-income, resource-constrained urban settings. Government nursing colleges were chosen as representative institutions for studying sensitive issues like menstruation among adult women, as they provide greater accessibility compared to other institutions.

3.3.3 Data collection

The research team, including the first author, and six research assistants collected data between June and July 2023. The first author trained and re-trained research assistants, focusing on the principles of qualitative data collection, the use of interview

guides, and ethical considerations. Participants were eligible if they were nursing or midwifery students, aged 18 years or older, had experienced menarche but not menopause, and had a recent menstruation (within the last three months). For participant recruitment, purposive sampling was employed for the FGDs, while convenience sampling was used for the IDIs. For the FGDs, we selected three participants from each site, ensuring that participants from the seven colleges were grouped together. This resulted in three FGDs, each consisting of seven participants, for a total of 21 participants (n= 21). A student at each study site identified and approached potential FGDs participants on behalf of the research team. They provided detailed written information, addressed initial queries, and confirmed eligibility. A mutually convenient time and date were then arranged for the FGDs, which took place in a private room at the respective site. The interview duration was 77–92 minutes for each group. For the IDIs, we selected two participants from each site, separate from those in the FGDs, resulting in a total of 14 participants (n=14). Participants were initially approached in their college, followed by a phone call to schedule the interview. The face-to-face interview duration was 47-73 minutes for each participant. The content of the FGDs and IDIs guides was informed by the study conducted by Boyers et al., 2022 and further developed by the research team [*Annexure file 3*]. The FGDs and IDIs topic guides opened with the question: "Can you tell me about yourself and your surroundings? Can you explain what menstruation means to you?" This question was designed to initiate discussion on menstruation and allow participants to express their initial thoughts. Both the FGDs and IDIs topic guides covered three key thematic areas. First, fear and confusion during first menstruation examined participants' initial reactions, sources of menstrual knowledge, and emotional responses. Second, barriers to menstrual product accessibility focused on preferences, affordability, availability, and cultural restrictions. Lastly, challenges in menstrual

hygiene management addressed difficulties in accessing changing and washing facilities, along with challenges in product disposal. The session concluded with an invitation for participants to share their opinions on potential changes they would like to see regarding menstrual management.

3.3.4 Data Analysis

All FGDs and IDIs were digitally recorded and transcribed verbatim by the first authors. The original data were in Bengali, and after transcription, they were translated into English. The interviewer or moderator reviewed each transcript to ensure its accuracy and completeness, particularly for assigning participant numbers where needed in the FGDs. In analyzing the data, efforts were made to ensure rigor from four perspectives: credibility, confirmability, dependability, and transferability (Lincoln & Guba, 1985).

Credibility was ensured through the triangulation of researchers. The first author was present in each interview and responsible for coding the data independently. MAXQDA2023 software was used to facilitate the coding process and ensure that the data were represented as accurately as possible. Verbatim quotes were included throughout the analysis to maintain the authenticity of participants' voices and perspectives. The results and interpretations were shared with the participants for feedback, and consensus was achieved through member checking. Additionally, member checks were conducted, whereby the first author summarized the participants' responses multiple times during the interviews, culminating in a final summary at the end of each session to verify the accuracy of the data and interpretations.

Confirmability was established through a systematic and transparent decision-making process, which followed the six-step thematic analysis framework (Braun & Clarke, 2006, 2022). An audit trail was maintained, documenting all decisions, including

raw data, field notes, coding processes, and related literature. The research team engaged in peer debriefing, where all interpretations were critically discussed and reviewed. Feedback from other authors helped ensure that personal perspectives did not unduly shape the data interpretation.

Dependability was achieved by employing a multi researcher coding strategy. Three researchers independently coded the transcripts and later compared their results. Discrepancies between codes were addressed through discussions with a fourth researcher experienced in qualitative methods. These discussions continued until consensus was reached, ensuring that the data interpretation remained consistent and reliable. To further solidify dependability, the coding process was revisited multiple times, and the resulting themes were reviewed against the raw data to ensure they accurately reflected participants' perspectives.

Transferability was considered by providing rich, detailed descriptions of the participants, their contexts, and the research environment. This information allows other researchers or practitioners to assess the relevance of the findings in different settings. The level of detail in the methods and results sections is intended to enable readers to evaluate the potential applicability of the study’s outcomes in their own contexts. The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist was used to ensure the quality of research reporting (Tong et al., 2007).

3.3.5 Research Team and Reflexivity

The first author, a registered nurse and senior staff nurse with 8 years of clinical experience, may have had an impact on the study's results. Positively, participants might have felt more at ease sharing their experiences, knowing the researcher shared their professional background. However, as a male, the first author's gender and position could have influenced discussions on topics specific to female nursing students, such as MHH

barriers. To mitigate this, interviews were conducted by female research assistants, all of whom were experienced nurses and midwives. Despite this effort, there remained the possibility that the first author could have interpreted the participants' responses through his own perspectives, potentially missing important insights. To address this, the second author, a Ph.D. in nursing, occupational therapist, senior lecturer, and expert in qualitative research and rehabilitation science, was included. Although both the first and second authors had limited prior experience in MHH research, this allowed them to approach the participants' experiences without preconceptions or biases. However, this lack of specific expertise might have made it challenging to fully grasp the nuances of the participants' experiences. To strengthen the study, the third author, a Ph.D., assistant professor and experienced researcher in WASH and MHH, was included. The fourth author, a Ph.D., professor of health sciences and a human ecologist and WASH expert, served as the study's supervisor. The second, third, and fourth authors contributed to developing the interview guide, guiding the coding process, and reviewing the data analysis and summary of the results and discussion. This collaborative approach ensured that diverse perspectives informed the research process.

3.3.6 Ethical considerations

This study and research tools gained ethical approval from Ethical Review Committee of the Faculty of Health Sciences, Hokkaido University in Japan (23-52), Directorate General of Nursing and Midwifery, Dhaka (45.03.0000.008.14.097.2021-354), and NIANER, Dhaka (NIA-OS-2023-09). The first author and the research team obtained informed consent from all participants before conducting each IDIs and FGDs. Participants were given an information sheet and a consent form, and they provided written signature to confirm their consent.

3.4 Results

3.4.1 Participant characteristics

A total of 35 nursing students including midwifery aged 19- 38 years participated in the study, 14 (mean 26.21 ± 5.52) of whom contributed to IDI and 21 (mean 26.1 ±4.75) to FGD (Table 14). Regarding marital status, half of the participants are single in the IDI, and almost half in FGD. Among the students, the IDI comprises 29% Master of Science (M.Sc.) in Nursing students, 43% Bachelor of Science (B.Sc.) in Nursing students, and 29% B.Sc. in Midwifery (Post Basic) students, while the FGD has 29% M.Sc. in Nursing students, 38% B.Sc. in Nursing students, and 33% B.Sc. in Midwifery (Post Basic) students. The majority of participants practiced Islam (77%), while a smaller portion followed Hinduism (23%). In terms of birthplace, 60% came from urban areas, whereas 40% were from rural regions. Most participants were single (69%), while 31% were married. When looking at the economic background, more than half (54%) belonged to families with a monthly income between 200-300 USD, while 26% came from households earning less than 200 USD, and 20% had a family income above 300 USD per month. In terms of clinical experience during hospital placements, nearly half of the participants (48%) had 2 to 4 years of experience, followed by those with over 4 years (26%) and below 2 years (26%).

Table 14 Characteristics of the participants (N= 35)

Variables		IDI (N=14) n (%) or M±SD	FGD (N= 21) n (%) or M±SD	Total (N=35) n (%) or M±SD
Age		26.21 ± 5.52	26.1 ± 4.75	26.14 ± 5
Marital status	Single	7 (50)	10 (48)	17 (49)
	Married	7 (50)	11 (52)	18 (51)
Course name	M.Sc. in Nursing	4 (29)	6 (29)	11 (31)
	B.Sc. in Nursing	6 (43)	8 (38)	13 (38)
	B.Sc. in Midwifery (Post Basic)	4 (29)	7 (33)	11 (31
Religion	Islam	11 (79)	16 (76)	27 (77)
	Hinduism	3 (21)	5 (24)	8 (23)
Birthplace	Urban	8 (57)	13 (62)	21 (60)
	Rural	6 (43)	8 (38)	14 (40)
Marital status	Single	9 (64)	15 (71)	24 (69)
	Married	5 (36)	6 (29)	11 (31)
Monthly family income	Below 200 USD*	4 (29)	5 (24)	9 (26)
	200-300 USD	7 (50)	12 (57)	19 (54)
	Above 300 USD	3 (21)	4 (19)	7 (20)
Clinical experience in hospital	Below 2 years	3 (21)	6 (29)	9 (26)
	2-4 years	6 (43)	11 (52)	17 (48)
	Above 4 years	5 (36)	4 (19)	9 (26)

**USD= United States Dollar*

3.4.2 Thematic analysis findings

Through analysis of the interview data, 03 themes with 08 subthemes and 459 codes emerged. In the FGDs, individual participants were identified using the label (e.g., P1, P2) to represent each person. The themes and subthemes are listed in Table 15.

Table 15 Themes and Subthemes of Menstrual Information, Product Selection and Disposal Among Female Nursing Students

Themes	Subthemes
Fear and confusion during first menstruation	1.1 Feeling during first menstruation
	1.2 Confusion surrounding menstrual onset
Barriers to menstrual product accessibility	2.1 Preferences and accessibility
	2.2 Economic barriers
	2.2 Social barriers
Challenges in menstrual hygiene management	3.1 Inadequate product change facilities
	3.2 Inadequate washing facilities
	3.3 Inadequate disposal practices
	3.4 Emotional impact

3.4.2.1 Fear and confusion during the first menstruation

Participants' narratives from both IDIs and FGDs revealed negative perceptions of menstruation, with many describing their experiences primarily as marked by fear and confusion. Additionally, female family members and friends were the main source of menstrual information and assurance by the female family members. The encumbrance comprised three key aspects: feeling during first menstruation; source of information; and the assurance for menstruation.

We found that menstrual preparedness was not timely, resulting in significant challenges for every participant. The majority of the participating nursing students (71%) reported that they did not know about menstruation before its onset. The experience of first menstruation was often accompanied by a range of intense emotions, primarily fear and confusion. Many participants recalled their first encounter with menstruation as a bewildering and frightening experience due to a lack of prior knowledge and preparation.

"When I had my 1st menstruation, I actually didn't know about it beforehand. For which I am very afraid. I worried a lot about it (IDI 1)"

"When I had my 1st menstruation, I didn't know about it beforehand. (IDI 14)"

"The first day I got my menstruation, I didn't understand what was happening to me, my blood flowed up to my leg, I didn't understand (IDI 5)"

"I did not understand what was happening to me, I realized that my blood was rushing to my feet (IDI 8)"

"I was very scared (IDI 6)"

"I was scared when I first got my menstruation (IDI 4)"

The initial knowledge about menstruation for many participants came predominantly from female family members, particularly mothers. Most (71%) were

unaware of menstruation before their first menstruation and only learned about it after their first menstruation. They were scared during their first menstruation because they hadn't known about it beforehand. Mothers remained their primary source of menstrual information, while schoolgirl friends were rarely mentioned. This indicates the crucial role that mothers play in educating their daughters about menstrual health.

"My mother first told me about it (IDI 5)"

"I learned about them from my mother (IDI 12)"

"I first heard it from my mother, then at school from a friend (IDI 8)"

"First, I heard from my school friends and was very scared (IDI 9)"

"I was scared when I first heard from my girlfriend (IDI 10)"

Receiving reassurance and support during the first menstruation was critical for alleviating fear and confusion. Many participants found comfort and understanding from their mothers and other female family members like sisters, who provided explanations and guidance.

"I received emotional and mental support during my first menstruation only from one woman, my mother (FGD1, P 5)"

"When the 1st happened, my mother helped me, explaining that it happens to girls from adulthood (IDI 4)"

"My mother explained everything to me, and I gradually became convinced. Initially, I had a different understanding, but over time, my perspective and feelings have positively changed (IDI 3)"

"My elder sister understands the matter and she tell everything about this, how to manage what (IDI 14)"

3.4.2.2 Barriers to menstrual product accessibility

Participants across both FGDs and IDIs reported a strong preference for sanitary pads. As health care professionals they used old clothes when they grew up but now a days, they usually use sanitary pads.

"I always use sanitary pads (IDI 11)"

"As I am a midwife, I also use pads as I understand this (FGD 3, P7)"

"I used to use cloth when I grew up but now, I use pads (IDI 10)"

This preference for pads was influenced by their familiarity and perceived reliability. However, some participants mentioned that they reverted to traditional methods when pads were unavailable.

"If there is no pad, I often use cloth or tissue (IDI 6)"

Additionally, there was a lack of awareness and exposure to alternative menstrual products, such as menstrual cups.

"I heard about menstrual cups a few days ago. I have never seen it. (FGD 2, P3)"

Most participants acquired menstrual products from pharmacies, primarily those located in town, indicating that these are the primary sources. However, there were no pharmacies within the hospital premises.

"I am buying sanitary products from a pharmacy (IDI 3)"

"I am buying pads from a pharmacy (IDI 9)"

"I am taking pads from the pharmacy (IDI 13)"

Some participants also mentioned cosmetics stores as an alternative source.

"Available from pharmacies and cosmetics stores (FGD 1, P4)"

Many participants said that the prices were beyond their financial reach. The increasing cost of menstrual products poses a significant barrier to accessibility, especially for those from lower socioeconomic backgrounds.

"The price of the product is very high. Many have that beyond their purchasing power (IDI 2)"

"Now its price is increasing day by day (IDI 11)"

"Currently they are very expensive (IDI 14)"

"It doesn't seem cost effective to me at all. Because it is actually very difficult to buy for middle class families or lower-class families (IDI 5)"

Several participants reported feeling ashamed or embarrassed when purchasing sanitary products, especially in the presence of male individuals. This sense of shame can hinder women from purchasing the products they need, further complicating access to menstrual hygiene.

"I feel ashamed when a young male salesman or a male acquaintance was present in the pharmacy while I'm purchasing sanitary products, and sometimes I leave without buying them (FGD 3, P 3)"

"I feel embarrassed in-front of my father, or any male relatives were present in the pharmacy while I'm purchasing sanitary products (FGD 1, P1)"

Another concern raised was the physical accessibility of shops that sell menstrual products. Some participants highlighted the inconvenience of traveling to distant shops. This indicated a need for more convenient access to menstrual products, such as availability within residential areas or institutions like hostels.

"Shops are far away so it's a bit of a problem. It would be great if they were available at the hostel (IDI 8)"

3.4.2.3 Challenges in menstrual hygiene management

The participants indicated that washrooms and toilets were the primary locations for changing menstrual products, largely influenced by the availability of facilities. In Bangladesh, washrooms typically consist of a toilet, basin, and bathing facilities. Therefore, these spaces were the main choices for changing menstrual products due to their comprehensive amenities.

"Normally we change in washroom (IDI 9)"

"Most of the time I change in the toilet (IDI 4)"

When at home, participants preferred changing pads immediately when they became full or they started feeling discomfort, highlighting the comfort and convenience of home environments. But outside even in college they were unable to change it

"When I am at home, I change immediately. But I can't change it outside (IDI 8)"

However, outside the home, especially in hostels or public places, the frequency and immediacy of changing menstrual products were affected. They often became late in changing their menstrual products due to the lack of proper disposal facilities. In many places, there were simply no disposal facilities available.

"If I am in the hostel, I change it but if I am outside, it is late (IDI 11)"

"Although there is a public toilet outside, there is no disposal facility (IDI 12)"

Washing practices varied among the participants, often depending on the availability of water, soap, and other cleaning agents. Most of the participants washed themselves with normal water and soap after each product changes and used tissues to clean. Some went a step further and used detergent or Savlon (disinfectant) in addition to soap. However, there were times when soap was not available, and in those instances, they resorted to using only water for washing.

"After each change, wash with normal water and clean with a tissue and use a new pad (IDI 12)"

"During menstruation, I usually use warm and clean water and use soap or detergent and Savlon (IDI 2)"

"Wash immediately after each change. Sometimes I just wash with water when there is no soap (IDI 6)"

While washing facilities at home were generally adequate, hostile environments pose significant challenges. One of the primary issues was the lack of a separate place for drying washed clothes. This highlights the need for improved facilities in hostels to support menstrual hygiene practices.

"Wash the clothes with soap or detergent. There is no problem at home but there is a problem in the hostel. There is no separate place for drying (IDI 6)"

Disposal of used menstrual products was a significant concern among the participants. Many reported the absence of proper disposal facilities. The lack of bins was a major concern, as it prevents women from properly disposing of their used pads. Additionally, the shared bathrooms used by both men and women create an uncomfortable environment for women to discard their pads discreetly. These statements underscored the lack of adequate disposal facilities, and the uncomfortable, unhygienic conditions faced by female participants.

"There is no place to drop the used pad (FGD1, P7)"

"There is no good changing system or there is no bin to throw the dirt or pad that we use, or it is not disposed of in front of everyone and the cleaning area is not clean either. Also, many times a bathroom is used by both boys and girls, there is no such environment for a girl to drop her pad (FGD 3 P2)"

As a result, some women resorted to wrapping used pads in polythene or paper and disposing of them later when they are outside. These practices not only caused inconvenience but also posed potential health risks due to improper disposal, leading to an unhygienic environment, bacterial growth and unpleasant odors.

“Wrap the pads in polythene when I was in outside and throw them in the hostel dustbin after coming back from outside (IDI 7)”

“I wrap it in a paper or some paper and throw it in the dustbin which is dirty (IDI 10)”

Menstruation had a significant emotional impact on nursing students. Balancing clinical responsibilities while managing menstruation presented both emotional and practical challenges. Many students experienced embarrassment and anxiety, particularly in professional settings where they had to handle menstruation discreetly. The pressure to maintain professionalism often forces them to endure discomfort in silence, fearing judgment from peers, instructors, and male nursing students as well as male health care staff.

"During my clinical placement, I had to change my pad, but I was too embarrassed to ask for a break. I kept waiting until my shift ended, and by then, I was feeling so uncomfortable that it was hard to focus on my duties (IDI 5)”

"Even though we are training to be healthcare providers, menstruation still feels like a taboo topic. I hesitate to talk about menstrual pain or discomfort because I don’t want to be seen as weak (FGD 2)”

"Once, I stained my uniform during class. I was so ashamed that I couldn’t concentrate for the rest of the day. I had to sit still; afraid someone male would notice (IDI 3)”

"There is no proper disposal system in the hospital restroom, so I had to carry my used pad in my bag until I got home. It was stressful because I didn't want anyone to find out (FGD 4)"

3.5 Discussion

The findings from this qualitative research on menstrual information, product selection, and disposal among female nursing students in Bangladesh provide important insights into these students' complex challenges. The pervasive influence of social stigma, embarrassment, and insufficient infrastructure mirrors patterns identified in other Low- and Middle-Income Countries (LMICs), where cultural norms, inadequate facilities, and limited access to menstrual health resources exacerbate the difficulties of managing menstruation (Hennegan et al., 2019; S. F. Shah et al., 2023).

Most menstrual information is passed down informally from female relatives, primarily mothers and sisters. This mode of education, though common, is often incomplete and lacks accuracy. The participants, who are specialized healthcare provider nursing students, reported that their primary source of knowledge about menstruation was their families, rather than formal education in school before the national curriculum was reformed. Many students grow up with inadequate or incorrect knowledge about menstrual health, perpetuating harmful taboos and misinformation (WHO/UNICEF JMP for WASH, 2024). Similar findings have been noted in other studies, where young girls and adolescents are left with minimal understanding of menstruation, reinforcing societal stigmas (S. F. Shah et al., 2023; V. Shah et al., 2019). In these cases, cultural beliefs take precedence over scientific understanding, further embedding myths and misconceptions into the students' knowledge base. This gap in formal menstrual education not only

stigmatizes menstruation but also deepens the feelings of shame and embarrassment that women experience.

Another significant challenge identified in this study is the reluctance of students to purchase menstrual products in the presence of male shopkeepers or male relatives. The deep-rooted embarrassment and fear of judgment prevent many women from acquiring necessary menstrual supplies, a phenomenon observed in several other LMICs (McMahon et al., 2011). This reluctance to access male-dominated spaces reflects the broader societal stigma attached to menstruation, which often leaves women without safe, accessible ways to manage their menstrual health. The need for discreet, female-friendly spaces to obtain menstrual products is critical, as the lack of such space's limits women's autonomy and control over their own health needs.

The psychological burden associated with menstruation was further highlighted by the students' reluctance to dispose of used menstrual products in public areas, especially when men are present. This finding reflects the emotional strain that menstruation places on these women, often leading to anxiety and stress (Betsu et al., 2023). The emotional toll of managing menstruation in secret, compounded by the fear of public embarrassment, can have long-term effects on mental health. This burden is especially pronounced for students in professional and academic environments, where the pressure to conceal menstruation can interfere with their ability to focus and perform. Similar to research in different regions, which linked menarche with increased anxiety due to societal pressures (Sommer, Ackatia-Armah, et al., 2015). Our findings emphasize the emotional impact of menstruation in Bangladesh, particularly for nursing students who are expected to balance their professional responsibilities with managing a highly stigmatized bodily process.

The inadequate disposal facilities reported by the students poses another significant challenge. The practice of wrapping and carrying used menstrual products until they can be discreetly disposed of in hostel bathrooms highlights the lack of appropriate infrastructure. This inconvenience not only reinforces the secrecy surrounding menstruation but also adds to the mental and physical discomfort experienced by the students. Similar disposal challenges have been reported in schools across LMICs, where the absence of private, sanitary spaces creates distress and anxiety among menstruators (UNICEF, 2019). Furthermore, the absence of proper WASH facilities exacerbates the difficulties of managing menstruation, particularly in public and educational institutions, making it harder for women to maintain hygiene and dignity (Hennegan et al., 2019; Winter et al., 2022).

Privacy emerged as a crucial aspect of menstrual management in this study. Participants emphasized the need for private and safe spaces where they can manage their menstruation with dignity, both in hostel settings and in public spaces. This aligns with other research, which underscores the importance of private areas where women can change menstrual products, bathe, wash reusable products, and dry them in a sanitary environment (H. Parker et al., 2014; Marni Sommer, 2012; Schmitt et al., 2017). The lack of such facilities contributes to a cycle of shame, secrecy, and poor menstrual hygiene practices. Ensuring the availability of private, hygienic spaces for menstrual management is essential for preserving the dignity and well-being of menstruators, particularly in institutional and public settings (Jahan et al., 2024).

3.5.2 Policy Implications

The findings from this study underscore the critical need for comprehensive menstrual health education programs that go beyond the family context and are integrated into formal education systems. Ensuring that students receive accurate and timely

information about menstruation is essential in breaking down the barriers of stigma and embarrassment (Sobudula & Naidoo, 2024). This should include training for healthcare professionals and educators to provide culturally sensitive and factually correct menstrual health information.

Additionally, our findings indicate a pressing need for improved WASH facilities, particularly in educational institutions. Schools and universities should provide safe, private spaces equipped with disposal systems, water, and soap to ensure that menstruators can manage their menstruation with dignity. This aligns with the broader global recognition of menstrual hygiene management as a fundamental human right, as declared by the United Nations (UNICEF, 2019). Policies that promote the development of gender-sensitive infrastructure, including separate facilities for menstruators and non-menstruators, will be crucial in addressing the practical challenges identified in this study.

3.6 Limitations

This study has several limitations. Firstly, we did not use theoretical sampling, as our focus was on exploration and description rather than theory development (Polit & Beck, 2021). However, purposive and convenience sampling provided valuable insights from a diverse group of participants (Polit & Beck, 2021). Secondly, gender of the first author, a male researcher, which could have influenced participants' comfort levels in discussing intimate topics like menstruation. Despite the involvement of female research assistants in conducting the interviews, some participants may have still felt hesitant to fully disclose their experiences due to the gender dynamics. Lastly, the participants' experiences of menarche are based on retrospective recollections, often from ten or more years ago. Their past experiences may not fully reflect the current realities of adolescent

menstrual health. Given that national MHH policies and awareness initiatives have evolved over the past decade, these findings may not provide a comprehensive representation of contemporary menstrual health experiences. The participants were asked to recall their experiences with MHH practices and respond to questions during the interviews. Since all participants had a strong interest in MHH, the responses were largely positive, which may have influenced the overall findings.

3.7 Conclusion

This study highlights the complex challenges nursing students in Bangladesh face regarding MHH, deeply influenced by cultural stigma, inadequate facilities, and limited access to menstrual products. It reveals that informal education from mothers and female relatives, while common, often lacks accuracy and perpetuates misconceptions about menstruation. Sanitary pads were the preferred menstrual product, but the embarrassment of buying products in front of males often made purchasing them difficult and they used old clothes. The absence of appropriate disposal facilities further complicates menstrual management and embarrassment in managing menstruation in public was a significant concern. The findings underscore the urgent need for comprehensive menstrual education within formal curricula and improvements in WASH infrastructure, particularly in educational institutions, to support dignified MHH.

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CHAPTER 4

Understanding Barriers to Menstrual Health and Hygiene: A Mixed-Methods Study on Knowledge, Economics, and WASH Challenges among Nursing Students in Bangladesh

4.1 Abstract

Menstrual health and hygiene (MHH) remain stigmatized and neglected in low- and middle-income countries like Bangladesh due to cultural taboos, poor infrastructure, and limited education. This study examines how knowledge, socioeconomic background, and WASH facilities influence key MHH indicators. A convergent parallel mixed-methods design was used between December 2024 and January 2025. A survey of 370 students from seven public nursing institutions assessed MHH indicators. In parallel, six focus group discussions with 42 students (21 males, 21 females) explored gendered experiences and barriers. Quantitative data were analyzed using descriptive statistics and multivariable logistic regression in JMP Student Version 18, with $P < 0.05$ considered statistically significant; qualitative data were analyzed thematically using MAXQDA 2024. The study found significant disparities in MHH based on program level, maternal education, income, and rural background. Students from higher-income families and advanced programs had better access to knowledge and materials, while those from rural areas and with less-educated parents faced greater challenges. Qualitative findings highlighted gaps in early education, economic barriers, product-related shame, emotional distress, and inadequate WASH facilities. Male students showed both limited awareness and growing empathy. Nursing students with a health

education background continue to experience gendered menstrual challenges due to limited menstrual education, low economics status, and poor WASH support. Engaging both male and female students is key to fostering menstrual dignity and advancing reproductive health equity.

Keywords *Menstrual health and hygiene, Gendered perspectives, Students, Mixed methods, Bangladesh*

4.2 Introduction

Menstrual Health and Hygiene (MHH) are increasingly recognized as a critical component of public health, gender equity, and human rights (Hennegan et al., 2021). Despite growing international advocacy and policy attention, menstruation remains shrouded in stigma, misinformation, and infrastructural neglect particularly in Low-and Middle-Income Countries (LMICs), where access to safe, affordable, and culturally appropriate menstrual materials and sanitation facilities is often limited (Chandra-Mouli & Patel, 2020; UNICEF, 2019). In this context, MHH indicators such as access to adequate menstrual materials, knowledge and education, Water, Sanitation and Hygiene (WASH) facilities, social support, and the ability to manage pain and emotional discomfort serve as measurable benchmarks to assess the quality and inclusiveness of menstrual health systems (Hennegan et al., 2022). In South Asia, including Bangladesh, these challenges are compounded by deeply entrenched social norms that frame menstruation as a source of shame and impurity, contributing to inadequate knowledge, restricted mobility, and poor menstrual hygiene practices (Aziz et al., 2024; Nurunnahar et al., 2025; Zaman et al., 2024).

Recent studies have begun to illuminate the emotional and practical burdens that menstruators face, including fear and confusion at menarche, discomfort in accessing

products, and the absence of safe, private spaces for menstrual management (Harerimana et al., 2025; Maulingin-Gumbaketi et al., 2022). Bangladesh presents a particularly urgent context for such investigations. The country has implemented policy reforms, including the incorporation of MHH into the 2016 National Curriculum, and the implementation of the Water and Sanitation Sector Development Plan (2011–2025) is not consistent (Bureau, 2020; World Bank, 2015). Despite formal training in reproductive health, many nursing students still face suboptimal menstrual practices due to inadequate sanitation, embarrassment, and gendered misinformation, with factors like parental education, poor infrastructure, and emotional discomfort shaping their product choices and disposal behaviors (Zaman et al., 2025; Zaman et al., 2024). However, much of the related research has focused narrowly on adolescent schoolgirls, with limited attention given to young adult women in health-related disciplines, particularly nursing students. These students play a dual role: not only as menstruators but also future healthcare providers responsible for delivering sexual and reproductive health education and care.

Understanding how their menstrual experiences intersect with their educational and professional trajectories is essential for informing more inclusive and contextually relevant MHH policies (Bobel et al., 2020; Mahon & Fernandes, 2010). However, there remains a critical gap in the understanding of how gender dynamics further shape these experiences. Although male nursing students are not biologically affected by menstruation, they often lack menstrual education and may hold stigmatizing views due to societal silence on the topic (Khan et al., 2023; van Lonkhuijzen et al., 2023). Moreover, female students continue to report secrecy, emotional burdens, and social restrictions, suggesting that formal education alone is insufficient to dismantle deeply rooted menstrual stigma (Zaman et al., 2025; Sommer et al., 2015). Investigating these

gendered perspectives is essential for designing gender-sensitive interventions that can transform not only knowledge but also attitudes and behaviours among future healthcare providers.

To address this underexplored area, the present study examines key MHH indicators and how knowledge, socioeconomic background, and WASH facilities influence MHH among nursing students in Bangladesh. By employing a mixed-methods approach, this research aims to generate an in-depth understanding of the menstrual experiences, perceptions, and needs of both male and female students within the nursing education system. This study contributes to a more holistic understanding of menstruation in health education contexts and offers evidence for policy, curriculum, and infrastructure reform to promote menstrual justice and gender equity in nursing education and beyond.

4.3 Methods

4.3.1 Study Design

This study employed a convergent parallel mixed methods design to investigate MHH practices, experiences, and gendered perceptions among nursing and midwifery students in Bangladesh. In this approach, both quantitative and qualitative data were collected concurrently but analysed independently. The results from both strands were then integrated during the interpretation phase to offer a comprehensive understanding of the research problem (Dawadi et al., 2021). The quantitative component involved a structured cross-sectional survey to measure the MHH indicators and the sociodemographic effects. The qualitative component utilized focus group discussions (FGDs) with both male and female students to explore nuanced, gendered perspectives, including stigma, coping mechanisms, and sociocultural barriers. This mixed-methods

design allowed for the triangulation of findings and provided depth and breadth in understanding the multifaceted experiences of menstruation in a gender-segregated and resource-constrained educational context.

4.3.2 Study Setting and Population

The study was conducted across seven government nursing and midwifery colleges located in four districts of Bangladesh: Dhaka, Rajshahi, Naogaon, and Satkhira. These sites were strategically chosen to ensure representation from different administrative divisions (Dhaka, Rajshahi, and Khulna), providing diversity in socioeconomic, infrastructural, and cultural contexts. The study population consisted of full-time students aged 18 years and older who were enrolled in recognized nursing and midwifery programs and had experienced menarche. Participants were eligible if they had menstruated within the past three months, ensuring the relevance of self-reported menstrual experiences. For the qualitative strand, both male and female students were included to capture a holistic, gendered understanding of MHH.

4.3.3 Sampling Strategy

4.3.3.1 Quantitative Sampling

A total of 370 participants were recruited via stratified random sampling. Strata were created on the basis of institution, year of study, and academic discipline (nursing or midwifery). Proportional allocation ensures that each stratum contributes to the final sample in accordance with its population size. The sample size was calculated via Cochran's formula for proportions (Cochran WG, 1977), assuming a 50% prevalence rate to maximize variability, with a 95% confidence level and 5% margin of error. The final number was adjusted for finite population correction and an estimated 10% nonresponse rate.

4.3.3.2 Qualitative Sampling

For the qualitative strand, 42 participants (21 males, 21 females) were purposively selected on the basis of diversity in academic year, socioeconomic background, and region. The participants were distributed into six FGDs (three male groups and three female groups), with each group comprising 7 individuals. This group size facilitates rich interaction while maintaining manageable dynamics for in-depth d

Figure 6 Study Participants

4.3.4 Data collection procedures

4.3.4.1 Quantitative Data Collection

The structured survey was developed by adapting the shortlist of priority MHH indicators (Hennegan et al., 2023), which was specifically designed to standardize national and global MHH monitoring [*Annexure file 4*]. The questionnaire covered domains such as material adequacy, menstrual knowledge, pain and emotional management, privacy and sanitation access, and educational exposure to menstruation. The tool was translated into Bangla, followed by back-translation to ensure conceptual equivalence. The data were collected through face–to–face interviews conducted by trained research assistants in private rooms within college premises between December 2024 and January 2025.

4.3.4.2 Qualitative Data Collection

The FGD guides were developed on the basis of previous studies in similar contexts (Chidya et al., 2024; Zaman et al., 2025) [*Annexure file 3*]. The female FGDs explored firsthand menstrual experiences, product choices, emotional burdens, social taboos, and coping strategies . In contrast, the male FGDs focused on perceptions, misinformation, social attitudes, and readiness to support peers. All FGDs were conducted in Bangla, audio-recorded with participants' consent, and lasted approximately 70–90 minutes. Sessions were facilitated by gender-matched moderators, female facilitators for female FGDs and Male facilitators for the male to minimize response bias and foster participant comfort. The transcripts were transcribed verbatim and subsequently translated into English for analysis.

4.3.5 Data analysis

4.3.5.1 Quantitative analysis

The data were entered and analysed via JMP Student Version 18 (SAS Institute Inc.). Descriptive statistics (frequencies, percentages, means, standard deviations) were calculated for all the variables. Bivariate analyses via Pearson's chi-square test were used to assess associations between sociodemographic characteristics and MHH indicators. To control for potential confounders, multivariable logistic regression models were constructed for each key MHH indicator. Variables with $p < 0.2$ 0 in bivariate analyses were entered into the final models. The results are reported as adjusted odds ratios (AORs) with 95% confidence intervals (CIs). Statistical significance was defined as $p < 0.05$.

4.3.5.2 Qualitative Analysis

Qualitative data were analysed via thematic analysis guided by Braun and Clarke's six-phase approach (Braun & Clarke, 2006, 2022). The analysis process included becoming familiar with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and producing the final report. Coding was performed both inductively (from data) and deductively (from the FGD guide). The transcripts were imported into MAXQDA Analytics Pro 2024 for coding and organization. Coding was performed independently by multiple researchers to enhance intercoder reliability, with discrepancies resolved through consensus. The themes were further validated through peer debriefing, and representative direct quotes were selected to illustrate thematic findings. Data from male and female FGDs were analysed separately to preserve gendered narratives and then compared for points of convergence and divergence.

4.3.6 Reflexivity and Positionality

The research team comprised professionals with diverse expertise in health sciences, nursing, human ecology, and qualitative research, including both male and

female members. The first author, a male nurse with experience in MHH research, oversaw the design and implementation of the quantitative component. To mitigate gender-related power dynamics, female research assistants conducted FGDs with female participants, encouraging open and uninhibited responses. The team maintained reflexive journals throughout the research process, documenting observations, assumptions, and interactions with participants. Peer review and audit trials were used to enhance transparency and ensure the rigor and trustworthiness of the findings (Lincoln & Guba, 1985).

4.3.7 Ethical considerations

This study adhered to established ethical standards for human subject research. Ethical approval was obtained from the Ethical Review Committee, Faculty of Health Sciences, Hokkaido University (Ref: 23–52), Directorate General of Nursing and Midwifery, Bangladesh (Ref: 45.03.0000.008.14.097.2021–650) and the National Institute of Advanced Nursing Education and Research (Ref: NIA-OS-2023-09). All the participants provided written informed consent after being briefed on the study's purpose, voluntary nature, and right to withdraw at any stage without penalty. Confidentiality was maintained by anonymizing the data and securing all files digitally with password protection.

4.4 Results

4.4.1 Sociodemographic characteristics of the quantitative findings

The mean age of the participants was 23.7 years (SD = 11.1), and the mean age at menarche was 13 years (SD = 4.21). The majority of participants were nursing students (60%), while 40% were enrolled in midwifery programs. With respect to course enrolment, over half were pursuing a diploma in midwifery (56.5%), followed by the B.

Sc in Nursing (4 years) program (14.3%) and MSc in Nursing (9.4%). A smaller proportion were enrolled in the Diploma in Nursing & Midwifery (5.9%), B. Sc in Midwifery (Post Basic) (8.65%), and B. Sc in Nursing (Post Basic) (5.1%) programs.

Table 16 Sociodemographic characteristics of the quantitative findings (N=370)

Variables	Category	n (%) or Mean ±SD
Age		23.7 ± 11.1
Age at Menarche		13 ± 4.2
Category of studentship	Nursing	222 (60)
	Midwifery	148 (40)
Name of Course	Diploma in Midwifery	209 (56.5)
	Diploma in Nursing & Midwifery	22 (5.9)
	B.Sc in Midwifery (Post Basic)	32 (8.6)
	B.Sc in Nursing (Post Basic)	19 (5.2)
	B.Sc in Nursing (4 years)	53 (14.3)
	MSc in Nursing	35 (9.4)
Year of college	First year	176 (47.5)
	Second y ear	77 (20.8)
	Third year	97 (26.2)
	Fourth year	20 (5.4)
Religion	Islam	328 (88.6)
	Hinduism	35 (9.4)
	Buddhism	2 (0.5)
	Christian	5 (1.3)
Fathers Education level	Graduate or above	46 (12.4)
	Higher Secondary	58 (15.6)
	Secondary	107 (28.9)
	Primary	122 (32.9)
	Illiterate	37 (10)
Mother’s Education level	Graduate or above	19 (5.14)
	Higher Secondary	38 (10.2)
	Secondary	135 (36.4)
	Primary	147 (39.7)
	Illiterate	31 (8.3)
Birthplace status	Urban	75 (20.2)
	Rural	295 (79.7)
Resident status	Hostel	270 (72.9)
	Own house	100 (27)
Monthly Family Income	Below 10000 BDT*	113 (30.5)
	10000-20000 BDT	111 (30)
	20000-30000 BDT	80 (21.6)
	More than 30000 BDT	66 (17.8)

Most participants were in their first year (47.5%), with decreasing representation across the second (20.81%), third (26.2%), and fourth years (5.4%). In terms of religion, the majority identified as Muslim (88.6%), followed by Hindu (9.4%), Christian (1.3%),

and Buddhist (0.5%). A substantial proportion of participants reported that their fathers had completed primary education (32.9%) or secondary education (28.9%), whereas only 12.4% of fathers had attained graduate-level education or higher. Mothers' education levels were generally lower, with only 5.1% reporting graduate-level education or above; the majority had completed primary (39.7%) or secondary education (36.4%). Most participants were born in rural areas (79.7%) and resided in hostels during their studies (72.9%). In terms of economic status, 30.5% of the participants reported a monthly family income below BDT 10,000, whereas only 17.8% reported a monthly income exceeding BDT 30,000 (Table 16).

4.4.2 Menstrual health and hygiene (MHH) indicators

A majority of the participants (71.3%) reported having enough menstrual materials to change as often as needed during their last menstrual period, while 20.2% did not, and 8.3% could not recall them. Less than half (41.8%) changed their menstrual materials at school during their last period, indicating limited access to appropriate facilities. While 43.2% stated that the place they used to change was clean, over one-third (35.6%) reported unclean conditions. Privacy concerns were notable; 29.7% of the participants were worried about being seen while changing, whereas 47.8% said they felt safe during the process. Regarding menstrual education, 47.8% had received information during secondary school, 3.7% in primary school, and 28.6% during both periods. However, 19.7% reported receiving no menstrual education in school. Notably, only 45.1% had knowledge about menstruation prior to their first period, whereas 49.7% did not. Knowledge about fertility was moderate, with 61.3% identifying the most fertile time in the menstrual cycle. In contrast, 15.1% responded negatively, and 23.5% were uncertain. When addressing menstrual pain management, 45.4% successfully reduced discomfort, whereas 23.5% could not, and 31% could not recall it. Most participants

(74%) felt comfortable seeking support from healthcare providers regarding menstruation. Similarly, 71.3% had someone to approach for advice, emotional support, or resources, 19.4% lacked such support, and 9.1% reported that such support was not needed. Menstruation disrupted daily activities for 45.4% of the students, and 58.6% experienced difficulty participating in class during menstruation, highlighting a significant burden on academic engagement and wellbeing (Table 17).

Table 17 Menstrual health and hygiene indicators (N=370)

Indicator	Category	n (%)
Had enough menstrual materials to change as often as needed during the last period	Yes	264 (71.3)
	No	75 (20.2)
	Don't Remember	31(8.3)
Changed menstrual materials at school during the last period	Yes	155 (41.8)
	No	215 (58.1)
The place for changing menstrual materials at school was clean	Yes	160 (43.2)
	No	132 (35.6)
Felt worried that someone might see while changing at school	Yes	110 (29.7)
	No	179 (48.3)
Felt safe while changing menstrual materials at school	Yes	177 (47.8)
	No	104 (28.1)
Received education about menstruation in school	Primary	14 (3.7)
	Secondary	177 (47.8)
	Both	106 (28.6)
	None	73 (19.7)
Knew about menstruation before the first period	Yes	167 (45.1)
	No	184 (49.7)
	Don't Remember	19 (5.1)
Knows the most fertile time in the menstrual cycle	Yes	227 (61.3)
	No	56 (15.1)
	Don't Remember	87 (23.5)
Able to reduce menstrual pain during the last period when needed	Yes	168 (45.4)
	No	87 (23.5)
	Don't Remember	115 (31)
Feels comfortable seeking help from a health worker for menstrual concerns	Yes	274 (74)
	No	96 (25.9)
Has someone to ask for support (advice, resources, or emotional help) during menstruation	Yes	264 (71.3)
	No	72 (19.4)
	Not Needed	34 (9.1)
Menstruation does not impact daily activities	Yes	202 (54.5)
	No	168 (45.4)
Had difficulty participating in class due to menstruation	Yes	217 (58.6)

	No	153 (41.3)

4.4.3 Significant sociodemographic characteristics with MHH indicators

The multivariable logistic regression analysis revealed several significant associations between sociodemographic characteristics and MHH indicators (Table 18). Compared with the students enrolled in the Diploma in the Midwifery program (reference group), those in the B. Sc in Nursing (4 years) program had significantly greater odds of reporting adequate access to menstrual materials (AOR = 6.91, 95% CI: 2.44–19.55, p = 0.0003), followed by those in MSc in Nursing (AOR = 2.94, 95% CI: 1.05–8.21, p = 0.0387) and WASH facilities B. Sc in Midwives (AOR = 2.87, 95% CI: 1.28–6.43, p = 0.0102), followed by diploma in Nursing & Midwives (AOR = 2.72, 95% CI: 1.01–7.32, p = 0.0468). In terms of year of study, fourth-year students had significantly greater odds of reporting adequate WASH facilities (AOR = 3.18, 95% CI: 1.04–9.68, p = 0.0408), whereas students in the second and third years had mixed results. Fourth-year students had lower odds of reporting sufficient materials (AOR = 0.15, 95% CI: 0.04–0.58, p = 0.0054).

Parental education, particularly mothers' education, was significantly associated with multiple MHH indicators. Compared with mothers with graduate-level education, students whose mothers had secondary (AOR = 4.82, 95% CI: 1.52–15.28, p = 0.0074) education were more likely to report inadequate access to materials. Primary (AOR = 3.79, 95% CI: 1.01–14.10, p = 0.0460), or no formal education (AOR = 5.36, 95% CI: 1.23–23.29, p = 0.0251) education were more likely to report WASH facilities. Furthermore, mothers with secondary (AOR = 0.24, 95% CI: 0.10–0.59, p = 0.0017), primary (AOR = 0.32, 95% CI: 0.13–0.78, p = 0.0120), and illiterate backgrounds (AOR = 0.23, 95% CI: 0.08–0.71, p = 0.0101) were also associated with increased discomfort. Additionally, students whose fathers had no formal education had significantly lower

odds of reporting menstrual health problems (AOR = 0.26, 95% CI: 0.10–0.68, p = 0.0062).

Geographical background and economic status also play a role in shaping MHH experiences. Students from rural areas had significantly lower odds of reporting knowledge (AOR = 0.52, 95% CI: 0.30–0.91, p = 0.0217) and menstrual health (AOR = 0.48, 95% CI: 0.27–0.83, p = 0.0091). In terms of economic status, students from households earning more than BDT 30,000 per month had lower odds of supporting social environment (AOR = 0.44, 95% CI: 0.22–0.87, p = 0.0193) than did those earning less than BDT 10,000, suggesting a protective effect of higher income.

Table 18 Significant MHH Indicators with Sociodemographic Characteristics in the Multivariable Logistic Regression Model

Variables		MHH Indicators											
		Materials		**WASH**		**Knowledge**		**Menstrual Health**		**Supporting Social Environment**		**Discomfort**	
		AOR (95% CI)	P- value	AOR (95% CI)	P- value	AOR (95% CI)	P- value	AOR (95% CI)	P- value	AOR (95% CI)	P- value	AOR (95% CI)	P- value
Name of Course	Diploma in Midwifery	Ref		Ref									
	Diploma in Nursing & Midwifery	2.96 (0.89-9.8)	0.0758	2.72 (1.01-7.32)	0.0468*								
	B.Sc in Midwifery (Post Basic)	0.61 (0.21-1.73)	0.3600	2.87 (1.28-6.43)	0.0102*								
	B.Sc in Nursing (4 years)	6.91 (2.44-19.55)	0.0003*	0.64 (0.30-1.38)	0.2617								
	MSc in Nursing	2.94 (1.05 – 8.21)	0.0387*	0.88 (0.38-2.02)	0.7647								
Year of college	First year	Ref		Ref									
	Second year	0.55 (0.28-1.11)	0.0976	2.27 (1.22-4.23)	0.0095*								
	Third year	0.48 (0.24-0.96)	0.0366*	1.92 (1.03-3.57)	0.0388*								
	Fourth year	0.15 (0.04-0.58)	0.0054*	3.18 (1.04-9.68)	0.0408*								
Fathers Education level	Graduate or above							Ref					
	Illiterate							0.26 (0.10-0.68)	0.0062*				
Mother's Education level	Graduate or above	Ref		Ref		0.62 (0.19-2.04)	0.4352					0.42 (0.12-1.47)	0.1795
	Higher Secondary	2.27 (0.62-8.31)	0.2127	6.19 (1.47-26.00)	0.0126*	Ref						Ref	
	Secondary	4.82 (1.52-15.28)	0.0074*	5.06 (1.36-18.85)	0.0156*	0.76 (0.36-1.61)	0.4789					0.24 (0.10-0.59)	0.0017*
	Primary	1.81 (0.59-5.54)	0.2918	3.79 (1.01-14.10)	0.0460*	0.35 (0.16-0.75)	0.0074*					0.32 (0.13-0.78)	0.0120*
	Illiterate	2.07 (0.54-7.83)	0.2828	5.36 (1.23-23.29)	0.0251*	0.97 (0.36-2.60)	0.9621					0.23 (0.08-0.71)	0.0101*
Birthplace status	Urban					Ref		Ref					
	Rural					0.52 (0.30-0.91)	0.0217*	0.48 (0.27-0.83)	0.0091*				
Monthly Family Income	Below 10000/-									Ref		Ref	
	10000-20000/-									1.05 (0.55-1.99)	0.8735	0.54 (0.31 - 0.95)	0.0338*
	20000-30000/-									0.75 (0.35-1.60)	0.4724	0.62 (0.15-0.60)	0.0006*
	More than 30000/-									0.44 (0.22-0.87)	0.0193*	0.30 (0.15-0.60	0.1354

4.4.4 Qualitative Gendered Perspectives on Menstrual Health and Hygiene

This section presents a detailed synthesis of the qualitative findings derived from FGDs with both female and male nursing students. The FGDs included 42 nursing students, equally divided by sex (21 males and 21 females), with a mean age of 23.1 years (SD = 3). The participants were enrolled in MSc in nursing (24%), B. Sc in Nursing (33%), and B. Sc. in midwifery (Post Basic) programs (43%). The majority identified as Muslim (81%), whereas 19% were Hindu. Most participants were from urban areas (60%) and were single (64%). The monthly family income varied, with over half (55%) earning between 20000–30000 BDT. With respect to clinical experience, half had 2–4 years of hospital exposure, whereas 29% had more than 4 years (Table 19).

Table 19 Characteristics of the focus group discussion participants (N= 42)

Variables		**Male (N=21)** n (%) or M±SD	**Female (N= 21)** n (%) or M±SD	**Total (N=42)** n (%) or M±SD
Age		23.2 ± 3.5	23.1 ± 2.7	23.1 ± 3
Course name	M.Sc. in Nursing	4 (19)	6 (29)	10 (24)
	B.Sc. in Nursing	6 (29)	8 (38)	14 (33)
	B.Sc. in Midwifery (Post Basic)	11 (52)	7 (33)	18 (43)
Religion	Islam	18 (86)	16 (76)	34 (81)
	Hinduism	3 (14)	5 (24)	8 (19)
Birthplace	Urban	12 (57)	13 (62)	25 (60)
	Rural	9 (43)	8 (38)	17 (40)
Marital status	Single	12 (57)	15 (71)	27 (64)
	Married	9 (43)	6 (29)	15 (36)
Monthly family income	10000-20000/-	4 (19)	5 (24)	9 (21)
	20000-30000/-	11 (52)	12 (57)	23 (55)
	More than 30000/-	6 (29)	4 (19)	10 (24)
Clinical experience in hospital	Below 2 years	3 (14)	6 (29)	9 (21)
	2-4 years	10 (48)	11 (52)	21 (50)
	Above 4 years	8 (38)	4 (19)	12 (29)

Thematic analysis yielded four overarching themes and thirteen subthemes that illuminate the sociocultural, emotional, and infrastructural dimensions of MHH. In the FGDs, individual participants were identified via the labels Male (M), Female (F) and

Participants number (e.g., P1, P2) to represent each person. The themes and subthemes are listed in Table 20.

Table 20 Themes and subthemes of the gendered perspective of MHH

Theme	Subtheme
Menstrual Knowledge and Information	1.1 Lack of early education
	1.2 Mother/sister as primary educators
	1.3 Male exclusion information
	1.4 Early ignorance
Menstrual product accessibility and availability	2.1 High cost and affordability issues
	2.2 Distribution and distance
	2.3 Shame in purchasing
Physical and Emotional Discomfort	3.1 Pain and fatigue
	3.2 Coping strategies
	3.3 Emotional toll
	3.4 Class abstinences
WASH facilities	4.1 Lack of private changing space
	4.2 Limited disposal systems

4.4.5 Menstrual knowledge and information

4.4.5.1 Lack of early education

Both female and male participants consistently emphasized the absence of structured menstrual education prior to menarche or during early adolescence. The female students shared vivid recollections of fear and confusion upon experiencing menstruation for the first time. One participant reflected, *"When I had my first period, I didn't know what was happening. I was so afraid" (F, P-3).* Similarly, a male student remarked, *"In rural areas, when girls start menstruating, they know nothing about it. It becomes a crisis" (M, P-2).*

This lack of foundational knowledge often leads to misinterpretation of menstrual symptoms, panic, and psychological distress, especially during initial episodes.

4.4.5.2 Mothers and Sisters as Primary Educators

In the absence of formal education, female students often rely on maternal figures or older sisters for guidance and reassurance. The participants repeatedly mentioned, *"My elder sister understood the matter and told me how to manage it" (F, P-6),*

indicating that interpersonal female networks served as the primary knowledge transfer system. In contrast, male participants described this educational transmission as inaccessible to them. One expressed, *"My sister never talked to me about menstruation, even though we're close" (M, P-6).*

4.4.5.3 Male exclusion from menstrual information

A deeply entrenched gender divide was evident in access to information. The female participants noted that menstruation was treated as a private matter that must be hidden from men. *"This is something we never say in front of men—it's shameful" (F, P-2).* Male students confirmed this invisibility, stating, *"We boys never learned anything from girls or family members about menstruation" (M, P-7).* This silence perpetuated myths, misunderstandings, and social distancing.

4.4.5.4 Early ignorance and social mockery

Ignorance during adolescence contributes to inappropriate behaviors, particularly among boys, including mocking menstruating girls. One male student confessed, *"When we saw stains in school, we laughed because we didn't understand" (M, P-2).* The female participants shared similar stories of being mocked or misunderstood, exacerbating feelings of shame and isolation during early menstrual experiences: *"The first day I got my period, I didn't understand what was happening to me…" (F, P-6).*

4.4.6 Menstrual Product Accessibility and Availability

4.4.6.1 High Cost and Affordability Issues

Economic barriers were commonly cited by both genders. The female participants noted the financial burden of purchasing sanitary pads: *"It's quite expensive compared to our income" (F, P-2).* Male participants acknowledged that affordability influenced the continued use of unhygienic alternatives: *"Many women's still use old cloths because they cannot afford sanitary pads" (M, P-5).* The intersection of poverty

and gender norms limits women's access to safe menstrual materials, even in healthcare student populations.

4.4.6.2 Distribution and distance

Product accessibility was particularly problematic for rural students. The female participants described having to travel several kilometers to purchase pads: *"It takes me 4 km to get them. The shop is far" (F, P-1).* Male students confirmed this barrier, stating, *"Pads are not always available in villages. Girls have to travel far to buy them" (M, P-2).* Limited on-campus availability compounded the challenge, suggesting a need for institutional support in product distribution.

4.4.6.3 Shame in Purchasing

Shame surrounding menstruation extends into purchasing behavior. Female students expressed reluctance to buy pads in the presence of male shopkeepers*: "Sometimes I just leave without buying because I feel embarrassed" (F, P-2).* Male participants acknowledged this stigma, noting, *"Pads are sold in black poly bags, as if it's something illegal" (M, P-5).* This discomfort inhibited autonomy and underscored the internalization of menstrual taboos.

4.4.7 Physical and Emotional Discomfort

4.4.7.1 Pain and Fatigue

Menstrual symptoms such as abdominal pain, backache, and fatigue were universally reported by female participants. *"I am in great pain. I have a lot of pain" (F, P-7)* and *"I feel weak and dizzy" (F, P-3)* were typical accounts. Male students also observed these symptoms among peers, describing them as *"physically tired and quiet" (M, P-5),* reflecting awareness of the somatic burden of menstruation.

4.4.7.2 Coping Strategies

In the absence of professional care, participants adopted informal coping methods. The female students mentioned using hot compresses and painkillers: *"Baking*

massage gives a lot of relief" (F, P-3). Support from peers was also emphasized: *"Friends give warm food or stay close" (F, P-4).* Male students recognized this dynamic, stating, *"Support from friends or family helps them deal with the emotional burden" (M, P-5).*

4.4.7.3 Emotional Toll

Mood swings, irritability, and psychological strain were recurrent themes. One female participant said, *"I feel very upset. I cannot take good things from people" (F, P-5).* Male students noticed these changes, remarking, *"Mood swings occur; they become irritated easily and feel mentally disturbed" (F, P-3).* Emotional well-being during menstruation emerged as a critical, often overlooked, aspect of MHH.

4.4.7.4 Class Abstinence

Menstrual discomfort often leads to academic disengagement. Female students reported skipping classes and preferring isolation: *"I want to rest; I don't want to do anything" (F, P-7).* Male participants acknowledged this, noting, *"They often skip class or avoid group work during menstruation" (M, P-5).* These disruptions affect educational continuity and highlight the need for menstrual support in academic settings.

4.4.8 WASH Facilities

4.4.8.1 Lack of private changing space

Inadequate changing facilities are a major barrier to menstrual management. The female participants reported sharing or cogender bathrooms in hostels and classrooms: *"There's no good changing system… sometimes the same bathroom is used by boys and girls" (F, P-1).* Male participants echoed this concern, stating, *"There is no proper place to change pads privately" (M, P-3),* demonstrating shared recognition of poor infrastructure.

4.4.8.2 Limited Disposal Systems

The disposal of used menstrual products has emerged as a critical concern. Female students described wrapping pads in paper and discarding them in unhygienic dustbins: *"I throw it in the basket… but it's dirty" (F, P-7).* Male participants discussed unsafe practices such as flushing or open dumping: *"In rural areas, they throw used pads in ponds or burn them secretly" (M, P-5).* The absence of disposal education and facilities contributes to environmental and health risks.

4.5 Discussion

This study provides an in-depth exploration of the gendered dimensions of MHH among nursing students in Bangladesh, illuminating the challenges shaped by gender education, socioeconomic status, and institutional WASH facilities limitations. Despite the participants' education in health sciences, the findings suggest that both male and female students are deeply embedded within and affected by prevailing sociocultural norms around menstruation. Through a convergent parallel mixed-methods approach, the integration of quantitative trends and qualitative narratives yields a nuanced understanding of how gender intersects with education, economic status, and WASH facilities influence MHH indicators.

One of the most striking findings from this study is the pervasive lack of knowledge of menstruation prior to menarche among female students. Nearly half of them were unaware of menstruation before their first period, a finding that is consistent with previous studies conducted in South Asia and sub-Saharan Africa (Chandra-Mouli & Patel, 2017; Girod et al., 2017; Zaman et al., 2024). The qualitative data strongly reinforce this, with female participants describing feelings of shock, fear, and confusion during their first menstrual experience. Mothers and older sisters emerged as the primary

sources of information, but their guidance was often limited, informal, and reactive rather than proactive. This familial transmission of knowledge, although well-intentioned, may perpetuate misinformation and secrecy, as it lacks scientific grounding and is constrained by generational taboos (Sommer et al., 2015; Zulaika et al., 2019). The persistence of early ignorance, as voiced in focus groups, underscores the urgent need for standardized, age-appropriate, and inclusive menstrual education in both schools and nursing curricula.

Male students revealed near-total exclusion from their menstrual education, both within their home and educational settings. Their narratives reflected not only ignorance but also early participation in mocking behaviours often driven by misconceptions or embarrassment. These accounts echo findings from earlier qualitative studies in Kenya and India, which revealed that boys are socialized to avoid menstruation-related topics and that their exclusion reinforces menstrual stigma and shame (Crichton et al., 2013; Mahon & Fernandes, 2010; Tesfay et al., 2024). The silence around menstruation, especially in coeducational contexts, not only isolates girls but also prevents boys from becoming informed allies. This gendered knowledge gap may have long-term implications for future clinical practice, particularly when these individuals become healthcare providers responsible for delivering sexual and reproductive health services.

Economic barriers were another salient issue highlighted in this study. While more than 70% of the students reported adequate access to menstrual materials, significant disparities emerged by course type, place of birth, and household income. Students enrolled in higher-level programs had significantly greater access to sanitary products than their counterparts in diploma programs did, mirroring existing evidence that socioeconomic privilege improves access to health commodities (Hennegan et al., 2019; Shannon et al., 2021). Female students from rural or low-income households described financial strain in purchasing sanitary pads, often resorting to unhygienic

alternatives, a pattern also reported in studies from Ethiopia and Bangladesh (Zaman et al., 2025; Tegegne & Sisay, 2014; Zaman et al., 2024). The qualitative findings further emphasize the emotional toll associated with purchasing menstrual products, as many female participants expressed reluctance or embarrassment when buying pads from male shopkeepers. Some even reported abandoning the purchase altogether due to discomfort, an insight supported by studies on menstrual taboos and marketplace stigma (Castro & Czura, 2025; Sumpter & Torondel, 2013). These findings underscore how financial hardship and social stigma together hinder access to safe menstrual products, particularly for student form low socioeconomic backgrounds.

Menstrual pain, fatigue, and emotional instability were consistently reported by female participants, underscoring the physical and psychological burden of menstruation. Half of the students managed menstrual pain and many students reported using home remedies such as hot compresses or taking painkillers without medical consultation in qualitative findings. Although 74% expressed comfort in seeking help from health workers, the qualitative data revealed that peer and family support remained the first line of care. This duality of access to medical knowledge yet reliance on informal coping strategies suggests that even among educated populations, menstruation remains private and often unspoken struggle (Hennegan et al., 2019, 2022). While being physically unaffected, male students demonstrated a growing awareness of their female peers' distress, a shift that indicates the potential for transforming traditional masculine attitudes through inclusive education (Bobel et al., 2020). These findings highlight that despite medical training, menstruation remains a private and often unsupported experience, though male students' increasing empathy offers hope for more inclusive care.

Inadequate WASH facilities emerged as a cross-cutting barrier to effective MHH management. Fewer than half of the students found their school's changing facilities

clean, and qualitative testimonies revealed an alarming lack of privacy in hostels and classrooms. Shared bathrooms between male and female students, inadequate disposal bins, and the absence of designated changing spaces have emerged as serious concerns echoing global findings that poor WASH infrastructure undermines safe menstrual management and school attendance (Sommer et al., 2015; Tegegne & Sisay, 2014). Notably, both male and female students highlighted the lack of disposal education and facilities, with some rural participants reporting the practice of burning or discarding used pads in open environments. These practices not only threaten environmental safety but also reflect institutional negligence in integrating menstrual needs into campus design and maintenance.

Parental education, particularly maternal literacy, was found to significantly influence students' MHH practices and perceptions. Students whose mothers lacked formal education were significantly more likely to report poor access to materials and inadequate WASH facilities. This finding is consistent with prior research showing that maternal literacy enhances daughters' menstrual health practices, knowledge, and emotional coping (van Eijk et al., 2016; van Lonkhuijzen et al., 2023). The qualitative data revealed that students from rural areas were less likely to possess adequate menstrual knowledge, reinforcing the rural–urban divide in terms of access to health education and commodities. Monthly income remained a strong protective factor against discomfort, with higher-income students reporting fewer menstrual disruptions, suggesting that economic stability enables access not only to products but also to comfort-enhancing environments Click or tap here to enter text.. Maternal education, rural background, and family income play a crucial role in shaping nursing students' menstrual health experiences and access to essential resources.

4.6 Limitations

This study has several limitations that should be acknowledged. First, the research was conducted exclusively among students from government nursing institutions, which may limit the generalizability of the findings to private or non-governmental settings. However, the inclusion of seven diverse public institutions across different geographic regions of Bangladesh aimed to enhance the representativeness of the sample within the public sector context. Second, the cross-sectional design of the study limits causal inference. To mitigate this, the study employed a convergent mixed-methods approach, combining quantitative data with qualitative insights to strengthen the depth and contextual understanding of the findings. Third, the reliance on self-reported data introduces the possibility of recall bias and social desirability bias, particularly on sensitive topics such as menstruation. To reduce this risk, participants were assured of confidentiality and anonymity, and the survey and FGDs were facilitated by trained female researchers with experience in conducting sensitive health-related interviews. Fourth, while gender-segregated FGDs encouraged open discussion and helped participants feel more comfortable, it is possible that group dynamics, peer influence, or institutional hierarchies may have influenced individual responses. To address this, facilitators used culturally sensitive and nonjudgmental prompts, ensured equitable participation, and conducted debriefings to reflect on potential bias in group interactions.

4.7 Conclusion

This mixed- methods study reveals that gendered knowledge gaps, financial struggle, and inadequate WASH facilities undermine safe and dignified menstrual experiences. Despite their medical training, many nursing students especially those from low-income and rural backgrounds face significant barriers to menstrual education, product access, and privacy. To

ensure safe and dignified menstrual experiences, it is essential to integrate gender-inclusive education and improve WASH infrastructure.

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CHAPTER 5

Empowering Future Nurses: A Participatory Educational Intervention to Improve Menstrual Health and Hygiene Knowledge, Attitudes, and Practices in Bangladesh

5.1 Abstract

Menstrual Health and Hygiene (MHH) is fundamental to women's well-being but remains underprioritized in professional health education. In Bangladesh, nursing and midwifery students, future frontline health workers, rarely receive structured menstrual health curricula. This study assessed the effectiveness of a participatory educational intervention in improving menstrual Knowledge, Attitudes, and Practices (KAP) among nursing students. A quasi-experimental pre-test–post-test design was conducted from January to June 2025 among 384 female students at Rajshahi Nursing College, equally divided into intervention and control groups (n = 192 each). The four-week intervention adapted from WaterAid's Menstrual Hygiene Matters training guide included sessions on menstrual physiology, hygiene practices, stigma reduction, and WASH management. Data were collected using validated questionnaires (KAP tools) and analyzed with paired and independent *t*-tests, with $p < 0.05$ considered significant. Participants' mean age was 23.3 ± 5.1 years, and both groups were demographically comparable at baseline. Post-intervention analysis revealed significant improvements across all domains in the intervention group compared with the control. Knowledge indicators such as correct understanding of menstrual-cycle length (8 % → 78 %) and uterine physiology (22 % → 34 %) improved markedly ($p < 0.001$; $d = 0.68$). Attitudinal scores demonstrated positive

normalization of menstruation (mean = 4.8 → 5.9; $p < 0.001$; $d = 0.74$), while hygienic practices such as regular pad use (31 % → 88 %), frequent material change, and handwashing before and after handling materials increased significantly ($p < 0.01$; $d = 0.82$). The intervention's success reflects the cognitive–affective–behavioral pathway of learning: factual knowledge fostered understanding, emotional engagement reduced stigma, and experiential learning reinforced hygienic habits. A short, participatory menstrual health education program significantly enhanced MHH knowledge, attitudes, and practices among nursing students. While the intervention did not modify physical WASH infrastructure, it improved what students could do within existing constraints. Integrating similar gender-sensitive modules into nursing curricula can empower future health professionals to promote menstrual dignity and advance gender-equitable healthcare.

Keywords: Menstrual health and hygiene, Nursing students, educational intervention, Knowledge–attitude–practice, WASH, Bangladesh

5.2 Introduction

5.2.1 Background

Menstruation is a universal biological process and a vital indicator of reproductive and overall health for nearly half of the world's population. Despite its normalcy, menstruation remains shrouded in social silence, stigma, and misinformation across many societies, especially in low- and middle-income countries (LMICs) (Plesons et al., 2021; Shannon et al., 2021). Poor menstrual health and hygiene (MHH) management has been linked not only to reproductive tract infections but also to school absenteeism, psychosocial distress, and gender-based inequalities (Phillips-Howard et al., 2016; UNICEF & WHO, 2024). Addressing MHH is therefore a public health priority

directly connected to the Sustainable Development Goals (SDGs), particularly SDG 3 (Good Health and Well-being), SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 6 (Clean Water and Sanitation) (Sommer et al., 2021).

Although global awareness of menstrual health has grown substantially over the last decade, research and interventions have been largely concentrated on adolescent schoolgirls, while older adolescents and adult women, especially those in vocational and healthcare training—remain neglected in both research and policy frameworks (Evans et al., 2022; Hennegan et al., 2021). The World Health Organization (UNICEF & WHO, 2024) and WaterAid (House et al., 2013)have emphasized that ensuring menstrual dignity requires not only access to sanitary materials and facilities but also education that builds Knowledge, Attitudes, and Practice (KAP) to manage menstruation hygienically and without shame.

5.2.2 Menstrual Health Challenges in South and Southeast Asia

In South and Southeast Asia, Menstrual Hygiene Management (MHM) continues to be influenced by traditional taboos, gender norms, and infrastructural inadequacies. Studies in Nepal, Bangladesh, and India reveal that menstruation is often treated as a secretive and impure phenomenon, with restrictions placed on women's diet, mobility, and participation in daily activities (Alam et al., 2022; Budhathoki et al., 2018; Mudi et al., 2023). Many young women lack comprehensive knowledge of menstrual physiology prior to menarche and rely on peers or family members who often hold misconceptions themselves. Inadequate water, sanitation, and hygiene (WASH) facilities in educational institutions exacerbate these challenges by making MHM unhygienic and stressful (Winter et al., 2022).

Bangladesh, in particular, faces a dual challenge. While school-based MHH programs have been implemented through partnerships with UNICEF and WaterAid, few

initiatives have extended into tertiary or professional education. Research shows that even university and nursing students who are expected to possess health literacy often lack accurate information and experience menstrual stigma (Alam et al., 2017; Zaman et al., 2024). Cultural silence within academic and hostel settings further discourages open discussion, reinforcing secrecy and shame. As a result, future health professionals may enter the workforce without adequate understanding or comfort in addressing their patients' menstrual health concerns.

5.2.3 Significance of Menstrual Health Education for Nursing Students

In this study, "nursing students" refers to both nursing and midwifery students enrolled at Rajshahi Nursing College, as both cadres' study under the Directorate General of Nursing and Midwifery (DGNM). While they follow distinct clinical tracks, their foundational coursework, hostel environments, and exposure to community health topics are similar, and both groups will care for menstruating clients in clinical and community settings. Nursing and midwifery students represent a crucial but under-examined population in menstrual health research. As future providers and educators, they will be expected to promote hygiene and reproductive well-being. However, internalized stigma and misinformation can undermine both personal well-being and professional practice (Pereda & Mahuna, 2025). Studies from various settings indicate that myths about menstruation persist even among health-professional students, and discussions often remain limited due to cultural discomfort (Das et al., 2015; Gouvernet et al., 2023; Zaman et al., 2025)

Improving MHH literacy among nursing and midwifery students has potential "multiplier" effects: better-informed providers are more likely to give accurate, empathetic counseling to patients and to support community-level health promotion. While evidence directly demonstrating long-term community impacts is still limited,

interventions in related areas of sexual and reproductive health show that provider education can improve quality of counseling and client outcomes. Embedding menstrual health education into curricula is therefore consistent with contemporary emphasis on gender-sensitive, holistic care (Baird et al., 2022; Thompson et al., 2021).

5.2.4 Theoretical Basis and Conceptual Framework

Effective health-education interventions rely on understanding how individuals acquire and apply knowledge. This study draws on Bloom's taxonomy and Bandura's social cognitive theory, which together emphasize cognitive, affective, and behavioral pathways of learning (Bandura, 1986; Bloom et al., 1956; Krathwohl et al., 1964). The cognitive pathway focuses on factual knowledge and understanding of menstrual physiology and hygiene, addressed through interactive lectures and demonstrations (Anderson & Krathwohl, 2001; Bloom et al., 1956). The affective pathway targets emotions, beliefs, and values, aiming to reduce shame and normalize menstruation via group discussion, reflection, and supportive dialogue (Ajzen, 1991; Krathwohl et al., 1964). The behavioral pathway strengthens self-efficacy and practical skills through role-play, problem-solving, and practice in applying hygienic behaviors (Bandura, 1986; Rosenstock et al., 1988).

This framework is operationalized through the *Menstrual Hygiene Matters* training model (House et al., 2013; WaterAid, 2017), which emphasizes participatory learning, peer engagement, and sensitivity to local WASH constraints. Such an approach has proven effective in diverse contexts—from schoolgirls in Kenya (Phillips-Howard et al., 2016), but has rarely been tested within professional healthcare education (Evans et al., 2022). The present intervention adapted this model to the realities of Bangladeshi hostel-based nursing and midwifery students, focusing on what students could realistically implement in their daily lives and future practice.

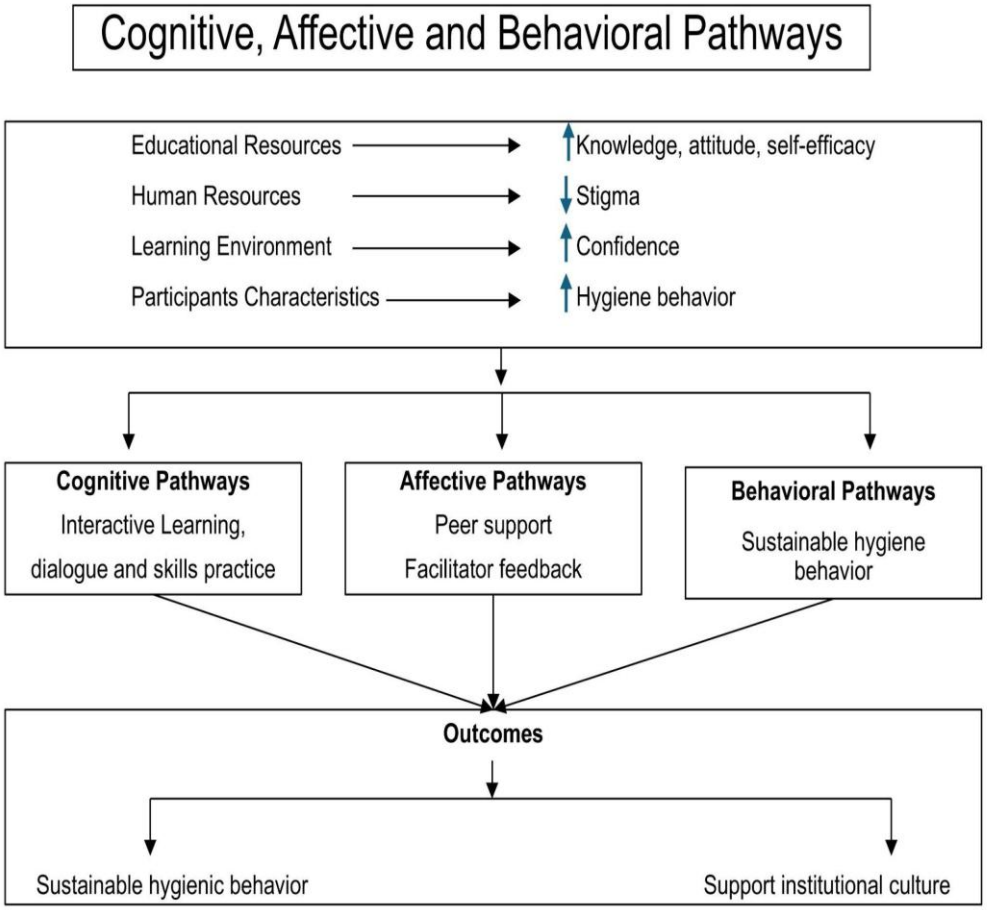

Figure 7 Theoretical framework

5.2.5 Rationale for the Study

Despite recent progress in menstrual health research, a significant gap persists in understanding how structured educational interventions affect menstrual knowledge, attitudes, and practices (KAP) among nursing students in LMICs. Existing literature largely focuses on adolescents, overlooking the specific needs of young adult women who are preparing for healthcare professions (Hennegan et al., 2019; Rezaei et al., 2022). Given that nurses play a pivotal role in patient education and community health promotion, empowering them with accurate menstrual knowledge is not only a matter of personal well-being but also a societal responsibility.

Furthermore, in Bangladesh, nursing institutions often lack formal curricula addressing MHH, and discussions are constrained by gendered norms that frame menstruation as a private and shameful topic. Addressing this silence through participatory education could enhance not only students' self-efficacy but also the broader culture of healthcare training. Evaluating the outcomes of such an intervention provides an evidence base for curricular reform and gender-sensitive health policy within nursing education systems.

5.2.6 Study Objective

The overarching aim of this study was to assess the effectiveness of a structured educational intervention on menstrual health and hygiene knowledge, attitudes, and practices (KAP) among female nursing students in Bangladesh. Specifically, the study sought to: Measure changes in menstrual KAP before and after the intervention; Compare the extent of improvement between intervention and control groups; and Explore the potential of participatory education as a model for integrating menstrual health into nursing curricula.

5.3 Methodology

5.3.1 Study Design

This study employed a quasi-experimental pre-test and post-test design to evaluate the effectiveness of a structured educational intervention on menstrual health and hygiene (MHH) knowledge, attitudes, and practices (KAP) among nursing students in Bangladesh. The quasi-experimental design was selected because full randomization was not feasible within the institutional academic context; however, it allowed for meaningful causal inference through comparison of intervention and control groups before and after exposure to the educational program. Such designs are widely

recognized as appropriate for assessing behavioral and educational interventions where random assignment is impractical or unethical, particularly in school or university settings (Agbede & Ekeanyanwu, 2021; Khan et al., 2023; Rezaei et al., 2022). The intervention was guided by the principles of participatory learning, gender-sensitive health promotion, and adult education theory, ensuring active student engagement and long-term retention of menstrual health knowledge. The intervention model was structured around three interrelated learning domains—cognitive, affective, and behavioral pathways—adapted from Bloom's taxonomy and social cognitive learning theory (Bandura, 1986; Bloom et al., 1956; Krathwohl et al., 1964).

5.3.2 Study Setting, Population and Sampling Procedures

The study was conducted between January and June 2025 at Rajshahi Nursing College, one of the largest government nursing institutions in northwestern Bangladesh, operating under the Directorate General of Nursing and Midwifery (DGNM), which enrolls students from diverse socioeconomic and geographic backgrounds, including both urban and rural communities. This diversity provided an ideal environment for evaluating menstrual health interventions, as it reflected the broader social and cultural variations in menstrual practices and perceptions within the country.

The study population included all female undergraduate nursing students enrolled at the college who had experienced menarche and provided written informed consent. To ensure representativeness, a stratified random sampling technique was used. The population was stratified by academic year (first through fourth year), and within each stratum, participants were randomly selected from the official class attendance registers. Subsequently, entire class sections were assigned to either the intervention or control group to minimize contamination of information and peer influence across groups. Students who were pregnant, seriously ill, or absent during both baseline and endline

data collection were excluded from participation. This approach ensured that all participants could attend the full intervention cycle and follow-up assessment, maintaining internal validity.

Figure 8 Study participants

5.3.3 Sample Size Determination

The sample size was determined using G*Power (version 3.1) software for a two-tailed independent samples t-test. Based on prior studies of menstrual and reproductive health interventions, an expected medium effect size (Cohen's d = 0.3), alpha level of 0.05, and statistical power of 80% were applied (Agbede & Ekeanyanwu, 2021; Rezaei et al., 2022). The minimum required sample size was calculated as 176 participants per group. To account for potential non-response or attrition, a 10% adjustment was made, resulting in 192 participants in the intervention group and 192 in the control group, for a total of 384 students.

Allocating participants by class section preserved the natural learning structure and minimized logistical disruption, while pre-test comparisons confirmed baseline equivalence between groups in socio-demographic characteristics and MHH indicators. The final sample size provided sufficient statistical power to detect meaningful improvements in KAP outcomes following the intervention, consistent with standards for educational intervention trials in LMIC contexts (Japalaghi et al., 2025; Khan et al., 2023; Rezaei et al., 2022)

5.3.4 Data Collection Instruments

Data were collected using a pre-tested and validated structured questionnaire that was developed by adapting items from several internationally recognized instruments. The knowledge domain was adapted from previous study (Alam et al., 2022), which assesses menstrual physiology, hygiene practices, and product use in school-based interventions. The attitudinal domain was derived from the Menstrual Attitude Questionnaire (MAQ) originally developed by Brooks-Gunn and Ruble (Brooks-Gunn & Ruble, 1980), which captures multidimensional beliefs about menstruation as a natural, debilitating, or bothersome event. Practice-related items, including access,

comfort, and adequacy of menstrual management behaviors, were adapted from the Menstrual Practice Questionnaire (MPQ) (Hennegan et al., 2020).

The final questionnaire comprised four sections: (i) socio-demographic characteristics; (ii) menstrual knowledge (nine items); (iii) attitude (33 items across five MAQ sub-domains); and (iv) hygienic practices (30 items) [*Annexure file 5*]. Responses were collected using a combination of multiple-choice and five-point Likert-scale items. To ensure content validity and contextual appropriateness, the instrument was reviewed by three experts in public health nursing and women's health. A pilot test was conducted with 30 nursing students from another college to assess clarity, comprehension, and reliability. The instrument demonstrated satisfactory internal consistency, with Cronbach's $\alpha = 0.84$ for the total scale and domain-specific reliabilities of 0.80 for knowledge, 0.82 for attitude, and 0.79 for practice, indicating good reliability and stability across constructs.

5.3.5 Description of the Intervention

The educational intervention was designed and implemented following the WaterAid "Menstrual Hygiene Matters: Training Guide for Practitioners" (House et al., 2013; WaterAid, 2017), a globally recognized resource that situates menstrual health within the broader Water, Sanitation, and Hygiene (WASH) and gender-equity framework. The program emphasized participatory learning, self-efficacy enhancement, and stigma reduction [*Annexure file 6*].

The intervention comprised four weekly face-to-face sessions of 60–90 minutes each, delivered over one month. A combination of lectures, interactive discussions, role-plays, visual demonstrations, and short documentary films—including Adolescent School Girls in Bangladesh on Managing Menstruation and Making the Invisible Visible (WaterAid India/Vatsalya) was used to maximize engagement and retention. Session 1

introduced reproductive anatomy and physiology, explained the menstrual cycle, and dispelled common myths and misconceptions. Session 2 covered menstrual hygiene materials—both disposable and reusable—highlighting proper usage, washing, drying, and safe disposal practices. Session 3 addressed stigma reduction, effective communication, and peer-support strategies to normalize menstruation in academic and clinical environments. Session 4 focused on WASH facility management, access to clean water and soap, and the creation of a supportive institutional environment for menstruating students.

Each participant in the intervention group received printed handouts, a menstrual-cycle tracking calendar, and sample menstrual products for demonstration purposes. Sessions were facilitated by female nurse educators and a gynecologist who underwent a preparatory orientation on participatory facilitation techniques to ensure interactive and culturally sensitive delivery. The control group did not receive any additional training beyond the standard nursing curriculum. To maintain ethical fairness, all educational materials were subsequently provided to the control group after the completion of data collection.

5.3.6 Data Collection Procedure

Baseline (pre-test) data were collected from both groups one week prior to the intervention, while endline (post-test) data were obtained six months after completion of the four-week training program to evaluate knowledge retention and behavioral change. The same validated questionnaire was administered at both time points to ensure comparability. Data collection was supervised by trained research assistants who were not involved in delivering the intervention, minimizing interviewer bias. All participants were briefed on the objectives and assured of anonymity and confidentiality. Unique identification codes were assigned to match each participant’s pre- and post-test

responses. Questionnaires were self-administered in classroom settings under direct supervision to ensure uniformity, minimize discussion among participants, and prevent missing responses. Completed questionnaires were checked daily for completeness and securely stored in locked cabinets before data entry.

5.3.7 Data Management and Statistical Analysis

All data were entered and analyzed using JMP Pro 18 (SAS Institute Inc., USA). Data cleaning involved verification of completeness, logical range checks, and removal of outliers. Descriptive statistics—including means, standard deviations, frequencies, and percentages—were used to summarize demographic characteristics and baseline variables. The Shapiro–Wilk test was applied to assess normality of continuous data distributions. Within-group changes in mean KAP scores from pre- to post-intervention were examined using paired t-tests, while independent t-tests were employed to compare mean differences between intervention and control groups. Chi-square tests were used to evaluate associations between categorical variables. Statistical significance was set at $p < 0.05$. In addition, Cohen's d effect sizes were computed to estimate the magnitude of the intervention's impact, and 95% confidence intervals were reported for key parameters to enhance interpretability and robustness of findings.

5.3.8 Ethical Considerations

Ethical approval was obtained from the Ethical Review Committee of the Graduate School of Health Sciences, Hokkaido University, Japan (23-52). Institutional permission was also secured from DGNM, Dhaka and the Principal of Rajshahi Nursing College, Bangladesh. All participants were informed about the study objectives, voluntary participation, and the right to withdraw without penalty. Written informed consent was obtained prior to participation. Data confidentiality was maintained through anonymized coding and restricted data access. The educational materials used in this

intervention were adapted from publicly available, open-access resources (e.g. WaterAid), in accordance with their Creative Commons licensing terms with full attribution to the original sources. The study strictly adhered to the ethical standards outlined in the Declaration of Helsinki for research involving human participants.

5.4 Results

5.4.1 Socio-Demographic Characteristics of Participants

A total of 384 female nursing students participated in the study, equally divided between the intervention and control groups (n = 192 each). Table 21 presents the baseline socio-demographic profile. The mean age of the participants was 22.5 ± 3.2 years in the intervention group and 24.1 ± 6.7 years in the control group, while the mean age at menarche was similar between groups (13.0 ± 1.3 years vs 12.9 ± 1.5 years). Most respondents were nursing students (84 % in the intervention and 89 % in the control group). Religiously, Islam predominated (88 % and 95 %), followed by Hinduism (10 % and 4 %). Educational attainment of participants' fathers and mothers showed that over half had completed at least secondary education, while roughly one-quarter had primary education. Approximately three-quarters (75–78 %) of participants were from rural backgrounds and an equal proportion resided in hostels. Household income distribution was similar across groups, with about one-third earning between 10000 – 20000 BDT per month. Baseline socio-demographic comparisons revealed no significant differences between the two groups ($p > 0.05$ for all variables), indicating comparability at the start of the intervention (Table 21).

Table 21 Socio-demographic characteristics of study participants (N = 384)

Variables	Category	Control Group (n = 192)	Intervention Group (n = 192)	*p*-value
Age (years, mean ± SD)		24.1 ± 6.7	22.5 ± 3.2	0.18
Age at menarche (years)		12.9 ± 1.5	13.0 ± 1.3	0.42
Category of studentship	Nursing	170 (89%)	161 (84%)	0.29
	Midwifery	22 (11%)	31 (16%)	
Religion	Islam	182 (95%)	169 (88%)	0.12
	Hinduism	8 (4%)	19 (10%)	
Father's education	Secondary +	57 (30%)	62 (32%)	0.36
Mother's education	Secondary +	73 (38%)	78 (41%)	0.33
Residence	Hostel	145 (76%)	146 (76%)	0.94
Birthplace	Rural	149 (78%)	144 (75%)	0.59
Monthly family income	≤ 20 000 BDT	115 (60%)	122 (63%)	0.71

No significant between-group differences at baseline (χ^2 and t-tests, $p > 0.05$).

5.4.2 Changes in Knowledge on Menstrual Health and Hygiene

Table 22 summarizes pre- and post-intervention knowledge outcomes. At baseline, both groups demonstrated moderate awareness of menstrual physiology and hygiene. Following the educational intervention, the intervention group exhibited substantial improvement in nearly all knowledge indicators, while the control group showed minimal or no change. Some changes were largely attributable to classroom exposure rather than targeted training, however. For example, correct identification of the average menstrual-cycle length (28 days) increased dramatically from 8 % → 78 % in the intervention group ($p < 0.001$, paired t-test), compared with 26 % → 34 % in the control group. Awareness that menstruation is caused by shedding of the uterine lining improved modestly (22 % → 34 %) in the intervention group, whereas no change occurred in the control group (24 % → 24 %). Recognition of the reproductive organs rose from 35 % → 65 % in the intervention group versus 20 % → 28 % in the control, reflecting peer learning effects. Knowledge regarding the use of water and soap for reusable materials increased slightly (33 % → 53 %)in the intervention group, where as no change of control group 54 % → 52 %). Appropriate disposal of used materials little

bit improved from 31 % → 34 % in the intervention group and 25 % → 30 % in the control group . Overall mean knowledge scores improved significantly in the intervention group ($p < 0.001$), confirming the positive cognitive impact of the structured educational sessions.

Table 22 Knowledge of menstrual health and hygiene among participants

Knowledge indicators	Control Baseline	Control Endline	Interv. Baseline	Interv. Endline	*P* (within)	*P* (between)
Correct age of menarche (13 y)	22 %	61 %	20 %	55 %	< 0.01	0.48
Correct cause ("shedding uterus lining")	24 %	24 %	22 %	34 %	< 0.05	< 0.05
Avg. menstrual cycle = 28 days	26 %	34 %	8 %	78 %	< 0.001	< 0.001
Duration 3–7 days	86 %	85 %	86 %	86 %	ns	ns
Identify reproductive organs	20 %	28 %	35 %	65 %	< 0.01	< 0.05
Knows 3 methods to reduce pain	33 %	52 %	31 %	39 %	< 0.05	< 0.05
Wash reusable w/soap + sun	54 %	52 %	33 %	53 %	< 0.05	< 0.05
Proper disposal (bin/incinerate)	25 %	30 %	31 %	34 %	ns	ns
Change every ≤ 6 h	90 %	85 %	86 %	86 %	ns	ns

5.4.3 Changes in Attitudes Toward Menstruation

Attitudinal outcomes measured using the Menstrual Attitude Questionnaire (MAQ) are presented in Table 23. At baseline, participants in both groups displayed moderately conservative or negative perceptions, viewing menstruation as debilitating and bothersome. Post-intervention, the intervention group demonstrated a marked attitudinal shift toward normalization and empowerment, while the control grup not significantly improved.

Under the "Menstruation as a natural event" subscale, mean scores rose from 4.8 → 5.9 in the intervention group, indicating a stronger recognition of menstruation as a

natural and healthy process ($p < 0.001$). Attitudes toward "Menstruation as a debilitating event" improved slightly (mean = 4.6 → 5.2), suggesting reduced perceived interference with daily life. Scores in the "Menstruation as a bothersome event" subscale decreased, reflecting reduced stigma and discomfort. Similarly, positive changes were observed in the "Anticipation and prediction" domain, where awareness of premenstrual signs improved (mean = 4.4 → 6.0). Paired t-tests confirmed statistically significant within-group improvements in the five domains ($p < 0.05$). Between-group comparisons at endline revealed higher composite attitude scores in the intervention group than the control group ($p < 0.001$; Cohen's d = 0.74), supporting the effectiveness of the participatory, stigma-reducing modules.

Table 23. Attitudes toward menstruation among participants (MAQ subscales)

Scale	Control Baseline	Control Endline	Interv. Baseline	Interv. Endline	Within-group *p*	Cohen's d
Menstruation as debilitating	4.7	4.8	4.6	5.2	< 0.01	0.52
Menstruation as bothersome	4.9	5.1	4.3	5.0	< 0.05	0.44
Menstruation as natural	4.8	5.1	4.8	5.9	< 0.001	0.68
Anticipation/prediction	4.5	4.8	4.4	6.0	< 0.001	0.71
Denial of effect	4.4	4.5	4.2	4.8	< 0.05	0.36

5.4.4 Changes in Menstrual Hygiene Practices

Menstrual hygiene practices improved notably among participants who received the intervention (Table 24). At baseline, only 31 % of intervention participants reported using disposable sanitary pads consistently at home beyond old clothes; this increased to 88 % post-intervention ($p < 0.001$). In contrast, the control group showed minor changes 48% → 58%. Similarly, reuse of clean cloths bought specifically for menstruation rose from 43 % → 57 %, reflecting improved hygienic sourcing. The frequency of changing materials at least three times daily during heavy flow increased from 35 % → 65 % in

the intervention group, compared to 26 % → 39 % in the control group. Moreover, the proportion of students who reported washing hands before changing materials every time increased from 45 % → 76 % and after changing from 82 % → 89 % ($p < 0.01$). Correct genital-washing frequency (≥ twice per day) improved to 79 % in the intervention group, and use of soap rose from 29 % → 47 %.

Improvements were also observed in the intervention group in safe disposal behaviors: wrapping used materials before disposal increased from 63 % → 89 %. Similarly, drying reusable materials in sunlight improved (50 % → 55 %), and sterilization by ironing increased from 23 % → 78 %. Composite practice scores showed a statistically significant improvement in the intervention group ($p < 0.001$; Cohen's $d = 0.82$), while no significant change was detected in the control group ($p > 0.05$).

Table 24. Menstrual hygiene practices of study participants

Practice indicator	Control Baseline	Control Endline	Interv. Baseline	Interv. Endline	*P* (within)	Cohen's d
Used disposable pad at home	48 %	58 %	31 %	88 %	< 0.001	0.84
Changed material ≥ 3 ×/day	26 %	39 %	35 %	65 %	< 0.01	0.73
Washed hands before changing	50 %	55 %	45 %	76 %	< 0.001	0.78
Used soap for washing genitals	29 %	36 %	29 %	47 %	< 0.05	0.41
Wrapped before disposal	63 %	70 %	63 %	89 %	< 0.01	0.65
Sun-dried reusables	43 %	43 %	50 %	55 %	< 0.05	0.34
Ironed reusables	23 %	53 %	23 %	78 %	< 0.001	0.86

5.5 Discussion

This quasi-experimental study evaluated the impact of a structured, participatory educational intervention on menstrual health and hygiene (MHH) knowledge, attitudes, and practices (KAP) among nursing students in Bangladesh. The findings revealed statistically significant improvements across all domains of knowledge, attitude, and practice following the intervention. These results confirm that short-term, interactive education can generate meaningful cognitive and behavioral change, even among health science students who are presumed to possess baseline awareness. Importantly, the intervention's participatory design, rooted in WaterAid's Menstrual Hygiene Matters framework (House et al., 2013; WaterAid, 2017), transformed not only what students knew but also how they felt and acted regarding menstruation. Together, these findings highlight that educational interventions in tertiary health institutions can effectively dismantle entrenched taboos, improve hygienic behavior, and strengthen the professional capacity of future nurses to advocate for menstrual dignity.

5.5.1 Enhancing Menstrual Knowledge through Participatory Learning

The most striking outcome of this study was the substantial increase in menstrual knowledge following the one-month intervention. Students' understanding of the menstrual cycle, physiological mechanisms, and appropriate hygiene practices improved dramatically; for instance, recognition of the average 28-day cycle rose from 8 % to 78 %, and correct identification of the uterine lining as the source of menstrual blood increased from 35% to 65%. These gains underscore the power of participatory and interactive pedagogy in health education. Comparable improvements have been reported in interventions conducted among adolescents in Iran (Rezaei et al., 2022) and secondary students in Nigeria (Agbede & Ekeanyanwu, 2021), yet our study adds new evidence that such approaches are equally effective among nursing students. Despite their clinical

background, many participants initially held misconceptions and cultural myths—revealing that professional education alone does not guarantee menstrual literacy. The observed cognitive shift aligns with Bloom's taxonomy of learning, which posits that comprehension and knowledge acquisition are prerequisites for behavioral change (Anderson & Krathwohl, 2001; Bloom et al., 1956). The intervention succeeded in converting fragmented biomedical knowledge into integrated, gender-sensitive understanding, a crucial first step toward developing competent and empathetic future healthcare providers.

5.5.2 Transforming Attitudes: From Silence to Empowerment

Beyond knowledge, the intervention fostered a profound attitudinal transformation among participants. Initially, many students regarded menstruation as a debilitating or inconvenient experience. Following the sessions, they increasingly described it as a natural and healthy bodily process, with significant increases in the "Menstruation as a natural event" domain of the Menstrual Attitude Questionnaire. This positive attitudinal shift reflects the affective learning process described by Krathwohl, Bloom, and Masia (Krathwohl et al., 1964), wherein emotional engagement and reflection enable learners to re-evaluate internalized beliefs. The open-discussion and peer-sharing components of the intervention helped students break the silence surrounding menstruation, normalize discussion of bodily functions, and develop empathy toward others who face menstrual challenges. Such findings are consistent with prior studies in Ethiopia (Tesfay et al., 2024) and India (Kumar et al., 2024), where participatory menstrual education reduced embarrassment and improved body image. For nursing students—future advocates of women's health—these attitudinal improvements are particularly important. They not only influence personal comfort but also shape professional behavior when providing menstrual health counseling to patients.

Ultimately, this shift from secrecy to empowerment demonstrates how affective learning can bridge knowledge and practice, transforming menstruation from a hidden topic into a normalized aspect of health discourse.

5.5.3 Improving Hygienic Practices and Self-Efficacy

The behavioral outcomes of this study showed the most robust improvements. After the intervention, sanitary-pad use increased from 31 % to 88 %, frequency of changing materials at least three times per day rose from 35 % to 65 %, and regular hand-washing before and after changing materials reached 76 % and 89 %, respectively. Such changes represent not only acquired skills but also increased self-efficacy—the belief in one's ability to perform health-protective behaviors (Bandura, 1986). Previous WASH-linked menstrual interventions in Nepal (Budhathoki et al., 2018) and Kenya (Phillips-Howard et al., 2016) similarly demonstrated that behavioral improvement is sustained when educational content integrates practical demonstration, environmental awareness, and peer reinforcement. Notably, our participants also improved in environmentally safe practices such as proper disposal, sun-drying, and sterilization of reusable materials. These changes are essential in the Bangladeshi context, where hostel living conditions often limit access to safe disposal and private drying areas. Thus, the findings validated the behavioral pathway of learning by showing that cognitive gains and positive emotions, reinforced through modeling and feedback, could lead to sustainable hygiene behaviors (Rosenstock et al., 1988). By linking menstrual education with practical skill-building, the program bridged the gap between "knowing" and "doing."

5.5.4 Novelty: Positioning Nursing Students as Menstrual Health Advocates

A distinctive contribution of this study is its focus on nursing students rather than adolescents or adult women in general. As future frontline health professionals, nurses are uniquely positioned to influence public discourse and promote menstrual equity

(Pereda & Mahuna, 2025). However, research indicates that even in professional settings, menstrual stigma persists and can undermine clinical empathy (Bobel et al., 2020). Our findings reveal that before the intervention, many nursing students lacked confidence discussing menstruation, both personally and in patient contexts. After participation, students expressed greater comfort and readiness to address menstrual health with peers and future patients. This transformation is significant because it equips them to act as change agents, capable of disseminating accurate information and modeling dignity-based care. Therefore, this study not only improves individual outcomes but also builds institutional educational capacity for gender-sensitive nursing education. Embedding such interventions in curricula could help produce a generation of nurses who normalize menstruation within the healthcare system—an essential step toward dismantling long-standing cultural taboos.

5.5.5 Integration of Menstrual Health into Nursing Education and Policy

The evidence presented here supports institutionalizing menstrual-health education within nursing and midwifery curricula in Bangladesh. The Directorate General of Nursing and Midwifery (DGNM) could adopt participatory modules modeled on this intervention to strengthen gender-responsive training nationwide. Integrating menstrual health into nursing education would advance several Sustainable Development Goals—SDG 3 (Good Health), SDG 4 (Quality Education), SDG 5 (Gender Equality), and SDG 6 (Clean Water and Sanitation) (Sommer et al., 2021). Curricular integration must also be accompanied by infrastructural improvements, such as accessible WASH facilities, private changing rooms, and adequate disposal mechanisms, which reinforce learned behaviors (UNICEF, 2019; UNICEF & WHO, 2024). Similar policy shifts have been successful in India and Nepal, where WaterAid-supported programs established menstrual-friendly schools and training institutions (House et al., 2013; WaterAid, 2017).

Institutionalizing menstrual education in nursing can ensure that its future health workforce embodies the principles of equity, empathy, and evidence-based practice.

5.5.6 Comparison with Global Evidence and Theoretical Implications

The medium-to-large effect sizes observed in this study (0.68–0.82) align closely with findings from global meta-analyses, which report standardized mean differences between 0.5 and 0.8 for menstrual-education interventions (Evans et al., 2022). This confirms the robustness of participatory educational approaches across cultural contexts. However, our findings extend the literature by demonstrating their applicability in tertiary health education, a level rarely examined.

Theoretically, this study supports the integration of social cognitive theory and affective learning frameworks in designing menstrual-health programs. The cognitive improvements observed mirror Bloom's learning hierarchy, while attitudinal and behavioral changes reflect self-efficacy enhancement and the affective domain (Bandura, 1986; Krathwohl et al., 1964). Together, these findings contribute to an emerging model of menstrual health promotion in higher education, where skill, emotion, and environment intersect to produce sustainable change.

5.6 Strengths, Limitations, and Future Directions

This study's strengths include its quasi-experimental design, the use of validated instruments (KAP scales), and a six-month follow-up that captured sustained effects. The mixed cognitive-affective-behavioral approach provided a holistic perspective on menstrual learning. However, some limitations merit consideration. The study was confined to one nursing college, which may limit external generalizability. Self-reported behavioral data may be influenced by social desirability bias, although anonymity likely mitigated this effect. Future research should involve multiple institutions, include male nursing students to explore gender dynamics, and adopt longitudinal or randomized

designs to confirm causality. Additionally, integrating qualitative methods could deepen understanding of how social norms influence menstrual practices among healthcare trainees.

5.7 Conclusion

This study demonstrates that short-term, participatory menstrual-health education can generate substantial cognitive, emotional, and behavioral improvements among nursing students. By combining evidence-based content with dialogical learning, the intervention not only improved menstrual literacy but also empowered participants to challenge stigma and menstrual practices. These findings affirm that nursing education is a powerful platform for advancing menstrual equity and women's health rights. Integrating structured MHH modules into the nursing curriculum and institutional policy can help cultivate a new generation of health professionals who approach menstruation with empathy, knowledge, and professionalism.

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CHAPTER 6

GENERAL CONCLUSION AND RECOMMENDATIONS

6.1 Overall Conclusion

This thesis examined MHH among nursing students in Bangladesh through a life-course, gender-sensitive, and multi-method research approach. Drawing evidence from five interconnected studies including a narrative review, a cross-sectional study, a qualitative inquiry, a mixed-methods analysis, and an educational intervention this work demonstrates that MHH challenges are shaped by structural inequities, socio-cultural stigma, economic constraints, and inadequate WASH facilities. Together, these studies illuminate how menstrual inequities persist even among future healthcare professionals.

Across the life course, the narrative review revealed that menstrual challenges begin with insufficient knowledge at menarche and continue into adulthood, particularly in workplaces where women struggle with product affordability, lack of privacy, inadequate disposal systems, and stigma. These findings situate Bangladesh within a global landscape where menstrual health remains overlooked in policy, infrastructure, and gender-rights frameworks.

The cross-sectional survey highlighted that menstrual product choices among nursing students specifically the continued use of old cloth is significantly influenced not by students' own knowledge but by parental education level, socio-economic status, embarrassment in purchasing products, and poor sanitation facilities. This indicates that

menstrual inequities are rooted in familial, cultural, and environmental factors rather than individual knowledge alone.

The qualitative study further illustrated the emotional and experiential realities of period poverty among nursing students. Many participants experienced fear and confusion during menarche due to inaccurate or incomplete information from mothers or relatives. Despite preferring disposable sanitary pads, students often relied on old clothes due to embarrassment, financial constraints, and shame associated with buying products from male shopkeepers. Disposal challenges, lack of privacy, and the absence of hygienic WASH facilities created additional stress, reinforcing social silence around menstruation and internalized stigma.

The mixed-methods inquiry confirmed that menstrual challenges among nursing students are deeply gendered and intersectional. Students from rural backgrounds, lower-income families, and less-educated households faced disproportionately higher barriers. Male students expressed limited understanding but also a growing willingness to support menstrual dignity, illustrating the opportunity for gender-inclusive education. Despite formal nursing training that discussed MHH, many female students continued to experience emotional distress, secrecy, and restricted mobility, highlighting a disconnect between theoretical learning and lived experience.

Finally, the quasi-experimental intervention demonstrated that structured, participatory education significantly improves menstrual knowledge, attitudes, and practices—even within short timeframes. The intervention strengthened cognitive understanding of menstrual physiology, improved emotional comfort around menstruation, reduced stigma, and enhanced hygienic practices such as pad use, frequent material change, and handwashing. Although the intervention did not alter physical

infrastructure, it empowered students to navigate existing constraints more safely and confidently.

These findings affirm that nursing institutions can serve as powerful platforms for advancing menstrual literacy and transforming cultural norms. Taken together, the five studies show that menstrual health is not merely a biological or hygiene issue but a multidimensional challenge shaped by gender norms, socio-economic inequities, policy gaps, and inadequate institutional support. Improving MHH among nursing students is not only vital for their personal well-being but also critical for the future of reproductive health services. As future nurses, midwives, and educators, these students will influence generations of women and health policies; therefore, strengthening their menstrual knowledge, dignity, and leadership is essential for achieving menstrual equity.

6.2 Recommendations

Drawing upon the integrated findings from all five chapters, the following recommendations are proposed at the policy, institutional, curricular, community, and research levels. These recommendations aim to strengthen menstrual health and hygiene (MHH) systems, reduce gendered inequities, and support the development of a knowledgeable, empathetic, and professionally competent nursing workforce.

6.2.1 Policy-Level Recommendations

- **Integrate MHH into National Health, Education, and Labor Frameworks**

Incorporate menstrual health as a core component of the National Reproductive Health Strategy, national WASH policies, and occupational health and safety guidelines. Establish regulatory mandates requiring menstrual-friendly WASH facilities including private toilets, disposal mechanisms, and water access—in all educational institutions, hostels, and workplaces.

- **Ensure Affordability and Accessibility of Menstrual Products**

Reduce or eliminate taxation on sanitary products and consider government-supported schemes for free or subsidized menstrual products in public institutions, such as schools, hostels, and health facilities. Strengthen social protection mechanisms to support low-income students through targeted provisions of disposable sanitary pads or reusable alternatives.

- **Embed Menstrual Equity within Gender and Human Rights Policies**

Align menstrual health initiatives with Sustainable Development Goals (SDGs)—particularly SDGs 3, 4, 5, and 6 to ensure clear accountability for menstrual equity within national planning of MHH. Implement nationwide stigma-reduction campaigns to normalize menstruation and counter harmful social norms, in partnership with government agencies, NGOs, and media outlets.

6.2.2 Institutional-Level Recommendations

- **Improve WASH Infrastructure in Institutions and Hostels**

Ensure availability of clean, functional, and gender-sensitive WASH facilities equipped with privacy locks, adequate lighting, running water, and soap. Install appropriate disposal systems, including covered bins and environmentally safe waste-management solutions within toilets and dormitories.

- **Ensure Continuous Availability of Menstrual Products on Campus**

Establish institutional mechanisms such as pad banks, vending machines, or subsidized reusable products to ensure reliable access throughout the academic year. Provide emergency menstrual kits in hostels, classrooms, and clinical training areas.

- **Promote Gender-Inclusive and Supportive Campus Environments**

Foster respectful and gender-inclusive dialogue by organizing structured forums that encourage open communication among male and female students. Provide training

for faculty members, hostel supervisors, and administrators to enhance menstrual health sensitivity, student support, and gender-responsive leadership.

6.2.3 Curriculum and Pedagogical Recommendations

- **Integrate Structured MHH Modules into Nursing and Midwifery Curricula**

Include comprehensive content on menstrual physiology, diverse product options, pain management, rights-based perspectives, and WASH management. Strengthen training on culturally competent communication to prepare students for addressing menstrual stigma in clinical and community contexts.

- **Utilize Participatory and Experiential Learning Approaches**

Incorporate methods such as role-play, peer-led discussions, problem-solving exercises, and reflective journaling to enhance active engagement and self-efficacy. Ensure meaningful participation of male students to promote gender-transformative learning and reduce misinformation.

- **Embed MHH within Clinical Practice and Community Outreach**

Require nursing and midwifery students to conduct menstrual awareness sessions during community placements as part of their professional development. Support student-led advocacy initiatives on MHH within both urban and rural communities to strengthen public engagement and leadership skills.

6.2.4 Community and Family-Level Recommendations

- **Strengthen Parental and Family Menstrual Literacy**

Develop community-based educational programs aimed at mother–daughter communication, particularly in rural and low-income settings where misinformation persists. Encourage participation of fathers and male guardians to reduce household stigma, support informed decision-making, and foster shared responsibility.

- **Normalize Menstrual Discourse in Community Settings**

Engage peer educators, youth organizations, and religious or community leaders to promote menstrual dignity and challenge entrenched misconceptions. Implement culturally tailored awareness campaigns to disseminate accurate information and shift harmful social norms surrounding menstruation.

6.2.4 Recommendations for Future Research

- Evaluate long-term outcomes of educational interventions, particularly their effects on students' future clinical practice, patient counseling, and leadership roles in reproductive health.
- Explore the menstrual experiences of male nursing students to inform the design of gender-inclusive curricula.
- Investigate MHH challenges among women in diverse workplace settings (e.g., garment workers, nurses, informal workers), with attention to policy-practice gaps and occupational health risks.
- Assess the cost-effectiveness, environmental impact, and acceptability of reusable menstrual products and innovative disposal technologies in institutional and community settings.
- Conduct longitudinal studies examining how enhanced MHH knowledge, attitudes, and practices influence academic performance, mental health, professional readiness, and gender-equitable behaviors over time.

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8.0 ACHIEVEMENTS

8.1 Publications

8.1.1 Peer-Reviewed Journal Articles

1. Zaman, M. N. U., Sai, A., Nyambe, S., & Yamauchi, T. (2024). Parental education, embarrassment, and sanitation facilities influence menstrual product choices among female nursing students in Bangladesh. *Journal of Water, Sanitation and Hygiene for Development, 14*(10), 1003–1016. https://doi.org/10.2166/washdev.2024.226
2. Zaman, M. N. U., Takashima, R., Sai, A., & Yamauchi, T. (2025). Period poverty: Menstrual information, product selection, and disposal among urban female nursing students in Bangladesh. *Health & Place, 93*, 103467. https://doi.org/10.1016/j.healthplace.2025.103467

8.1.2 Conference Proceedings

1. Zaman, M. N. U., Nyambe, S., Sai, A., & Yamauchi, T. (2024). Exploring menstrual hygiene management and socio-demographic factors affecting menstrual product usage among nursing and midwifery students in Bangladesh. *Sanitation, 8(1):* 9-10. https://doi.org/10.34416/sanitation.00033

8.2 Oral Conference Presentations

1. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2023, June 18). *Menstrual hygiene management and Water, Sanitation and Hygiene Technology for the pre-research baseline study*. Seminar on MHH and WASH, Directorate General of Nursing and Midwifery, Dhaka, Bangladesh (In-person).

2. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2023, November 28). *Exploring menstrual hygiene management and socio-demographic factors affecting menstrual product usage among nursing and midwifery students in Bangladesh*. The International Society for Sanitation Studies (ISSS) Annual Conference, Hokkaido University, Japan (Online).
3. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2024, February 26–28). *Exploring MHH research and future*. JICA Network Seminar, Tokyo, Japan (In-person).
4. Zaman, M. N. U., Nyambe, S., Sai, A., & Yamauchi, T. (2024, June 10–14). *Socio-cultural factors influencing menstrual product choices among nursing students in Bangladesh*. Sustainable Research Innovations Conference, Helsinki, Finland (In-person).
5. Zaman, M. N. U., Sai, A., Nyambe, S., & Yamauchi, T. (2024, October 12–13). *Socio-economic and demographic factors influencing menstrual hygiene product choices among nursing students in Bangladesh*. 89th Annual Meeting of the Japanese Society of Health and Human Ecology (JSHHE), Tokyo, Japan (In-person).
6. Zaman, M. N. U., Sai, A., Takashima, R., & Yamauchi, T. (2024, November 26). *Menstrual information, product selection, and disposal practices among female nursing students in Bangladesh: A qualitative study*. ISSS Annual Conference, Hokkaido University, Japan (Online).
7. Zaman, M. N. U., Sai, A., Nyambe, S., & Yamauchi, T. (2024, October 28–30). *Parental education and embarrassment influence menstrual product choices among female nursing students in Bangladesh*. Hokkaido University–University of Melbourne Joint MHH Workshop, Melbourne, Australia (Online).

8. Zaman, M. N. U., & Yamauchi, T. (2024, December 6–7). *Navigating menstrual health and hygiene: A mixed-methods study of parental influence, embarrassment, and sanitation challenges among nursing students in Bangladesh*. 10th International Public Health Conference, Bogura, Bangladesh (In-person). **(Best Presenter Award)**
9. Zaman, M. N. U., Sai, A., Nyambe, S., & Yamauchi, T. (2025, May 28). *Period-friendly Bangladesh*. 1st Menstrual Hygiene Day Symposium, Hokkaido University, Sapporo, Japan (In-person).
10. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2025, July 21). *MHH and coping strategies among nursing students in Bangladesh*. WASH with a Focus on MHH to Foster School and Community Health Nursing, Directorate General of Nursing and Midwifery, Dhaka, Bangladesh (In-person).
11. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2025, July 23). *MHH and current status among nursing students in Bangladesh*. Building a Bridge for Future Collaboration Symposium, Rajshahi Medical University, Rajshahi, Bangladesh (In-person).
12. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2025, September 30). *Co-creating menstrual health and hygiene solutions: A mixed-methods study with male and female nursing students in Bangladesh*. ISSS Annual Conference, Hokkaido University, Japan (Online).
13. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2025, October 11). *Maternal and personal education influence menstrual product access and WASH facilities among nursing students in Bangladesh*. 90th Annual Meeting of the JSHHE, Hokkaido University, Sapporo, Japan (In-person).

8.3 Poster Presentations

1. Zaman, M. N. U., Sai, A., Nyambe, S., & Yamauchi, T. (2023, October 20). *Understanding menstrual hygiene management: A narrative review and pilot study in Bangladesh*. 6th Faculty of Health Sciences (FHS) International Conference, Hokkaido University, Sapporo, Japan (In-person).
2. Zaman, M. N. U., Sai, A., & Yamauchi, T. (2025, October 24). *Gender-inclusive education for menstrual health and hygiene among nursing students in Bangladesh: A mixed-methods study*. 7th FHS International Symposium, Hokkaido University, Sapporo, Japan (In-person).

9.0 Annexure

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Research Paper

Parental education, embarrassment, and sanitation facilities influence menstrual product choices among female nursing students in Bangladesh

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ABSTRACT

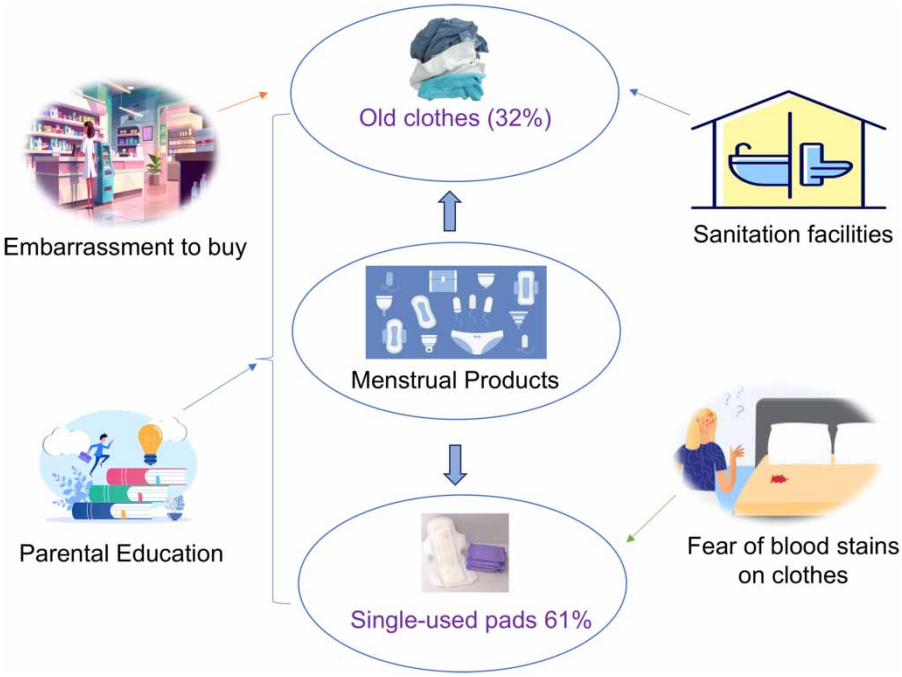
Understanding the factors that shape menstrual product choices is crucial for improving menstrual health and hygiene practices among young women in low-resource settings. This study investigates the influence of parental education, embarrassment, and sanitation facilities on the choice between hygienic menstrual products, like single-use pads, and unhygienic options, such as old clothes. A structured questionnaire was used to interview 366 nursing students in Bangladesh, with an average age of 23.3 $\pm$ 4.3 years. Descriptive statistics, Pearson's chi-square test, and multivariable logistic regression were performed using JMP Pro 17. The major products were single-use pads (61%) and old clothes (32%). Participants' family was the primary source of menstrual information, and product choices were influenced by both fathers' ($p < 0.05$) and mothers' ($p < 0.05$) education level. Additionally, the participants reported negative perceptions of the sanitation facilities, citing issues such as a lack of privacy, cleanliness, and the availability of water and soap. Embarrassment about buying (Adjusted Odds Ratio (AOR): 2.86 [1.16–7.07]) and privacy of bathroom facilities (AOR: 2.92 [1.12–7.63]) increased the odds of old clothes, while fear of staining blood (AOR: 2.95 [1.53–5.68]) increased the odds of having single-use pads. Better menstrual health and hygiene practices require improved parental education, reduced embarrassment, and better sanitation facilities.

Key words: Bangladesh, menstrual health and hygiene, menstrual hygiene products, nurses, women's health

HIGHLIGHTS

- We assess menstrual product preferences among nursing students.
- Parental education influenced menstrual product choices.
- The embarrassment of purchasing products influenced the use of old clothes.
- Sanitation facilities influenced product choices.

GRAPHICAL ABSTRACT



INTRODUCTION

Menstruation is a physiological process that usually occurs periodically in a cycle between 21 and 35 days and lasts for approximately 2–7 days, resulting in a blood flow of around 25–80 mL (Agampodi & Agampodi 2018). Although menstruation is a natural recurring event in the life of a woman or girl child, occurring between the ages of 12 and 50, more often than not, it is a subject that has been neglected worldwide. However, recent movements have propelled menstrual health to the forefront as an essential public health concern and a fundamental right to achieve the Sustainable Development Goals by 2030 (Sommer *et al.* 2021; Babbar *et al.* 2022). Hennegan and colleagues defined menstrual health as the absence of ailments and the overall state of physical, mental, and social well-being concerning the menstrual cycle (Hennegan *et al.* 2021).

It is of paramount importance that women and girls, particularly those residing in low- and middle-income countries (LMICs) and conflict zones, are empowered to manage their menstrual cycles privately, safely, and with dignity. This not only affects their health, both physically and mentally, but also their contribution to community development (Plesons *et al.* 2021). Poor menstrual health and hygiene (MHH) may lead to adverse health outcomes and adversely affect many parts of life, including education, social involvement, and psychological health (Balakrishnan *et al.* 2022). Every individual who is menstruating should be able to experience menstruation in a safe and dignified manner. Furthermore, gender equality, women's health, empowerment, education, and general well-being align with menstruation as factors that bring out the importance of menstrual hygiene management (MHM) in public health (UNICEF 2019). It, therefore, follows that the issue of menstruation has a strong bearing on the academic performance, class attendance, and general participation of the students in functions within the college or particularly in the university set-up (Munro *et al.* 2021).

MHH is a crucial factor that significantly contributes to the physical, emotional, and empowerment well-being of adolescent girls and women (World Bank Group 2021). The effective MHM comprises the use of hygienic materials to collect or absorb menstrual blood, access to facilities safe for disposing of and changing materials, and information distribution to raise awareness about menstruation and the use of menstrual hygiene (UNICEF 2019). The quality and safety of menstrual products are essential because they come into direct contact with the body repeatedly each month over a woman's lifetime, which, on average, spans about 40 years (Choi *et al.* 2021). Most of these girls and women lack access to high-quality, appropriate, hygienic, and absorbent materials to manage menstruation (WHO/UNICEF Joint Monitoring Programme (JMP) 2012). Menstrual hygiene products include one-time-use products such as disposable pads and tampons, as well as reusable products such as clothes, menstrual cups, and washable cloth pads (Pednekar *et al.* 2022). Due to high costs and limited

knowledge, many women resort to using old clothes as menstrual products (Meher & Sahoo 2023). However, these reusable materials can be unhygienic because they are often cleaned without soap and with unclean water, and social taboos and restrictions further complicate matters by forcing women to dry these clothes indoors, away from sunlight and fresh air (Das *et al.* 2015).

In Bangladesh, a densely populated South Asian country, there is commendable development in infrastructure related to water, sanitation, and hygiene (WASH). However, the country has a huge gap in the extensive literature on the practice of menstrual hygiene in the country (Ministry of Health and Family Welfare 2019; Ministry of Local Government 2021). According to the Bangladesh National Hygiene Survey, only 41% of females aged 15–49 practiced hygienic menstrual management, with a mere 39% having access to sanitary pads (Bangladesh Bureau of Statistics 2020). Most studies have focused exclusively on adolescent girls, offering a gendered perspective on menstruation. They largely emphasise societal stigma, including embarrassment, misconceptions about menstruation, inadequate facilities in educational institutions, and familial restrictions that contribute to school absenteeism.(Alam *et al.* 2017; Hennegan & Sol 2020). Most extant studies have concentrated on needs and practices concerning menstruation (Ha & Alam 2022; Hunter *et al.* 2022). However, limited studies have been undertaken on MHM among adult women, particularly those in specialised sectors such as nursing. Women in these fields are essential members of the female population and future healthcare professionals who tackle women's health concerns. This implies, therefore, that these MHH practices among women have to be well inculcated into the nursing programmes.

Based on the literature, many factors contribute to MHM, which play a vital role in the health, social involvement, and overall well-being of women. Despite progress in understanding MHH, there is still a notable gap in research that specifically addresses the factors influencing menstrual product choices among nursing students. Their choices and practices are shaped not only by personal preferences but also by the surrounding environment. This study thus sought to identify the parental education, embarrassment, and sanitation facilities that affect nursing students' choices of menstrual hygiene products in Bangladesh.

METHODS AND PARTICIPANTS

Study design and setting

A cross-sectional quantitative study of a descriptive nature was conducted among nursing students from four districts, named Dhaka, Rajshahi, Naogaon, and Satkhira, in three regions of Bangladesh (Figure 1). We selected these three regions including capital cities that represent diverse social, cultural, and economic backgrounds. Seven government nursing colleges within these regions were chosen: National Institute of Advanced Nursing Education and Research (NIANER), Dhaka; College of Nursing (CoN), Mohakhali, Dhaka; Dhaka Nursing College (DNC), Dhaka; CoN, Sher-E-Bangla Nagar, Dhaka; Rajshahi Nursing College (RNC), Rajshahi; Nursing Institute (NI), Naogaon; and Nursing and Midwifery College (NMC), Satkhira. The government nursing colleges were chosen as significant representatives of women for sensitive issues like menstruation because they are more accessible than other institutions for the researchers, allowing for easier data collection and engagement with participants.

Participants and sample size

All menstruating nursing students at these colleges were eligible to participate. The colleges comprised a total of 2,495 nursing students, among which 120 were found in NIANER; 290 in CoN, Mohakhali; 550 in DNC; 475 in CoN, Sher-E-Bangla Nagar; 550 in RNC; 225 in NI, Naogaon; and 285 in NMC, Satkhira. The sample size was calculated employing a single population proportion formula (Cochran 1977), considering specific assumptions as follows:

$$n_o = \frac{z^2 \times pq}{e^2} \tag{1}$$

where n_o is the expected sample size, z is equal to 1.96 for a 95% confidence level, p is equal to 0.50 (expressed as 50% in decimal form), $q = 1 - p$, and $e = 0.05$ (representing a 5% margin of error).

$$n_o = \frac{(1.96)^2 \times 0.5\ (1 - 0.5)}{(0.05)^2} \tag{2}$$

$$n_o = 384 \tag{3}$$

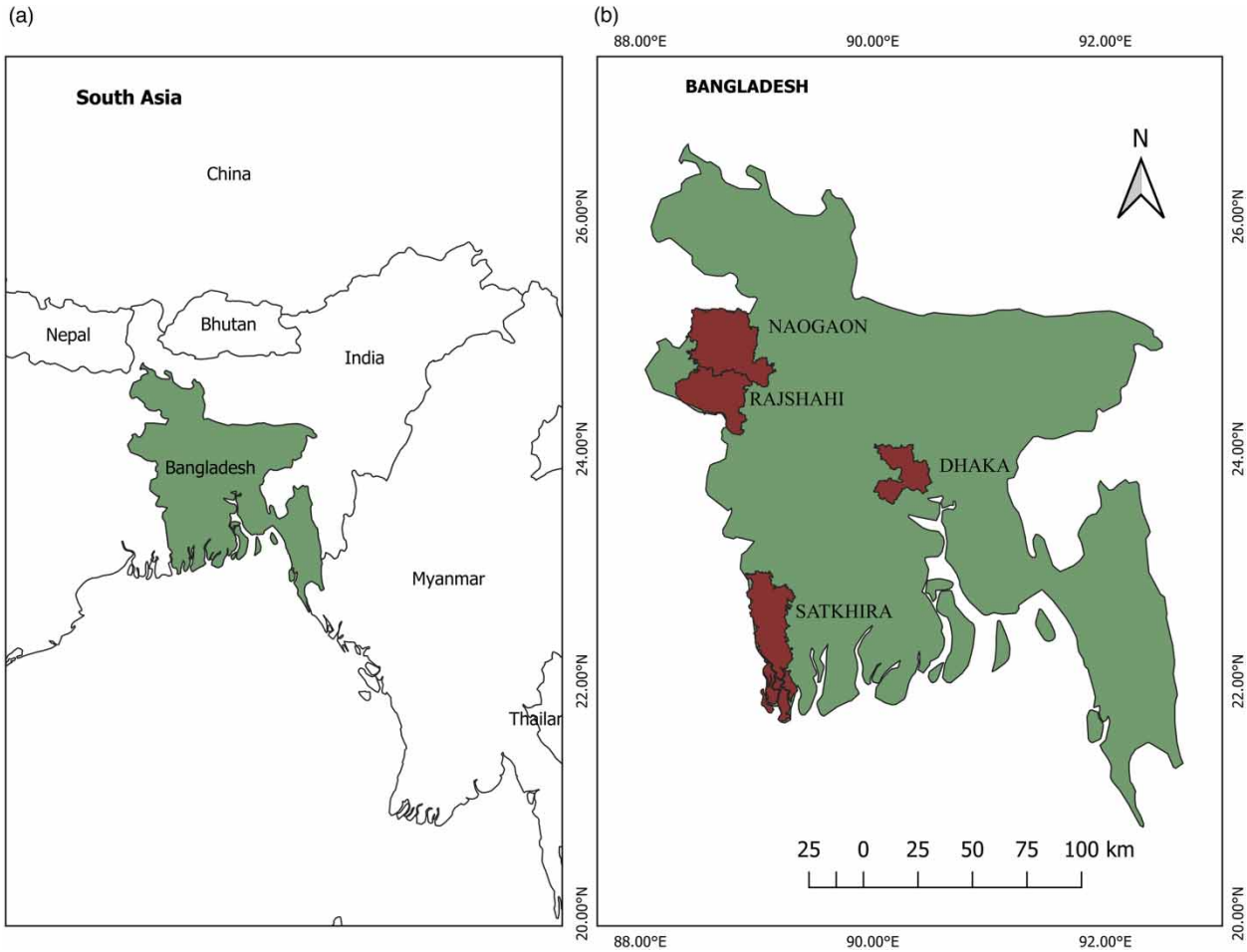


Figure 1 | Geographic distribution of the study site.

The final sample size (n) was determined using the correction formula, where n_o represents the initial sample size (384), and N represents the number of women at these colleges (2,495):

$$n = \frac{n_o}{[1 + \{(n_o - 1)/N\}]} \tag{4}$$

$$n = \frac{384}{[1 + \{(384 - 1)/2,495\}]} \tag{5}$$

$$n = 333 \tag{6}$$

Accounting for a non-response rate of 10%, the total sample size was calculated.

$$n = 333 + 33 = 366 \tag{7}$$

Therefore, 366 nursing students were included in this study after the sample size was calculated. Following the allocation of students from seven selected nursing colleges using proportional allocation to size (PAS), the participants were chosen through simple random sampling.

Instruments and data collection

The research instrument was a rigorously structured questionnaire that contained 64 questions from the Menstrual Health Questionnaire (Medina-Perucha *et al.* 2020; Hassan *et al.* 2023) and a recent study about confidence in managing menstruation (Munro *et al.* 2022). The research instrument underwent translation into Bangla and subsequent revision by the research team. The questionnaire gathered data on socio-demographic and menstrual characteristics, menstrual information and education, menstrual hygiene products and supplies, and perceptions of the sanitation facilities. The questionnaire included multiple-choice questions, yes/no questions, and Likert scale items. For example, one question asked, 'Are you embarrassed to buy menstrual products?', with response options on a Likert scale ranging from 1 (I do not know) to 5 (Always). The data were gathered through face-to-face interviews held on campus every weekday, except Friday, spanning from June to July 2023. The data collection process was facilitated by the first author and six trained research assistants, all of whom are professional nurses and midwives.

Data analysis

Numbers and percentages were utilised for the analysis of categorical variables. Pearson's chi-square was employed to evaluate the bivariate relationships between types of sanitary products and socio-demographic factors. Multivariable logistic regression analysis was employed to ascertain the potential factors linked to using single-use pads and old clothes. We created dummy variables for Likert scale data (e.g., lacked money to buy menstrual products) to input our regression models. Responses to items with 'always', 'sometimes', and 'few times' response options were recorded as '1' meaning yes and 'never', and the 'I don't know' response option was recorded as '0' meaning no. We similarly treated responses to each item on the perception of sanitation facilities, with 'always', 'most of the time', and 'sometimes' response options recorded as '1' meaning good and 'rarely' and 'never' response options recorded as '0' meaning poor conditions. The stepwise regression technique was used to select the best predictive model. In the stepwise regression variable selection, the bivariate odds ratio was calculated between each dependent and independent variable. Only those with an odds ratio less than 0.25 were incorporated into the multilevel model (Sun *et al.* 1996). For entry and removal into the adjusted odds ratio model, the respective p-value thresholds were set at 0.25 and 0.1. The significance level was established at $p < 0.05$, maintaining a confidence interval of 95% using JMP version 17 Pro (SAS Institute Inc., Cary, NC, USA).

Ethical considerations

Ethical approval was obtained from the Directorate General of Nursing and Midwifery, Dhaka (45.03.0000.008.14.097.2021-354), NIANER, Dhaka (NIA-OS-2023-09), and the Ethical Review Committee of the Faculty of Health Sciences, Hokkaido University in Japan (23-52). An information sheet was provided to the participants before the survey, explaining in clear terms the voluntary nature of their participation and their ability to withdraw from participation at any point. We obtained consent by affirming their willingness to participate with a response of 'yes'.

RESULTS

Socio-demographic characteristics

The mean age of participants was recorded as 23.3 $\pm$ 4.3 years (Table 1), and the average age at menarche was 13.2 $\pm$ 2.3 years. The majority of participants were first-year (54.1%), and 37.7% were enrolled in the B.Sc. in Nursing (4 years) course. Notably, 35.8% of participants' mothers had received a secondary education, whereas 29.9% of participants' fathers had received a higher secondary education. Additionally, it revealed that most of the participants' religions were Islam (86.1%), they were born in rural areas (75.7%), they lived in hostels (74.6%), and their monthly family income was between 10,000 and 20,000 BDT (36.6%).

Menstrual characteristics and sources of menstrual information and education

The research revealed that 15.8% of the participants had irregular menstrual periods (Table 2). Over half of the participants (51.9%) reported fear of blood leakage, which is a proxy for the severity of bleeding. The participants expressed a combination of favourable and unfavourable emotions while menstruating. The unfavourable emotions reported by participants were tired (54.9%), sensitivity (31.4%), anger (40.2%), sadness (32.5%), dirty (21.6%), and embarrassment (22.4%). Some participants reported feeling happy (1.1%) and relaxed (1.4%) during their periods. The key information source about menstruation for the participants was their family (80.6%), followed by school (24.9%) and friends (25.4%). More than half of the participants

Table 1 | Socio-demographic characteristics

Characteristics	*n*	%
Current age	366	Mean = 23.3 (SD = 4.3)
Age of menarche	366	Mean = 13.2 (SD = 2.3)
Category of studentship		
Master's in nursing	18	4.9
B.Sc. in Midwifery (Post Basic)	33	9
B.Sc. in Nursing (4 years)	138	37.7
B.Sc. in Nursing (Post Basic)	35	9.6
Diploma in Midwifery	87	23.8
Diploma in Nursing Science and Midwifery	55	15
Year of college		
First year	198	54.1
Second year	115	31.4
Third year	35	9.6
Fourth year	18	4.9
Religion		
Islam	315	86.1
Hinduism	45	12.3
Buddhism	1	0.3
Christian	5	1.4
Fathers' education level		
Graduate or above	63	17.3
Higher secondary	109	29.9
Secondary	94	25.8
Primary	78	21.4
Illiterate	21	5.8
Mothers' education level		
Graduate or above	28	7.7
Higher secondary	84	23
Secondary	131	35.8
Primary	104	28.4
Illiterate	19	5.2
Birthplace status		
Rural	277	75.7
Urban	89	24.3
Resident status		
Hostel	273	74.6
Own house	93	25.4
Monthly family income		
Below 10,000/- BDT	55	15
10,000–20,000/- BDT	134	36.6
20,000–30,000/- BDT	93	25.4
More than 30,000/- BDT	84	23

SD, standard deviation; BDT, the currency symbol for the Bangladesh taka.

Table 2 | Menstrual characteristics and sources of menstrual information and education

Characteristics	*n*	%
Is your menstrual cycle regular? ($N = 366$)		
The same every month	160	43.7
Varies each month slightly	148	40.4
Never the same each month	58	15.8
Fear of staining clothes with blood when menstruating? ($N = 366$)		
Yes	190	51.9
No	176	48.1
Do you suffer from menstrual pain? ($N = 366$)		
Always	81	22.1
Sometimes	226	61.7
Very few times	39	10.7
Never	20	5.5
How do you feel during menstruation? [a]$N = 366$ (for each choice, multiple response)		
Tired	201	54.9
Sensitive	115	31.4
Angry	147	40.2
Sad	119	32.5
Dirty	79	21.6
Embarrassed	82	22.4
Happy	4	1.1
Relaxed	5	1.4
Sources of menstrual information [a]$N = 366$ (for each choice, multiple response)		
Family	295	80.6
School	91	24.9
Friends	93	25.4
Internet	23	6.3
Social network	20	5.5
College	13	3.6
Magazine/books	22	6
Others	9	2.5
Did you know about menstruation before its first onset? ($N = 366$)		
Yes	151	41.3
No	215	58.7
When you got your first period, did you feel ready for it? ($N = 366$)		
Yes	71	19.4
No	276	75.4
I do not know	19	5.2
Do you need more information on menstruation? ($N = 366$)		
No, I have enough information/not interested	60	16.4
Yes	306	83.6
Menstrual delays[b]	169	55.2
Impact of menstruation on daily life[b]	179	58.5

(*Continued.*)

Table 2 | Continued

Characteristics	*n*	%
Menstrual products[b]	80	26.1
What is menstruation?[b]	29	9.5
Menstruation duration[b]	40	13.1
Do you feel embarrassed talking about menstruation? ($N = 366$)		
Always	58	15.8
Sometimes	200	54.6
Never	108	29.5

[a]The total adds up to more than 100 because this was a multiple-response question.
[b]Percentages out of those who said yes (N = 306) and total adds up to more than 100 due to multiple-response question.

(58.7%) did not have any knowledge about menstruation before they experienced their first period. Most participants (83.6%) expressed a need for more information on different topics related to menstruation. The majority (71.5%) of the participants experience feelings of embarrassment while discussing menstruation (always 15.8% and sometimes 54.6%).

Menstrual hygiene product choices

About 61% of participants preferred single-use pads, which are considered hygienic, while 32% relied on old clothes, which are deemed unhygienic due to improper cleaning and drying practices. A small portion (3%) used toilet paper, which is also considered unhygienic. Additionally, 2% used nappies, and another 2% opted for more hygienic alternatives like tampons, menstrual cups, or menstrual underwear (Figure 2).

Access to menstrual hygiene products and supplies

Almost all participants (98.9%) reported being unable to get free menstrual hygiene products in hostels (Supplementary material, Table S1). Most of them (85%) reported that menstrual hygiene products were expensive. Most of them (86.6%)

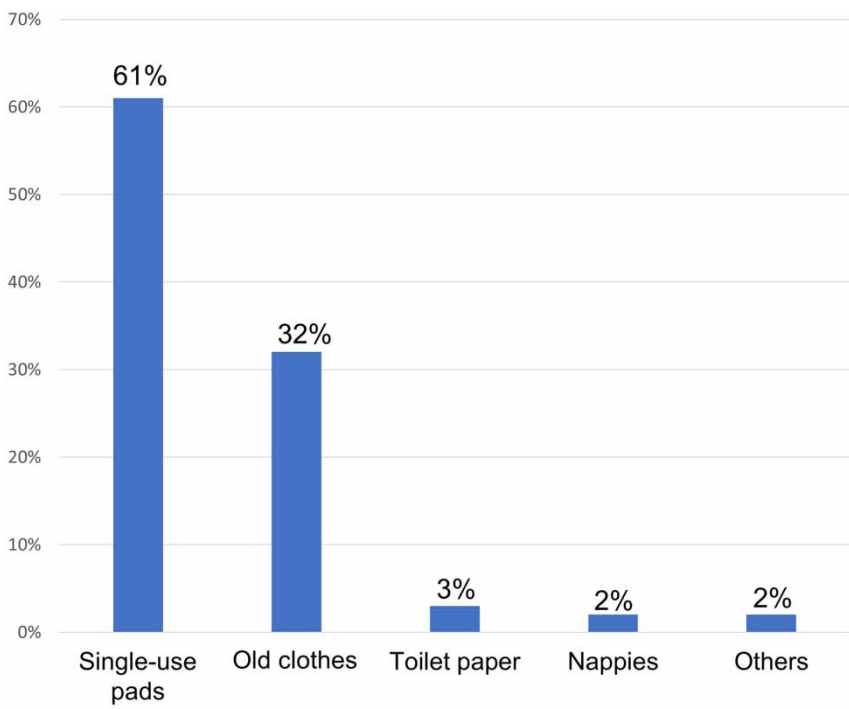


Figure 2 | Types of menstrual hygiene products reported to be used by women ($N = 366$). Other includes tampons, menstrual cups, and menstrual underwear.

stated that they obtain their menstrual products from pharmacies while on campus. The pharmacy was identified as the most preferred location for purchasing menstrual products due to comfort (71.3%). A large majority (86.3%) of those surveyed mentioned using menstrual products for an extended duration beyond recommendations due to inadequate access to suitable washing facilities. Among them, 5.8% answered 'always', while 64.8% replied 'sometimes', and 15.7% answered 'few times'. More than two-thirds (76.5%) of the participants also reported experiencing embarrassment when purchasing menstrual products. Among them, 10.1% answered 'always', 57.9% replied 'sometimes', and 8.5% answered 'few times'.

Perception of sanitation facilities

A minimal proportion (15.3%) always noted the presence of disposal bins for menstrual products in their regular bathrooms (Supplementary material, Table S2). Slightly more (15.6%) confirmed the consistent availability of clean running water and soap always for handwashing. Participants reported 'always' when asked if they had consistent privacy (22.1%), functional toilets (13.9%), cleanliness (13.4%), functional door locks (30.1%), and toilet paper availability (9.3%) in the bathrooms.

Socio-demographic characteristics of types of menstrual hygiene products

Table 3 shows the association between different menstrual hygiene products and socio-demographic backgrounds. Statistically noteworthy variations existed in the selection of menstrual hygiene products among the categories of studentship ($p \leq 0.0001$), fathers' education level ($p = 0.0307$), mothers' education level ($p = 0.0050$), and monthly family income ($p \leq 0.0001$). Interestingly, there were no statistically significant differences in types of menstrual hygiene products between the year of college ($p = 0.5687$), religion ($p = 0.3419$), birthplace status ($p = 0.9615$), and resident status ($p = 0.9562$).

Factors associated with the use of single-use pads and old clothes

Table 4 presents the multivariable logistic regression analysis for assessing the factors affecting single-use pads and old clothes. These were significantly predicted by menstrual characteristics, access to menstrual hygiene products, and perceptions of sanitation facilities. However, the utilisation of single-use pads and old clothes did not show significant prediction by menstrual information and education. The significant independent predictors that increased odds for single-use pads were fear of staining clothes with blood (AOR: 2.95; 95% CI: 1.53–5.68), having a clean and sanitary bathroom (AOR: 3.17; 95% CI: 1.20–8.39), and the bathroom having functional locks on doors (AOR: 4.45; 95% CI: 1.67–11.85). The odds of having single use pads were less for those who lacked the money to buy menstrual products (AOR: 0.26, 95% CI: 0.09–0.68), were embarrassed to buy menstrual products (AOR: 0.37, 95% CI: 0.16–0.86), and had privacy in their bathroom (AOR: 0.33, 95% CI: 0.14–0.77). Therefore, the significant independent predictors that increased odds for old clothes were being embarrassed to buy menstrual products (AOR: 2.86, 95% CI: 1.16–7.07) and having privacy in their bathroom (AOR: 2.92, 95% CI: 1.12–7.63). The significant independent predictors that had reduced odds for old clothes were the bathroom being clean and sanitary (AOR: 0.20, 95% CI: 0.07–0.58), the bathroom having functional door locks (AOR: 0.21; 95% CI: 0.07–0.67), and the bathroom having a supply of water and soap (AOR: 0.23; 95% CI: 0.07–0.77).

DISCUSSION

Family is the primary source of menstrual information (Table 2), and choices of menstrual hygiene products are significantly influenced by parental education, as given by Pearson's chi-square test (Table 3). In other related studies carried out in different nations, the family was the primary source of information on menstruation: Egypt (53–92.2%) (Chandra-Mouli & Patel 2017), Saudi Arabia (66.8%) (Alharbi *et al.* 2018), India (50.3%) (Tshomo *et al.* 2021), and Indonesia (almost half) (Assa *et al.* 2024). This suggested the importance of family as an educational resource for girls who are menstruating and the need for proper menstrual hygiene practices. The resulting lack of information about menstruation can lead to the use of unhygienic materials, which have significant implications for women's health, including an increased risk of infections and other health issues. The unique educational and professional context of the participants as nursing students does not directly affect their product choices, as these decisions are often influenced more by their surrounding environment than by personal preference. This indicated that not only are menstrual information and education important, but parental education is also significant for the participants.

Most participants experienced embarrassment both in discussing menstruation (Table 2) and purchasing menstrual products (Supplementary material, Table S1). This embarrassment significantly increased the likelihood of using old clothes rather than single-use pads in multivariable logistic regression (Table 4). Similar levels of embarrassment were observed in studies from Bangladesh, India, and Australia (Hennegan & Sol 2020; Munro *et al.* 2022; Kumar *et al.* 2024), in contrast

Table 3 | Association between socio-demographic characteristics with types of menstrual hygiene products

	Types of menstrual hygiene products *n* (%)					
Characteristics	**Nappies**	**Other**	**Old clothes**	**Single use pad**	**Toilet paper**	***p*-value**
Category of studentship						
Master's in nursing	1 (0.27	1 (0.27)	2 (0.55)	14 (3.83)	0 (0.00)	
B.Sc. in Midwifery (Post Basic)	0 (0.00)	0 (0.00)	4 (1.09)	25 (6.83)	4 (1.09)	<0.0001*
B.Sc. in Nursing (4 years)	4 (1.09)	3 (0.82)	43 (11.75)	84 (22.95)	4 (1.09)	
B.Sc. in Nursing (Post Basic)	1 (0.27)	5 (1.37)	7 (1.91)	21 (5.74)	1 (0.27)	
Diploma in Midwifery	2 (0.55	0 (0.00)	21 (5.74)	64 (17.49)	0 (0.00)	
Diploma in Nursing Science and Midwifery	1 (0.27)	0 (0.00)	39 (10.66)	14 (3.83)	1 (0.27)	
Year of college						
First year	5 (1.37	7 (1.91)	62 (16.94)	119 (32.51)	5 (1.37)	0.5687
Second year	3 (0.82)	0 (0.00)	34 (9.29)	74 (20.22)	4 (1.09)	
Third year	1 (0.27)	2 (0.55)	15 (4.10)	16 (4.37)	1 (0.27)	
Fourth year	0 (0.00	0 (0.00)		13 (3.55)	0 (0.00)	
Religion						
Islam	6 (1.64)	9 (2.46)	94 (25.68)	198 (54.10)	8 (2.19)	0.3419
Hinduism	3 (0.82)	0 (0.00)	20 (5.46)	20 (5.46)	2 (0.55)	
Buddhism	0 (0.00)	0 (0.00)	1 (0.27)	0 (0.00)	0 (0.00)	
Christian	0 (0.00)	0 (0.00)	1 (0.27)	4 (1.09)	0 (0.00)	
Fathers' education level						
Graduate or above	0 (0.00)	3 (0.82)	11 (3.01)	48 (13.15)	1 (0.27)	0.0307*
Higher secondary	5 (1.37)	1 (0.27)	43 (11.78)	55 (15.07)	5 (1.37)	
Secondary	2 (0.55)	2 (0.55)	33 (9.04)	55 (15.07)	2 (0.55)	
Primary	0 (0.00)	3 (0.82)	21 (5.75)	52 (14.25)	2 (0.55)	
Illiterate	2 (0.55)	0 (0.00)	8 (2.19)	11 (3.01)	0 (0.00)	
Mothers' education level						
Graduate or above	2 (0.55)	3 (0.82)	3 (0.82)	20 (5.46)	0 (0.00)	0.0050*
Higher secondary	3 (0.82)	1 (0.27)	36 (9.84)	41 (11.20)	3 (0.82)	
Secondary	2 (0.55)	0 (0.00)	41 (11.20)	83 (22.68)	5 (1.37)	
Primary	1 (0.27)	3 (0.82)	31 (8.47)	67 (18.31)	2 (0.55)	
Illiterate	1 (0.27)	2 (0.55)	5 (1.37)	11 (3.01)	0 (0.00)	
Birthplace status						
Rural	7 (1.91)	6 (1.64)	89 (24.32)	167 (45.63)	8 (2.19)	0.9615
Urban	2 (0.55)	3 (0.82)	27 (7.38)	55 (15.03)	2 (0.55)	
Resident status						
Hostel	6 (1.64)	7 (1.91)	88 (24.04)	164 (44.81)	8 (2.19)	0.9562
Own house	3 (0.82)	2 (0.55)	28 (7.65)	58 (15.85)	2 (0.55)	
Monthly family income						
Below 10,000/- BDT	1 (0.27)	0 (0.00)	25 (6.83)	28 (7.65)	1(0.27)	<0.0001*
10,000–20,000/- BDT	5 (1.37)	0 (0.00)	51 (13.93)	75 (20.49)	3 (0.82)	
20,000–30,000/- BDT	1 (0.27)	1 (0.27)	29 (7.92)	61 (16.67)	1 (0.27)	
More than 30,000/- BDT	2 (0.55)	8 (2.19)	11 (3.01)	58 (15.85)	5 (1.37)	

Significance level *$p < 0.05$.

Table 4 | Multivariable logistic regression analysis of factors associated with single-use pads and old clothes

		Single-use pad			Old clothes		
		n (%)	AOR (95% CI)	*p*-value	*n* (%)	AOR (95% CI)	*p*-value
Menstrual characteristics							
Fear of staining blood	No	89 (24.32)	Ref.	–	68 (18.58)	Ref.	–
	Yes	133 (36.34)	2.95 (1.53–5.68)	0.0012*	48 (13.11)	0.62 (0.30–1.27)	0.1906
Access to menstrual hygiene products and supplies							
Lacked money	No	170 (46.45)	Ref.	–	105 (28.69)	–	–
	Yes	52 (14.21)	0.26 (0.09–0.68)	0.0064*	11 (3.01)		
Expensive	No	39 (10.66)	Ref.	–	7 (1.91)	–	–
	Yes	183 (50)	3.06 (0.74–12.66)	0.1235	109 (29.78)		
Washing facilities	No	41 (11.20)	Ref.	–	8 (2.19)	–	–
	Yes	181 (49.45)	0.51 (0.18–1.46)	0.2111	108 (29.51)		
Embarrassed to buy	No	67 (18.31)	Ref.	–	15 (4.10)	Ref.	–
	Yes	155 (42.35)	0.37 (0.16–0.86)	0.0218*	101 (27.60)	2.86 (1.16–7.07)	0.0230*
Perceptions of sanitation facilities on campus							
Privacy	Poor	45 (12.30)	Ref.	–	23 (6.28)	Ref.	–
	Good	177 (48.36)	0.33 (0.14–0.77)	0.0101*	93 (25.41)	2.92 (1.12–7.63)	0.0286*
Clean and sanitary	Poor	53 (14.48)	Ref.	–	77 (21.04)	Ref.	–
	Good	169 (46.17)	3.17 (1.20–8.39)	0.0198*	39 (10.66)	0.20 (0.07–0.58)	0.0032*
Functional door locks	Poor	38 (10.38)	Ref.	–	74 (20.22))	Ref.	–
	Good	184 (50.27)	4.45 (1.67–11.85)	0.0028*	42 (11.48	0.21 (0.07–0.67)	0.0080*
Toilet paper	Poor	140 (38.25)	–	–	85 (23.22)	Ref.	–
	Good	82 (22.40)			31 (8.74)	1.96 (0.59–6.52)	0.2719
Water and soap	Poor	75 (20.49)	Ref.	–	81 (22.13)	Ref.	–
	Good	147 (40.16)	2.29 (0.99–5.33)	0.0536	35 (9.56)	0.23 (0.07–0.77)	0.0167*

CI, confidence interval; Ref., reference.
Significance level *$p < 0.05$.

to Palestine, which had lesser embarrassment (Hassan *et al.* 2023). This indicates that the issue of embarrassment during menstruation is not dependent on the country's affluence but is a relatively sensitive topic. The embarrassment nursing students feel about menstruation is particularly troubling, as they are future healthcare providers who will need to educate and support patients. It could hinder their ability to properly educate and care for patients, leading to missed opportunities for effective menstrual education and potentially perpetuating misinformation. Researchers recommend further investigations, including qualitative research to see the reasons behind this embarrassment.

The fear of blood stains on clothes was significantly associated with menstrual product choices. A high proportion of the participants (51.9%) feared staining clothes with blood (Table 2), and this fear was associated with increased odds of using single-use pads rather than old clothes in multivariable logistic regression (Table 4). These findings differ from another study where 85.3% found fear of staining clothes with blood, but no association was measured (Hassan *et al.* 2023). The fear of this blood is mental, not physical, as the participants are aware that they menstruate every month. The concern, therefore, is to avoid washing the menstrual products. From the preferences for single-use pads, it follows that the fear of staining clothing with blood from menstruation would guide the choice of menstrual products and the demand for proper sanitation facilities.

The participants had a poor perception of sanitation facilities for practicing menstrual hygiene. These findings indicated that privacy (22.1%), cleanliness (13.4%), and functional door locks (30.1%) were always reported as poor in the bathrooms (Supplementary material, Table S2). These findings align with previous research demonstrating inadequate menstrual hygiene facilities on college campuses, schools, and communities (Hennegan & Sol 2020; Munro *et al.* 2021, 2022; Bhakta *et al.* 2024). A possible cause is the lack of prioritisation of sanitation facilities within both these institutions and the community. A good perception of the need for privacy, cleanliness, and functionality of sanitation facilities points to a significant need for prioritizing infrastructure development for sanitation to improve menstrual hygiene and sanitation conditions.

Decisions were based on the sanitation facilities, either single-use pads or old clothes. The multivariable logistic regression of the above-indicated user showed that privacy was a predictor for reduced odds of using single-use pads and an increased likelihood of using old clothes, while the functionality of door locks was one of the predictors for increasing the odds of using single-use pads but decreasing the use of old clothes (Table 4). Similar findings include students using menstrual products longer than advised without water, privacy, and sanitary waste bins (Munro *et al.* 2021), as well as latrine types (Mudi *et al.* 2023) and sanitation facilities influencing menstruation management (Shannon *et al.* 2021; Sato *et al.* 2023; Sambo *et al.* 2024). The preference for using old clothes in private bathrooms, despite less sanitary conditions, likely stems from a strong cultural emphasis on privacy and avoiding stigma, which outweighs concerns about the bathroom's cleanliness or functionality. Thus, the physical environment is critical in MHM. It becomes clear that menstrual hygiene product choices are not only a matter of individual choice but are deeply connected with parental education, embarrassment, and sanitation facilities. Addressing these factors can lead to better health outcomes and empower women to manage their menstruation with hygienic products.

Limitations

This study was confined to government nursing colleges and focused solely on nursing students, which may limit the generalizability of the findings to a broader population of women. The use of proportional sampling might help reduce biases that could affect the representation of the entire student population. Secondly, the study relied on self-reported data, which could be subject to response bias. Participants' answers might have been influenced by recall bias or the desire to present themselves in a socially desirable manner. The use of self-reporting also allows for the collection of nuanced personal experiences and perceptions, which are invaluable for understanding subjective phenomena like menstruation. Thirdly, this study's use of multivariate logistic regression allowed for the identification of statistically significant factors associated with product choices. Due to the complex and multifaceted nature of MHM, some factors that were not statistically significant in our model may still have important social and personal influences that were not fully captured. Future research should consider qualitative approaches to explore these nuanced contributions further. Lastly, the sanitation facilities considered in this study were limited to perceptions of bathrooms and access to menstrual hygiene products. Other potential WASH influences, such as exposure to menstrual health education outside of formal schooling, broader community support systems, and household conditions, were not explored. Concentrating on these specific aspects of WASH facilities allowed for a detailed exploration of core environmental and resource-based factors, directly impacting menstrual hygiene practices.

CONCLUSION

This study provides important insights into MHH among nursing students, as well as crucial future healthcare professionals. The participants had minimal knowledge of menstruation before menarche and that family was a main source of menstrual information. Single-use pads and old clothes were major menstrual products used among the participants. The inhibition of the menstrual product choices was influenced by parental education, not participant knowledge level. The use of single-use pads and old clothes is influenced by embarrassment about purchasing products, fear of blood-staining clothes, availability of water and soap, privacy of bathrooms, and functional door locks for bathrooms. Better practice of MHH requires improved parental education, reduced embarrassment, and better sanitation facilities.

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DATA AVAILABILITY STATEMENT

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

CONFLICT OF INTEREST

The authors declare there is no conflict.

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Period poverty: Menstrual information, product selection, and disposal among urban female nursing students in Bangladesh

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ABSTRACT

Period poverty, the lack of access to menstrual hygiene products, sanitation facilities, and education, remains a pressing issue in low- and middle-income countries. This study explored the emotional and practical challenges faced by nursing students, focusing on menstrual education, product accessibility, and disposal practices. A qualitative approach was adopted, involving 35 female nursing students (aged 26 ± 3.3 years) from seven government nursing colleges across three regions of Bangladesh. Data was collected from June to July 2023 through Focus Group Discussions (FGDs) and In-Depth Interviews (IDIs). Purposive sampling was employed for FGDs, while convenience was sampling used for IDIs. Thematic analysis, facilitated by MAXQDA2023 software, identified key themes and subthemes related to menstrual experiences. Three major themes emerged: (1) fear and confusion during first menstruation, (2) barriers to menstrual product accessibility, and (3) challenges in menstrual hygiene management. Many students reported fear and confusion during their first menstruation, largely due to inadequate information from female family members, especially mothers. Sanitary pads were the preferred menstrual product, but the embarrassment of buying products in front of men often made purchasing them difficult and they used old clothes. Additionally, a lack of proper disposal facilities and embarrassment in managing menstruation in public were significant concerns. This study underscores the need for comprehensive menstrual education and improved Water, Sanitation and Hygiene (WASH) infrastructure in educational institutions. Addressing these issues is critical to promoting safe and dignified menstrual management, reducing stigma, and enhancing health outcomes for menstruators.

1. Introduction

Period poverty is a lack of access to safe and hygienic menstrual products, basic sanitation services, and sufficient menstrual hygiene education (Carneiro, 2021). Although menstruation is a natural physiological process, it is considered by many societies as something unclean or impure wrapped in different misconceptions, taboos, and stigma (Sommer et al., 2015b; Thakur et al., 2014; Winkler, 2014). Menstruation is a private issue and is taken as an awkward issue to discuss, so generally, it is not discussed. Girls' little knowledge or information about menstruation is due to the lack of open conversation with their mother or other female family members. Especially in both rural and urban regions in south Asia, girls grow up with little knowledge about menstruation (Aziz et al., 2024; Nimbhorkar et al., 2023). This research suggests that within many families in these regions, menstruation is discussed only between mothers and daughters. As a result, most girls are unprepared and caught by surprise when they experience their first menstruation. They often lack knowledge about the physiological processes of sexual development and manage menstruation properly.

Proper Menstrual Health and Hygiene (MHH) is essential to the health and well-being of the menstruating girl and woman. Effective hygiene management requires access to hygienic absorbent materials, water, soap, and private toilet facilities (Meher and Sahoo, 2023; World Bank GroupT, 2021). The selection and utilization of menstrual products are critical in effectively managing a menstruation. Research has shown that the variation in the way women handle their menstruation also

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includes when product changes are made and bathing routines (Chandra-Mouli and Patel, 2020). According to the World Health Organization (WHO), an estimated 1.7 billion people lack access to basic sanitation services (WHO/UNICEF JMP forWASH, 2024). In slums, the high cost of menstrual products and low levels of awareness force a considerable number of women to adopt unhygienic alternatives, such as old clothes, to absorb the menstrual flow, may increase their risk of serious health complications, such as infections and cervical cancer (Singh et al., 2023). Poor menstrual hygiene is associated with limitations on daily activities, which lead to psychological stress (Handy et al., 2022). Again, access to facilities, socio-cultural norms, and knowledge about menstruation are large determinants of the practice of hygiene during menstruation (Karout, 2015; Lawan et al., 2010; Mahon and Fernandes, 2010). Socioeconomic and demographic factors also play a vital role in this context (Garg et al., 2022; Sarkar et al., 2017), and in many developing countries, especially in rural regions, a considerable proportion of women tend to follow unhygienic menstrual practices (Kuhlmann et al., 2017).

In Bangladesh, a South Asian country, limited menstrual education, cultural beliefs and inadequate sanitation facilities create barrier for women and girls in managing MHH. A national hygiene survey reported that 30 % of women in this country had no prior knowledge of menstruation before their first menstruation, and only 6 % of schools provide menstrual hygiene education (Bangladesh Bureau of Statistics, 2020). In the wake of these challenges, following the hygiene surveys in 2014 and 2018, Bangladesh has made giant strides in addressing MHH education through policy initiatives (Jahan et al., 2024; Khan et al., 2023; Murshid et al., 2023). The inclusion of MHH in the National Curriculum 2016, besides the Water and Sanitation Sector Development Plan (2011–2025), shows commitment from the country to better menstrual hygiene education and Water, Sanitation and Hygiene (WASH) facilities (World Bank, 2015). These initiatives enhance menstrual education, reduce school absenteeism, and promote proper hygiene management (Jahan et al., 2024). However, despite these achievements, cultural beliefs surrounding menstruation often viewing as a private and taboo topic leads to secrecy and embarrassment, making many women and girls feel uncomfortable discussing it openly (Alam et al., 2017; Castro and Czura, 2025; Hunter et al., 2022; Khan et al., 2023; Zaman et al., 2024). Washing genital area after menstruation, urination, or defecation is deeply rooted in cultural norms, with most people using water for cleansing rather than toilet paper, both at home and in public facilities (Sultana et al., 2022). However, our previous study found that the choice of menstrual products among nursing students is influenced by parental education, as well as embarrassment and sanitation facilities (Zaman et al., 2024). Limited access to affordable and hygienic menstrual products lead to poor menstrual hygiene (Chandra-Mouli and Patel, 2020). For example, the inexistence of gender sensitive sanitation facilities, even at the school and public spaces levels, only adds up to what stands in the way of the required safe menstrual management. This forces many women and girls to manage their menstrual blood in unsafe ways. Most research on menstruation has predominantly focused on adolescent girls, offering a gendered perspective that highlights societal stigma, including embarrassment, misconceptions, inadequate facilities in educational institutions, and familial restrictions that contribute to school absenteeism (Alam et al., 2017; Hennegan and Sol, 2020).

There is a significant gap in research on MHH among adult women, particularly those in specialized fields such as nursing students. Nursing students receive formal education and training in reproductive health, equipping them with structured knowledge about MHH. This sets them apart from the general population of young women, as they hold a dual role—not only as learners but also as future healthcare providers. With the potential to become advocates and educators in menstrual health, their perspectives offer valuable insights into how their education shapes their understanding of MHH. However, despite their medical training, cultural norms and personal experiences may still influence their perceptions and practices, creating gaps between learned knowledge and lived experiences. Exploring these gaps is crucial to identifying areas for improvement in both nursing education and menstrual health programs. Additionally, understanding their views can provide a foundation for enhancing MHH education and advocacy efforts in healthcare and community settings, ultimately strengthening menstrual health support systems. It will look at both the emotional and practical challenges concerning MHH that nursing students experience and is, thus, concentrated on menstrual education, product selection, and disposal practices.

2. Methods

2.1. Study design

An exploratory and descriptive research design was employed in the study (Hunter et al., 2019). This approach allowed for a thorough exploration of the lived experiences and perceptions (Churchill, 2022) of nursing students' regarding MHH. The exploratory nature of the research was crucial in revealing the wide range of experiences and perspectives, while the descriptive component ensured a detailed and nuanced account of these experiences (Shorey and Ng, 2022). This approach further enriched the study by focusing on the essence of these experiences, uncovering the deeper meanings. that nursing students experience MHH. Both Focus Group Discussions (FGDs) and In-Depth Interviews (IDIs) were utilized to collect data. The use of FGDs facilitated interactive discussions among participants, enabling them to share and reflect upon their experiences collectively. This group setting helped uncover shared norms, beliefs, and social dynamics within the student community. On the other hand, IDIs offered a private and confidential environment for participants to delve deeper into personal or sensitive issues they might be reluctant to discuss in a group. Combining FGDs and IDIs ensured a comprehensive understanding of the research topic from collective and individual perspectives.

2.2. Study setting

The study was conducted in four districts, Dhaka, Rajshahi, Naogaon, and Satkhira across three regions of Bangladesh: Dhaka, Rajshahi, and Khulna. We selected these three regions, including the capital city, representing diverse social, cultural, and economic backgrounds. Each district in these regions has a nursing college. Seven government nursing colleges among thirty-eight colleges within these regions were purposefully chosen to represent the nursing students living in improvised urban circumstances refer to low-income, resource-constrained urban settings. Government nursing colleges were chosen as representative institutions for studying sensitive issues like menstruation among adult women, as they provide greater accessibility compared to other institutions.

2.3. Data collection

The research team, including the first author, and six research assistants collected data between June and July 2023. The first author trained and re-trained research assistants, focusing on the principles of qualitative data collection, the use of interview guides, and ethical considerations. Participants were eligible if they were nursing or midwifery students, aged 18 years or older, had experienced menarche but not menopause, and had a recent menstruation (within the last three months). For participant recruitment, purposive sampling was employed for the FGDs, while convenience sampling was used for the IDIs. For the FGDs, we selected three participants from each site, ensuring that participants from the seven colleges were grouped together. This resulted in three FGDs, each consisting of seven participants, for a total of 21 participants (n = 21). A student at each study site identified and approached potential FGDs participants on behalf of the research team. They

provided detailed written information, addressed initial queries, and confirmed eligibility. A mutually convenient time and date were then arranged for the FGDs, which took place in a private room at the respective site. The interview duration was 77–92 min for each group. For the IDIs, we selected two participants from each site, separate from those in the FGDs, resulting in a total of 14 participants (n = 14). Participants were initially approached in their college, followed by a phone call to schedule the interview. The face-to-face interview duration was 47–73 min for each participant. The content of the FGDs and IDIs guides was informed by the study conducted by Boyers et al. (2022) and further developed by the research team (refer to supplementary S1–S2 files). The FGDs and IDIs topic guides opened with the question: "Can you tell me about yourself and your surroundings? Can you explain what menstruation means to you?" This question was designed to initiate discussion on menstruation and allow participants to express their initial thoughts. Both the FGDs and IDIs topic guides covered three key thematic areas. First, fear and confusion during first menstruation examined participants' initial reactions, sources of menstrual knowledge, and emotional responses. Second, barriers to menstrual product accessibility focused on preferences, affordability, availability, and cultural restrictions. Lastly, challenges in menstrual hygiene management addressed difficulties in accessing changing and washing facilities, along with challenges in product disposal. The session concluded with an invitation for participants to share their opinions on potential changes they would like to see regarding menstrual management.

2.4. Data analysis

All FGDs and IDIs were digitally recorded and transcribed verbatim by the first authors. The original data were in Bengali, and after transcription, they were translated into English. The interviewer or moderator reviewed each transcript to ensure its accuracy and completeness, particularly for assigning participant numbers where needed in the FGDs. In analyzing the data, efforts were made to ensure rigor from four perspectives: credibility, confirmability, dependability, and transferability (Lincoln and Guba, 1985).

Credibility was ensured through the triangulation of researchers. The first author was present in each interview and responsible for coding the data independently. MAXQDA2023 software was used to facilitate the coding process and ensure that the data were represented as accurately as possible. Verbatim quotes were included throughout the analysis to maintain the authenticity of participants' voices and perspectives. The results and interpretations were shared with the participants for feedback, and consensus was achieved through member checking. Additionally, member checks were conducted, whereby the first author summarized the participants' responses multiple times during the interviews, culminating in a final summary at the end of each session to verify the accuracy of the data and interpretations.

Confirmability was established through a systematic and transparent decision-making process, which followed the six-step thematic analysis framework (Braun and Clarke, 2006, 2022). An audit trail was maintained, documenting all decisions, including raw data, field notes, coding processes, and related literature. The research team engaged in peer debriefing, where all interpretations were critically discussed and reviewed. Feedback from other authors helped ensure that personal perspectives did not unduly shape the data interpretation.

Dependability was achieved by employing a multi researcher coding strategy. Three researchers independently coded the transcripts and later compared their results. Discrepancies between codes were addressed through discussions with a fourth researcher experienced in qualitative methods. These discussions continued until consensus was reached, ensuring that the data interpretation remained consistent and reliable. To further solidify dependability, the coding process was revisited multiple times, and the resulting themes were reviewed against the raw data to ensure they accurately reflected participants' perspectives.

Transferability was considered by providing rich, detailed descriptions of the participants, their contexts, and the research environment. This information allows other researchers or practitioners to assess the relevance of the findings in different settings. The level of detail in the methods and results sections is intended to enable readers to evaluate the potential applicability of the study's outcomes in their own contexts. The Consolidated Criteria for Reporting Qualitative Research (COREQ) checklist (refer to supplementary S3 files) was used to ensure the quality of research reporting (Tong et al., 2007).

2.5. Research team and reflexivity

The first author, a registered nurse and senior staff nurse with 8 years of clinical experience, may have had an impact on the study's results. Positively, participants might have felt more at ease sharing their experiences, knowing the researcher shared their professional background. However, as a male, the first author's gender and position could have influenced discussions on topics specific to female nursing students, such as MHH barriers. To mitigate this, interviews were conducted by female research assistants, all of whom were experienced nurses and midwives. Despite this effort, there remained the possibility that the first author could have interpreted the participants' responses through his own perspectives, potentially missing important insights. To address this, the second author, a Ph.D. in nursing, occupational therapist, senior lecturer, and expert in qualitative research and rehabilitation science, was included. Although both the first and second authors had limited prior experience in MHH research, this allowed them to approach the participants' experiences without preconceptions or biases. However, this lack of specific expertise might have made it challenging to fully grasp the nuances of the participants' experiences. To strengthen the study, the third author, a Ph.D., assistant professor and experienced researcher in WASH and MHH, was included. The fourth author, a Ph.D., professor of health sciences and a human ecologist and WASH expert, served as the study's supervisor. The second, third, and fourth authors contributed to developing the interview guide, guiding the coding process, and reviewing the data analysis and summary of the results and discussion. This collaborative approach ensured that diverse perspectives informed the research process.

2.6. Ethical considerations

This study and research tools gained ethical approval from Ethical Review Committee of the Faculty of Health Sciences, Hokkaido University in Japan (23–52), Directorate General of Nursing and Midwifery, Dhaka (45.03.0000.008.14.097.2021–354), and National Institute of Advanced Nursing Education and Research, Dhaka (NIA-OS-2023-09). The first author and the research team obtained informed consent from all participants before conducting each IDIs and FGDs. Participants were given an information sheet and a consent form, and they provided written signature to confirm their consent.

3. Results

3.1. Participant characteristics

A total of 35 nursing students including midwifery aged 19–38 years participated in the study, 14 (mean 26.21 ± 5.52) of whom contributed to IDI and 21 (mean 26.1 ± 4.75) to FGD (Table 1). Among the students, the IDI comprises 29 % Master of Science (M.Sc.) in Nursing students, 43 % Bachelor of Science (B.Sc.) in Nursing students, and 29 % B.Sc. in Midwifery (Post Basic) students, while the FGD has 29 % M. Sc. in Nursing students, 38 % B.Sc. in Nursing students, and 33 % B.Sc. in Midwifery (Post Basic) students. The majority of participants practiced Islam (77 %), while a smaller portion followed Hinduism (23 %). In terms of birthplace, 60 % came from urban areas, whereas 40 % were from rural regions. Most participants were single (69 %), while 31 %

Table 1
Characteristics of the participants (N = 35).

Variables		IDI (N = 14) n (%) or M ±SD	FGD (N = 21) n (%) or M±SD	Total (N = 35) n (%) or M±SD
Age		26.21 ± 5.52	26.1 ± 4.75	26.14 ± 5
Course name	M.Sc. in Nursing	4 (29)	6 (29)	11 (31)
	B.Sc. in Nursing	6 (43)	8 (38)	13 (38)
	B.Sc. in Midwifery (Post Basic)	4 (29)	7 (33)	11 (31
Religion	Islam	11 (79)	16 (76)	27 (77)
	Hinduism	3 (21)	5 (24)	8 (23)
Birthplace	Urban	8 (57)	13 (62)	21 (60)
	Rural	6 (43)	8 (38)	14 (40)
Marital status	Single	9 (64)	15 (71)	24 (69)
	Married	5 (36)	6 (29)	11 (31)
Monthly family income	Below 200 USD[a]	4 (29)	5 (24)	9 (26)
	200-300 USD	7 (50)	12 (57)	19 (54)
	Above 300 USD	3 (21)	4 (19)	7 (20)
Clinical experience in hospital	Below 2 years	3 (21)	6 (29)	9 (26)
	2–4 years	6 (43)	11 (52)	17 (48)
	Above 4 years	5 (36)	4 (19)	9 (26)

[a] USD= United States Dollar.

were married. When looking at the economic background, more than half (54 %) belonged to families with a monthly income between 200 and 300 USD, while 26 % came from households earning less than 200 USD, and 20 % had a family income above 300 USD per month. In terms of clinical experience during hospital placements, nearly half of the participants (48 %) had 2–4 years of experience, followed by those with over 4 years (26 %) and below 2 years (26 %).

3.2. Thematic analysis findings

Through analysis of the interview data, 03 themes with 09 subthemes and 459 codes emerged. In the FGDs, individual participants were identified using the label (e.g., P1, P2) to represent each person. The themes and subthemes are listed in Table 2.

3.2.1. Fear and confusion during the first menstruation

Participants' narratives from both IDIs and FGDs revealed negative perceptions of menstruation, with many describing their experiences primarily as marked by fear and confusion. Additionally, female family members and friends were the main source of menstrual information and assurance by the female family members. The encumbrance comprised three key aspects: feeling during first menstruation; source of information; and the assurance for menstruation.

We found that menstrual preparedness was not timely, resulting in significant challenges for every participant. The majority of the participating nursing students (71 %) reported that they did not know about menstruation before its onset. The experience of first menstruation was often accompanied by a range of intense emotions, primarily fear and confusion. Many participants recalled their first encounter with menstruation as a bewildering and frightening experience due to a lack of prior knowledge and preparation.

"When I had my 1st menstruation, I actually didn't know about it beforehand. For which I am very afraid. I worried a lot about it (IDI 1)"

"When I had my 1st menstruation, I didn't know about it beforehand. (IDI 14)"

"The first day I got my menstruation, I didn't understand what was happening to me, my blood flowed up to my leg, I didn't understand (IDI 5)"

"I did not understand what was happening to me, I realized that my blood was rushing to my feet (IDI 8)"

"I was very scared (IDI 6)"

"I was scared when I first got my menstruation (IDI 4)"

The initial knowledge about menstruation for many participants came predominantly from female family members, particularly mothers. Most (71 %) were unaware of menstruation before their first menstruation and only learned about it after their first menstruation. They were scared during their first menstruation because they hadn't known about it beforehand. Mothers remained their primary source of menstrual information, while schoolgirl friends were rarely mentioned. This indicates the crucial role that mothers play in educating their daughters about menstrual health.

"My mother first told me about it (IDI 5)"

"I learned about them from my mother (IDI 12)"

"I first heard it from my mother, then at school from a friend (IDI 8)"

"First, I heard from my school friends and was very scared (IDI 9)"

"I was scared when I first heard from my girlfriend (IDI 10)"

Receiving reassurance and support during the first menstruation was critical for alleviating fear and confusion. Many participants found comfort and understanding from their mothers and other female family members like sisters, who provided explanations and guidance.

"I received emotional and mental support during my first menstruation only from one woman, my mother (FGD1, P 5)"

"When the 1st happened, my mother helped me, explaining that it happens to girls from adulthood (IDI 4)"

"My mother explained everything to me, and I gradually became convinced. Initially, I had a different understanding, but over time, my perspective and feelings have positively changed (IDI 3)"

"My elder sister understands the matter and she tell everything about this, how to manage what (IDI 14)"

Table 2
Themes and subthemes of menstrual information, product selection and disposal among female nursing students.

Themes	Subthemes
Fear and confusion during first menstruation	1.1 Feeling during first menstruation 1.2 Confusion surrounding menstrual onset
Barriers to menstrual product accessibility	2.1 Preferences and accessibility 2.2 Economic barriers 2.3 Social barriers
Challenges in menstrual hygiene management	3.1 Inadequate product change facilities 3.2 Inadequate washing facilities 3.3 Inadequate disposal practices 3.4 Emotional impact

3.2.2. Barriers to menstrual product accessibility

Participants across both FGDs and IDIs reported a strong preference for sanitary pads. As health care professionals they used old clothes when they grew up but now a days, they usually use sanitary pads.

"I always use sanitary pads (IDI 11)"

"As I am a midwife, I also use pads as I understand this (FGD 3, P7)"

"I used to use cloth when I grew up but now, I use pads (IDI 10)"

This preference for pads was influenced by their familiarity and perceived reliability. However, some participants mentioned that they

reverted to traditional methods when pads were unavailable.

"If there is no pad, I often use cloth or tissue (IDI 6)"

Additionally, there was a lack of awareness and exposure to alternative menstrual products, such as menstrual cups.

"I heard about menstrual cups a few days ago. I have never seen it. (FGD 2, P3)"

Most participants acquired menstrual products from pharmacies, primarily those located in town, indicating that these are the primary sources. However, there were no pharmacies within the hospital premises.

"I am buying sanitary products from a pharmacy (IDI 3)"

"I am buying pads from a pharmacy (IDI 9)"

"I am taking pads from the pharmacy (IDI 13)"

Some participants also mentioned cosmetics stores as an alternative source.

"Available from pharmacies and cosmetics stores (FGD 1, P4)"

Many participants said that the prices were beyond their financial reach. The increasing cost of menstrual products poses a significant barrier to accessibility, especially for those from lower socioeconomic backgrounds.

"The price of the product is very high. Many have that beyond their purchasing power (IDI 2)"

"Now its price is increasing day by day (IDI 11)"

"Currently they are very expensive (IDI 14)"

"It doesn't seem cost effective to me at all. Because it is actually very difficult to buy for middle class families or lower-class families (IDI 5)"

Several participants reported feeling ashamed or embarrassed when purchasing sanitary products, especially in the presence of male individuals. This sense of shame can hinder women from purchasing the products they need, further complicating access to menstrual hygiene.

"I feel ashamed when a young male salesman or a male acquaintance was present in the pharmacy while I'm purchasing sanitary products, and sometimes I leave without buying them (FGD 3, P 3)"

"I feel embarrassed in-front of my father, or any male relatives were present in the pharmacy while I'm purchasing sanitary products (FGD 1, P1)"

Another concern raised was the physical accessibility of shops that sell menstrual products. Some participants highlighted the inconvenience of traveling to distant shops. This indicated a need for more convenient access to menstrual products, such as availability within residential areas or institutions like hostels.

"Shops are far away so it's a bit of a problem. It would be great if they were available at the hostel (IDI 8)"

3.2.3. Challenges in menstrual hygiene management

The participants indicated that washrooms and toilets were the primary locations for changing menstrual products, largely influenced by the availability of facilities. In Bangladesh, washrooms typically consist of a toilet, basin, and bathing facilities. Therefore, these spaces were the main choices for changing menstrual products due to their comprehensive amenities.

"Normally we change in washroom (IDI 9)"

"Most of the time I change in the toilet (IDI 4)"

When at home, participants preferred changing pads immediately when they became full or they started feeling discomfort, highlighting the comfort and convenience of home environments. But outside even in college they were unable to change it

"When I am at home, I change immediately. But I can't change it outside (IDI 8)"

However, outside the home, especially in hostels or public places, the frequency and immediacy of changing menstrual products were affected. They often became late in changing their menstrual products due to the lack of proper disposal facilities. In many places, there were simply no disposal facilities available.

"If I am in the hostel, I change it but if I am outside, it is late (IDI 11)"

"Although there is a public toilet outside, there is no disposal facility (IDI 12)"

Washing practices varied among the participants, often depending on the availability of water, soap, and other cleaning agents. Most of the participants washed themselves with normal water and soap after each product changes and used tissues to clean. Some went a step further and used detergent or Savlon (disinfectant) in addition to soap. However, there were times when soap was not available, and in those instances, they resorted to using only water for washing.

"After each change, wash with normal water and clean with a tissue and use a new pad (IDI 12)"

"During menstruation, I usually use warm and clean water and use soap or detergent and Savlon (IDI 2)"

"Wash immediately after each change. Sometimes I just wash with water when there is no soap (IDI 6)"

While washing facilities at home were generally adequate, hostile environments pose significant challenges. One of the primary issues was the lack of a separate place for drying washed clothes. This highlights the need for improved facilities in hostels to support menstrual hygiene practices.

"Wash the clothes with soap or detergent. There is no problem at home but there is a problem in the hostel. There is no separate place for drying (IDI 6)"

Disposal of used menstrual products was a significant concern among the participants. Many reported the absence of proper disposal facilities. The lack of bins was a major concern, as it prevents women from properly disposing of their used pads. Additionally, the shared bathrooms used by both men and women create an uncomfortable environment for women to discard their pads discreetly. These statements underscored the lack of adequate disposal facilities, and the uncomfortable, unhygienic conditions faced by female participants.

"There is no place to drop the used pad (FGD1, P7)"

"There is no good changing system or there is no bin to throw the dirt or pad that we use, or it is not disposed of in front of everyone and the cleaning area is not clean either. Also, many times a bathroom is used by both boys and girls, there is no such environment for a girl to drop her pad (FGD 3 P2)"

As a result, some women resorted to wrapping used pads in polythene or paper and disposing of them later when they are outside. These practices not only caused inconvenience but also posed potential health risks due to improper disposal, leading to an unhygienic environment, bacterial growth and unpleasant odors.

"Wrap the pads in polythene when I was in outside and throw them in the hostel dustbin after coming back from outside (IDI 7)"

"I wrap it in a paper or some paper and throw it in the dustbin which is dirty (IDI 10)"

Menstruation had a significant emotional impact on nursing students. Balancing clinical responsibilities while managing menstruation presented both emotional and practical challenges. Many students experienced embarrassment and anxiety, particularly in professional settings where they had to handle menstruation discreetly. The pressure to maintain professionalism often forces them to endure discomfort in silence, fearing judgment from peers, instructors, and male nursing students as well as male health care staff.

> "During my clinical placement, I had to change my pad, but I was too embarrassed to ask for a break. I kept waiting until my shift ended, and by then, I was feeling so uncomfortable that it was hard to focus on my duties (IDI 5)"

> "Even though we are training to be healthcare providers, menstruation still feels like a taboo topic. I hesitate to talk about menstrual pain or discomfort because I don't want to be seen as weak (FGD 2)"

> "Once, I stained my uniform during class. I was so ashamed that I couldn't concentrate for the rest of the day. I had to sit still; afraid someone male would notice (IDI 3)"

> "There is no proper disposal system in the hospital restroom, so I had to carry my used pad in my bag until I got home. It was stressful because I didn't want anyone to find out (FGD 4)"

4. Discussion

The findings from this qualitative research on menstrual information, product selection, and disposal among female nursing students in Bangladesh provide important insights into these students' complex challenges. The pervasive influence of social stigma, embarrassment, and insufficient infrastructure mirrors patterns identified in other Low- and Middle-Income Countries (LMICs), where cultural norms, inadequate facilities, and limited access to menstrual health resources exacerbate the difficulties of managing menstruation (Hennegan et al., 2019; Shah et al., 2023).

Most menstrual information is passed down informally from female relatives, primarily mothers and sisters. This mode of education, though common, is often incomplete and lacks accuracy. The participants, who are specialized healthcare provider nursing students, reported that their primary source of knowledge about menstruation was their families, rather than formal education in school before the national curriculum was reformed. Many students grow up with inadequate or incorrect knowledge about menstrual health, perpetuating harmful taboos and misinformation (WHO/UNICEF JMP for WASH, 2024). Similar findings have been noted in other studies, where young girls and adolescents are left with minimal understanding of menstruation, reinforcing societal stigmas (Shah et al., 2019, 2023). In these cases, cultural beliefs take precedence over scientific understanding, further embedding myths and misconceptions into the students' knowledge base. This gap in formal menstrual education not only stigmatizes menstruation but also deepens the feelings of shame and embarrassment that women experience.

Another significant challenge identified in this study is the reluctance of students to purchase menstrual products in the presence of male shopkeepers or male relatives. The deep-rooted embarrassment and fear of judgment prevent many women from acquiring necessary menstrual supplies, a phenomenon observed in several other LMICs (McMahon et al., 2011). This reluctance to access male-dominated spaces reflects the broader societal stigma attached to menstruation, which often leaves women without safe, accessible ways to manage their menstrual health. The need for discreet, female-friendly spaces to obtain menstrual products is critical, as the lack of such space's limits women's autonomy and control over their own health needs.

The psychological burden associated with menstruation was further highlighted by the students' reluctance to dispose of used menstrual products in public areas, especially when men are present. This finding reflects the emotional strain that menstruation places on these women, often leading to anxiety and stress (Betsu et al., 2023). The emotional toll of managing menstruation in secret, compounded by the fear of public embarrassment, can have long-term effects on mental health. This burden is especially pronounced for students in professional and academic environments, where the pressure to conceal menstruation can interfere with their ability to focus and perform. Similar to research in different regions, which linked menarche with increased anxiety due to societal pressures (Sommer et al., 2015a). Our findings emphasize the emotional impact of menstruation in Bangladesh, particularly for nursing students who are expected to balance their professional responsibilities with managing a highly stigmatized bodily process.

The inadequate disposal facilities reported by the students poses another significant challenge. The practice of wrapping and carrying used menstrual products until they can be discreetly disposed of in hostel bathrooms highlights the lack of appropriate infrastructure. This inconvenience not only reinforces the secrecy surrounding menstruation but also adds to the mental and physical discomfort experienced by the students. Similar disposal challenges have been reported in schools across LMICs, where the absence of private, sanitary spaces creates distress and anxiety among menstruators (UNICEF, 2019). Furthermore, the absence of proper WASH facilities exacerbates the difficulties of managing menstruation, particularly in public and educational institutions, making it harder for women to maintain hygiene and dignity (Hennegan et al., 2019; Winter et al., 2022).

Privacy emerged as a crucial aspect of menstrual management in this study. Participants emphasized the need for private and safe spaces where they can manage their menstruation with dignity, both in hostel settings and in public spaces. This aligns with other research, which underscores the importance of private areas where women can change menstrual products, bathe, wash reusable products, and dry them in a sanitary environment (H. Parker et al., 2014; Marni Sommer, 2012; Schmitt et al., 2017). The lack of such facilities contributes to a cycle of shame, secrecy, and poor menstrual hygiene practices. Ensuring the availability of private, hygienic spaces for menstrual management is essential for preserving the dignity and well-being of menstruators, particularly in institutional and public settings (Jahan et al., 2024).

4.1. Limitations

This study has several limitations. Firstly, we did not use theoretical sampling, as our focus was on exploration and description rather than theory development (Polit and Beck, 2021). However, purposive and convenience sampling provided valuable insights from a diverse group of participants (Polit and Beck, 2021). Secondly, gender of the first author, a male researcher, which could have influenced participants' comfort levels in discussing intimate topics like menstruation. Despite the involvement of female research assistants in conducting the interviews, some participants may have still felt hesitant to fully disclose their experiences due to the gender dynamics. Lastly, the participants' experiences of menarche are based on retrospective recollections, often from ten or more years ago. Their past experiences may not fully reflect the current realities of adolescent menstrual health. Given that national MHH policies and awareness initiatives have evolved over the past decade, these findings may not provide a comprehensive representation of contemporary menstrual health experiences. The participants were asked to recall their experiences with MHH practices and respond to questions during the interviews. Since all participants had a strong interest in MHH, the responses were largely positive, which may have influenced the overall findings.

4.2. Policy implications

The findings from this study underscore the critical need for comprehensive menstrual health education programs that go beyond the family context and are integrated into formal education systems.

Ensuring that students receive accurate and timely information about menstruation is essential in breaking down the barriers of stigma and embarrassment (Sobudula and Naidoo, 2024). This should include training for healthcare professionals and educators to provide culturally sensitive and factually correct menstrual health information.

Additionally, our findings indicate a pressing need for improved WASH facilities, particularly in educational institutions. Schools and universities should provide safe, private spaces equipped with disposal systems, water, and soap to ensure that menstruators can manage their menstruation with dignity. This aligns with the broader global recognition of menstrual hygiene management as a fundamental human right, as declared by the United Nations (UNICEF, 2019). Policies that promote the development of gender-sensitive infrastructure, including separate facilities for menstruators and non-menstruators, will be crucial in addressing the practical challenges identified in this study.

5. Conclusion

This study highlights the complex challenges nursing students in Bangladesh face regarding MHH, deeply influenced by cultural stigma, inadequate facilities, and limited access to menstrual products. It reveals that informal education from mothers and female relatives, while common, often lacks accuracy and perpetuates misconceptions about menstruation. Sanitary pads were the preferred menstrual product, but the embarrassment of buying products in front of males often made purchasing them difficult and they used old clothes. The absence of appropriate disposal facilities further complicates menstrual management and embarrassment in managing menstruation in public was a significant concern. The findings underscore the urgent need for comprehensive menstrual education within formal curricula and improvements in WASH infrastructure, particularly in educational institutions, to support dignified MHH.

CRediT authorship contribution statement

Md Nahid Uz Zaman: Writing – original draft, Validation, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Risa Takashima:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Conceptualization. **Akira Sai:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization. **Taro Yamauchi:** Writing – review & editing, Validation, Supervision, Project administration, Methodology, Funding acquisition, Conceptualization.

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Declarations of interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.healthplace.2025.103467.

Data availability

The data that supports the findings of this study is confidential and not publicly available.

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Appendix 8

【Participant Information Sheet】 Specific Research Content

a. Research Title: Assessing Menstrual Hygiene Management Practices and Identifying Challenges and Opportunities for WASH Technologies among Women in Bangladesh
b. Purpose of the research: (i) assessing menstrual hygiene management practices among Women; (ii) assess WASH facilities, menstrual product availability, cultural beliefs, socioeconomic status, and access to resources and (iii) Assess the impact of WASH technology implementation on MHM practices among women in Bangladesh and identify specific improvements in their practices as a result of these interventions.
c. Methods:The study will be conducted as a cross-sectional study design using mixed methods and experimental, consisting of 2 parts: (1) MHM practices on Women and (2) Water recycle technology for hand wash. Data collection will be about: socio-demographic characteristics, menstrual information and education, menstrual characteristics, access to menstrual hygiene products and supplies, Personal and physical factors affecting their menstrual experience and students' perceptions of the bathroom facilities for quantitative data; and focus group discussion and in-depth interview for qualitative data. For water recycle machine use its experiment on a nursing colleges. Soft copy data will be password protected; hard copy data will be in locked storage. All data will be protected and anonymous to maintain confidentially. The study will only be published for academic purposes (i.e., thesis, scientific presentations, and papers).
d. Participation in the research:The research will be conducted across three distinct regions in Bangladesh: Dhaka, Rajshahi, and Khulna. In each of these regions, a nursing college will be selected for study, and the sample population will consist of Nursing and Midwifery students. Participants will be: (i) nursing and midwifery students (n =366); (ii) Focus group discussion (n=3), in-depth interview (n=14); (iii) water quality of a college (n=1). All of participants will be recruited by purposive sampling. Participants in this study will get compensation/gift after data collection to acknowledge the time and effort in participating in the research.
e. Research plan: You are free to see the contents of the research plan at any time.
f. Benefits and disadvantages to research participants: Participants will learn about basic information of Menstrual Hygiene Management Practices and Identifying Challenges and Opportunities for WASH Technologies. After data processing and publishing the data, we will know the description of Menstrual Hygiene Management Practices and Identifying Challenges and Opportunities for WASH status of women.
g. Confidentiality: This research is being conducted with the permission (approval number XXX-XXX) of the head of the research institution (Director of the Graduate School of Health Sciences, Hokkaido University) after review by the Ethics Review Committee of the Graduate School of Health Sciences, Hokkaido University. The information collected in this research study will be kept strictly confidential. In order to protect your privacy, your name, date of birth, affiliation and other sensitive information will be deleted from survey forms and other pertinent documents and replaced by a coded number. The correspondence table that connects you with this number will be kept strictly by the researcher. Furthermore, your information will not be used for anything other than research. Collected data will be destroyed 10 years after the completion of the study duration (in the year 2036).
h. Research Results: Research results will be made available to you at your request.
i. Publication of research results: Research results will be presented at academic conferences, in academic journals and other research related outlets after anonymizing your personal information.

Corresponding Address (In case of questions and/or concerns)

Principle Investigator: Professor Taro Yamauchi
Address: Laboratory of Human Ecology, Faculty of Health Sciences, Hokkaido University, Kita 12, Nishi 5, Kita-Ku, Sapporo, 060-0812, Japan. TEL/FAX: +81-11-706-3379 | Email: taroy@med.hokudai.ac.jp

Other Investigator: Md. Nahid Uz Zaman
Address: Doctoral Student, Graduate School of Health Sciences, Hokkaido University, Japan
Address in Bangladesh: Senior Staff Nurse, Dhaka Medical College Hospital (Attached-Directorate General of Nursing and Midwifery, Mohakhali, Dhaka-1212) Mobile: +88 01719 826120 | Email: nuz1192@gmail.com

【Consent Form】

Principle Investigator, Professor Taro Yamauchi
Faculty of Health Sciences, Hokkaido University

I have read (or have had explained to me) the information about the research titled, 'Assessing Menstrual Hygiene Management Practices and Identifying Challenges and Opportunities for WASH Technologies among Women in Bangladesh' as contained in the Participant Information Sheet. I have had the opportunity to ask questions about it and any questions I have asked and have been answered to my satisfaction.

I now consent voluntarily to be a participant in this research and understand that I have the right to end my participation at any time, and to choose not to answer particular questions that are asked in the study.
My signature below says that I am willing to participate in this research:

Participants name (Printed): .....

Participants signature: ..... Consent Date: .....

Name of Research Assistant:……

Research Assistant Signature…….Date: ……..

Principle Investigator: Professor Taro Yamauchi
Other Investigator: Hokkaido University Graduate School of Health Sciences Doctoral Course First Year, Md. Nahid Uz Zaman

【Letter of Introduction】

北海道大学

大学院保健科学研究院 人類生態学研究室
〒060-0812
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E-mail：taroy@med.hokudai.ac.jp
URL：http://www35.atwiki.jp/smilelab/

TO WHOM IT MAY CONCERN:

.....

.....

.....

Date: .....

Dear Sir/Madam,

RE: Letter of Introduction – Md. Nahid Uz Zaman (Student ID Number: 50235106)

I am writing to request your assistance to the above-mentioned person. Md. Nahid Uz Zaman is a Doctoral Student at Graduate School of Health Sciences, Hokkaido University. He will conduct research entitled: 'Assessing Menstrual Hygiene Management Practices and Identifying Challenges and Opportunities for WASH Technologies among Women in Bangladesh'.

The research focus on assessing MHM practices and identifying challenges and opportunities for WASH technologies among adult women in Bangladesh. Please see the attached Participant Information Sheet for more information.

We hope that your institution will see the value of this project and in turn give Md. Nahid Uz Zaman every assistance possible in bringing the project to a successful outcome.

Yours sincerely,

Taro YAMAUCHI, Ph.D.
Director, Center for Environmental and Health Sciences, Hokkaido University
Professor, Faculty of Health Sciences, Hokkaido University, Japan

A. Socio-demographic characteristics **CODE:…….**

1.	Current age		
2.	Age of menarche		
3.	Category of studentship	Nursing	
		Midwifery	
4.	Name of Course	Diploma in Midwifery	
		Diploma in Nursing Science and Midwifery	
		B.Sc in Midwifery (Post Basic)	
		B.Sc in Nursing (Post Basic)	
		B.Sc in Nursing (4 years)	
		Masters in Nursing	
5.	Year of college	First year	
		Second year	
		Third year	
		Fourth year	
6.	Religion	Islam	
		Hinduism	
		Buddhism	
		Christian	
		Other	
7.	Fathers Education level	Graduate or Above	
		Higher Secondary	
		Secondary	
		Primary	
		Illiterate	
8.	Mothers Education level	Graduate or Above	
		Higher Secondary	
		Secondary	
		Primary	
		Illiterate	
9.	Birthplace status	Urban	
		Rural	
10.	Resident status	Hostel	
		Own house	
11.	Monthly Family Income	Below 10000/-	
		1000-20000/-	
		20000-30000/-	
		More than 30000/-	
12.	Income Source	Father	
		Mother	
		Both	
		Others	

B. Menstrual information and education among female students

13.	Sources of menstrual information	Family	
		School	
		Friends	
		Internet	
		Social network	
		University/college	
		Magazine/Books	
		Others	
14.		Yes	

	Did you know about menstruation before its first onset?	No	
15.	When you got your first period, did you feel ready for it?	Yes	
		No	
		I do not know	
16.	Do you need more information on menstruation?		
	No, I have enough information/not interested		
	Yes	*Menstrual delays*	
		Impact of menstruation on daily life	
		Menstrual products	
		What is menstruation?	
		Menstruation duration	
17.	Have you ever asked about menstruation in your health center, clinic or pharmacy?	Yes	
		No, but I would like to	
		No, and I do not want to	
		I do not know	
18.	Do you feel embarrassed talking about menstruation?	Yes	
		Sometimes	
		No	
19.	How often have you made up an excuse not to say that you were menstruating?	Always	
		Sometimes	
		Never/very few times	
20.	Based on your knowledge, what is true about menstruation?	Menstruation is blood that comes out of the vagina	
		People menstruate every 3 weeks	
		It is common to menstruate over 10 days or more	
		Women menstruate all their lives	
		I do not know	
21.	Do you think menstrual pain is normal?	Yes, it always hurts	
		It hurts sometimes	
		It shouldn't hurt too much	

C. Menstrual characteristics of female students

22.	Is your menstrual cycle regular?	The same every month	
		Varies each month slightly	
		Never the same each month	
23.	Scared of staining clothes with blood when menstruating?	Yes	
		No	
24.	Do you suffer from menstrual pain?	Always	
		Sometimes	
		Very few times	
		Never	
25.	How do you feel during menstruation?	Tired	
		Sensitive	
		Angry	
		Sad	
		Dirty	
		Embarrassed	
		Happy	
		Relaxed	
26.	In the last 6 months, did you suffer from any of the following?	Genital rash	
		Vaginal irritation	
		Genital redness or inflammation	

		Unusual vaginal discharge (colour/odour)	
		Others	

D. Access to menstrual hygiene products and supplies for female students

27.	Types of menstrual hygiene products reported to be used by female students	Single use pad	
		Toilet paper	
		Nappies	
		Reusable rags	
		Other (tampons, menstrual cup, underware)	
Cost			
28.	Do you think menstrual products are expensive?	Yes	
		No	
		I do not care	
29.	Have you ever lacked any money to buy menstrual products?	Always	
		Sometimes	
		Never	
		Few times	
		I do not know	
30.	Have you ever had to use menstrual products that you do not like because the ones you like are too expensive?	Always	
		Sometimes	
		Never	
		Few times	
		I do not know	
31.	Can you get free menstrual products in the university?	Yes	
		No	
		I do not care	
Source			
32.	From where you get menstrual products at college?	Home	
		Cafeteria	
		Pharmacy	
		Faculty club	
		Friend	
33.	It is comfortable to get menstrual products from:	College	
		Pharmacy	
		Supermarket	
		Sport club	
		Not comfortable at all	
Others			
34.	Have you ever used a menstrual product for longer than it is recommended because you did not have a replacement?	Always	
		Sometimes	
		Never	
		Few times	
		I do not know	
35.	Have you ever used a menstrual product for longer than it is recommended because you could not find appropriate washing facilities?	Always	
		Sometimes	
		Never	
		Few times	
		I do not know	
36.	Are you embarrassed to buy menstrual products?	Always	
		Sometimes	
		Never	

		Few times	
		Someone else buy them for me	

E. Personal and physical factors affecting their menstrual experience.

Personal Factor			
Knowledge of menstruation and menstrual management			
37.	Correctly identified and/or indicated:	Hormones as cause of menstruation	
		Uterus as location where menstrual bleeding originates	
		Awareness of menstruation prior to menarche	
		They believed they had enough knowledge to manage menses	
Knowledge score (range: 0–3)			
Perceived social stigma of menstruation			
38.	Society's attitude of menstruation is that it is taboo	Agree	
		Disagree	
		Neutral	
Positive perception of menstruation			
39.	Menstruation is a normal and healthy part of life	Agree	
		Disagree	
		Neutral	
Negative perception of menstruation			
40.	Menstruation is a curse	Agree	
		Disagree	
		Neutral	
41.	Menstruation is debilitating	Agree	
		Disagree	
		Neutral	
Comfort to discuss menstruation with others			
42.	Feel comfortable talking about menstruation with mother/female carer	Agree	
		Disagree	
		Neutral	
43.	Feel comfortable talking about menstruation with father/male carer	Agree	
		Disagree	
		Neutral	
44.	Feel comfortable talking about menstruation with sister	Agree	
		Disagree	
		Neutral	
45.	Feel comfortable talking about menstruation with brother	Agree	
		Disagree	
		Neutral	
46.	Feel comfortable talking about menstruation with friends	Agree	
		Disagree	
		Neutral	
47.	Feel comfortable talking about menstruation with partner	Agree	
		Disagree	
		Neutral	
48.		Agree	

	Feel comfortable talking about menstruation with health professional	Disagree	
		Neutral	

49.	Feel comfortable talking about menstruation with employer	Agree	
		Disagree	
		Neutral	
		Not applicable	
50.	Feel comfortable talking about menstruation with lecturer or tutor	Agree	
		Disagree	
		Neutral	
Physical factors *Menstrual characteristics*			
51.	Complications or adverse symptoms experienced during menstruation	Painful periods	
		Irregular/missing periods	
		Heavy bleeding	
		Migraines/headaches	
		Emotional symptoms (e.g. moody, stressed or depressed)	
		Other (e.g. back pain, gastrointestinal issues, acne or suicidal thoughts)	
		I don't experience any side effects	
52.	Consulted a health professional about menstrual-related complications	Yes	
		No	
53.	Diagnosed with a menstrual disorder if they answered yes to consulting a health professional	Yes	
		No	
54.	Diagnosis received after consulting with a health professional	Dysmenorrhea (painful periods)	
		Amenorrhea (missing periods)	
		Abnormal uterine bleeding (bleeding within periods)	
		Endometriosis	
		Polycystic ovarian syndrome	
		Other (e.g. premenstrual dysphoric disorder, adenomyosis or menorrhagia)	
Menstrual practices at last period			
55.	Main menstrual products	Pad	
		Tampon	
		Menstrual cup	
		Cloth/rag	
		Period underwear	
		Other (clothing, regular underwear, nothing)	
56.	Change menstrual products at college	Yes	
		No	
57.	Proportion of students who changed their menstrual products at college broken down by type they mainly used	Pad	
		Tampon	
		Menstrual cup	

		Cloth/rag	
		Period underwear	

58.	Reasons for not changing menstrual products at college	Not required	
		Fear of being heard/seen	
		No disposal bin	
		No replacement material to use	
		Unsanitary facilities	
		Other (e.g. washing and cleaning menstrual cup discretely, not enough time between class or toilets too far away from class)	

F. **Students' perceptions of the bathroom facilities**

Environmental factors (0-5)			
59.	Bathrooms have enough privacy so they can change their menstrual product if they use one	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	
60.	Bathrooms have functional toilets (not clogged, able to flush, toilet seats are not broken)	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	
61.	Bathrooms are clean and sanitary	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	
62.	Bathrooms have functional locks on doors so they can use the toilet in privacy	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	
63.	Bathrooms have a bin in each toilet where they can dispose of their used menstrual product	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	
64.	Bathrooms have enough supply of toilet paper so they can clean/wipe their genitals	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	
65.	Bathrooms have clean running water and soap for handwashing	Always	
		Most of the time	
		Sometimes	
		Rarely	
		Never	

FOCUS GROUP DISCUSSION GUIDED

MODERATOR: Document required information as appropriate for each FGD using the formats provided below. Date: _____/_____/_____

_____

Initials: Moderator: _____ Note Taker____ Recorder Number: __

Folder/File Name (location on recorder): _____

Interview location (Venue): _____FGD Group: _____

_____ FGD Number: ____ Time Start: _____

Time stop: _____ No. Participants at start of FGD:

_____No. Participants at the end of FGD: _____ **Demographic information for every FGD participant** ***[to be completed on a one-to-one basis, immediately after consent is obtained]***

Participant number or Fake name	Age in years
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

COMMENTS – reasons for withdrawal, refusal, ambience of FG, level of interest, disagreements, etc

Introduction

Thank you for your willingness to take part in this group discussion. My name is **Md. Nahid Uz Zaman.** I am from the Graduate School of Health Sciences. We are interested in hearing from you about menstrual needs and practices among women, to understand the problems and solutions faced on dealing with periods.

Focus groups like this are informal; you can talk about anything you think is important for us to know. I also want to remind you that everything we talk about today is confidential. No one will hear this tape except for people working on the project. Whenever we write a report, we will use numbers or fake names so no one can identify you. If there are any questions you'd rather not answer, just let me know - that's fine.

Your frank responses and discussion will be most helpful to us as we try to clarify the critical issues and consider what strategies can be developed to help resolve problems. Your answers are based on your experiences, observations, or feelings, and will not be considered "right" or "wrong", because we want to know what you think. Everyone's views are equally important. It's fine to disagree with other people's views, but if you do, it's important to disagree in a respectful and polite manner. It's important for you to talk in turns to speak, because if you all speak at once, we will not have a clear recording. If you disagree

with something anyone says, you can say 'I disagree' and then wait for them to finish before you speak.

- **Explain the role of note-takers and tape-recorder**
- **Give a few minutes for answering any questions regarding the FGD**

Please note the questions here:

Sl no	Main questions	Further probing on details
1.	Can you tell us what menstruation means to you	Does anyone have anything positive / negative to say about menstruation? What is the best thing about menstruation? What is the worst thing about menstruation? (Prompts: do you agree / disagree – why?)
2.	Can you tell us what menstrual products/materials are available in your area? Are there any other products that you have heard of – but might not have seen or are available to you?	for each they list, explore what they think of them- would they choose to use if they could– if not why not – discuss reasons for this, e.g. expense / availability / quality /practicality /culture
3.	What do you think about the affordability of menstrual products/materials available?	Are they affordable – How do you/your friends / others in similar circumstances afford, or do you have to go without / improvise? How important is it to you and your friends to have such products/materials? what do you/friends have to do to get them?
4.	Do you / your friends / others here have any difficulties changing your menstrual product/materials (if applicable).	probe – humiliation, shame, police, health impacts Is it easy to find places to change /dispose of soiled-used materials? what places? Are they suitable places? What about at night?
5.	Do you / your friends / others here have any difficulties being able to wash and dry yourself and materials used during menstruation?	Is it easy to find places to wash yourselves/ wash and dry materials e.g. cloth? what places? Are they suitable places? What about at night?
6.	What about period (menstrual) pain – Do you / your friends / others here need help managing menstrual pain?	Are you /your friends / others here able to get hold of anything that helps? (for yes): What is this? How do you / they manage to get hold of these things? (for no): What would you / your friends like to have? Is there anything you / your friends can do to make yourself feel better? What is menstrual pain like for you / your friends / others here? Does it place any restriction on what you / your friends / others here can do, or the way you/they behave?
7.	What changes could be made to make menstruation a better experience for women	Product/material related / cost / availability / washing / changing / disposal policies
8.	If there was just one thing that could be introduced to improve menstruation for women	what would this be? (note - see if FGD members can come to agreement)

For Male

Guiding questions

Section 1 focuses on boys' awareness of the changes that both boys and girls go through during adolescence to adults and their coping mechanisms

1. *Can you list down changes that take place in boys and during the adolescent and adult stage?*
2. *How do these changes affect boys i.e., relationships with peers, parent's, education, as well as the relationship with the opposite sex?*
3. *As boys how do you cope with the changes you experience?*
4. *Can you list down changes that take place in girls during the adolescent and adult stage*
5.
6. *How do these changes affect girls i.e., relationships with peers, parent's, education, as well as relationships with the opposite sex?*
7. *How do girls cope with changes?*

Section 2 focuses on boys' knowledge and practice of menstrual hygiene management and their support towards adolescent/adult

8. *What do you understand by the term period/menstruation?*
9. *How do girls get affected by menstruation?*
10. *Where do you access information on menstruation?*
11. *What challenges do you face when accessing information on menstruation?*
12. *Do boys and girls have equal access to information on menstruation?*
13. *In your community, what activities are girls prevented from performing when they are in menses?*
14. *What are the reasons for girls/women not performing such activities?*
15. *What is the current situation of bullying girls/women when they soil/stain their clothes with menses?*
16. *What impact does the bullying have on such girls/womens?*
17. *What sanitary products girls/womens used?*
18. *How do they dispose the products?*

INDEPTH INTERVIEW GUIDE

INTERVIEWER: Document required information as appropriate for each IDI using the formats provided below. Date:……

Initials: Interviewer:……. Recorder Number:……

Folder/File Name (location on recorder): …….

Interview location (Venue): Participant code: Participant age:

Current lodging: Time Start: Time stop:

COMMENTS – reasons for withdrawal, refusal, ambience of interview, level of interest, etc

Introduction

Thank you so much for your willingness to take part in this interview. My name is **Md. Nahid Uz Zaman.** I am from the Graduate School of Health Sciences. We are interested in hearing from you about menstrual needs and practices among women, to understand the problems and solutions faced on dealing with periods.

This interview will be informal; you can talk about anything you think is important for us to know. I also want to remind you that everything we talk about today is confidential. No one will hear this tape except for people working on the project. Whenever we write a report, we will use numbers or fake names so no one can identify you. If there are any questions you'd rather not answer, just let me know - that's fine.

Your frank responses and discussion will be most helpful to us as we try to clarify the critical issues and consider what strategies can be developed to help resolve problems. Your answers are based on your experiences, observations, or feelings, and will not be considered "right" or "wrong", because we want to know what you think. Everyone's views are equally important.

- **Explain the need for tape-recorder**
- **Give a few minutes for answering any questions regarding the interview**

Please note the questions here:

Sl no	Main questions	Further probing on details
1.	Can you start by telling me a little bit about yourself and your background? Can you tell me about your current living accommodation	How old are you? Where do you come from? Do you have family? (**probe on anything relevant to get them talking and opening up a little**) where do you live, how long have you been there? are you living here on your own or with anyone else?
2.	Can you tell me what menstruation means to you? Have you always felt like this?	Do you think there is there anything positive / negative about menstruation? If yes: where did you form your early opinion / what or who were your influences? If no: What was your earlier opinion? Why have you changed your opinion? What or who are your current influences?
3.	Can you tell me what having a period is physically like for you at the moment…?	how regular they are, for example do you have them every month? How long do they last? Are they light or heavy?
4.	Moving away from talking about your period itself, can you tell me how you feel in the day or so leading up to your period	Do you think about it? (what do you think / why?) Do you plan for it? (how? Why? What happens if you don't plan?) Do you try and budget for it? (how, what do you do?) When it starts what happens? How do you feel? (physically / emotionally)
5.	Do you suffer from period pain?	If yes: How bad is the pain? Does it restrict you from doing anything (what / how?) Are you able to take anything to help you? If yes: what? How much does it help? How do you get hold of it? Can you get this every month you need? If no: why is this?
6.	Do you usually feel unwell, (for example dizzy or very tired) during your period?	If yes: Do you ever need to rest – Do you have anywhere to go, what do you do?
7.	What do you think about the affordability of menstrual products/materials available? Can you tell me what menstrual products have you heard of?	Are they affordable? How important is it to you to have such products/materials? What product would you prefer to use if you had a choice of any? What are the reasons for your choice?
8.	Can you tell me about the products/materials you usually use when you are having your period……? What do you usually use?	**If manufactured (disposable pads / tampons /cup etc):** Can you usually get hold of these? How do you acquire them? (Do you buy them or get given or..?) Is this usually from the same source or do you acquire from different sources / ways at different times? Do you ever get products/materials from a foodbank? Do you ever get these for other members of your family or friends etc? Probe: Who do you do this for? / how often do you help them by doing this? Does this ever cause problems? If you have pads/tampons sometimes, do you have enough to last for your whole period? If not, why - what happens? How often do you need to use impromptu materials? how do you feel about this? How do you get hold of these materials? **If impromptu / improvised materials: (paper/cloth/cardboard etc):** How do you feel about using these materials? How do you get hold of these? **For**

Sl no	Main questions	Further probing on details
	How comfortable do you find (these materials / products)?	**all**: Do you ever get sore / chafing – is this often / occasionally? Is there a specific situation when this occurs eg if you wear for too long, or use a certain material? What do you do to help prevent this from happening? Is there anything you can do / use to provide relief? Have you ever had to resort to anything that added extra problems for you- such as stealing / shoplifting / performing favours or exchange sex for money to obtain materials or products; or money to buy products Can you tell me more about this. Was this a one off or does this happen regularly? How do you feel about this?
9.	Can you tell me what happens when you need to change your (product / material)? Where / what sort of place do you usually change your product / material?	How long do you usually last before you have to change it? Is this about the right length of time for you or do you ever have to wait before you change / why? Is this a good place to change? Why / not? Have you tried (unsuccessfully) other places to change – tell us about this. What happens at night – can you change / where? are there any hazards to doing this?
10.	Can you tell me about how you usually wash yourself during menstruation?	Where / how do you do this? Are there any problems or is this ok? (If any problem), please tell me more about this.
11.	What about washing your clothes, and any materials / products used for your menstruation?	Where / how do you do this? Are there any problems or is this ok? (If any problem), please tell me more about this – how do you dry reusable material / clothing, are there problems or repercussions of doing this? If you wash items, can you easily put them somewhere to dry? Are there any problems that arise in trying to dry them? Do you ever wear these when still damp? Does this cause any issues, please explain?
12.	Can you tell me about disposing of any soiled products / materials?	How do you deal with this? Does it vary by material? Or where you are? Do any problems arise in trying to dispose of any items (if yes: what are these / how do you try and deal with this?
13.	Does having or period restrict your life in any way? Would you ever consider using something like the coil – which stops you from having a period (but is not permanent)	If yes: Can you tell me how and why this happens? How does this make you feel? Are there any consequences from this restriction (if yes: what?) If yes: no: don't know – probe why, what are their thoughts on this
14.	Is there anything you would like to see changed in relation to helping women with menstruation? Is there anything important in relation to menstruation that we have not covered that you want to mention?	Probe: physically, emotionally, washing / changing, restrictions

A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

1.	Current age		
2.	How old were you when you started menstruating		
3.	Category of studentship	Nursing	
		Midwifery	
4.	Name of Course	Diploma in Midwifery	
		B.Sc in Nursing (Post Basic)	
		B.Sc in Nursing (4 years)	
5.	Year of college	First year	
		Second year	
		Third year	
		Fourth year	
6.	Religion	Islam	
		Hinduism	
		Buddhism	
		Christian	
		Other	
7.	Fathers Education level	Graduate or above	
		Higher Secondary	
		Secondary	
		Primary	
		Illiterate	
8.	Mother's Education level	Graduate or above	
		Higher Secondary	
		Secondary	
		Primary	
		Illiterate	
9.	Birthplace status	Urban	
		Rural	
10.	Resident status	Hostel	
		Own house	
11.	Monthly Family Income	Below 10000/-	
		1000-20000/-	
		20000-30000/-	
		More than 30000/-	

B. Menstrual Health and Hygiene Indicators

1.	During your last menstrual period, did you have enough menstrual materials to change them as often as you wanted to?	Yes	
		No	
		Don't remember	
2.	The last time you attended school during your menstrual period, did you change your menstrual materials at school?	Yes	
		No	
2-a.	If yes (to changing at school); Was the place that you changed your menstrual materials clean?	Yes	
		No	
2-b.	If yes (to changing at school); Did you worry that someone would see you while you were changing menstrual materials?	Yes	
		No	
2-c.		Yes	

	If yes (to changing at school); Did you feel safe while you were changing your menstruation materials?	No	
3.	Have you ever received education about menstruation (in school)	Yes, in primary school	
		Yes, in secondary school	
		Yes, in primary and secondary school	
		No, did not receive education about menstruation in school	
4.	Before you had your first menstrual period, did you know about menstruation?	Yes	
		No	
		Don't remember	
5.	From one menstrual period to the next, are there certain days when a woman is more likely to become pregnant?	Yes	
		No	
		Don't remember	
5-a.	If yes, is this time just before her period begins, during her period, right after her period has ended, or halfway between two periods? (pick one)	Just before her period begins	
		During her period	
		Right after her period has ended	
		Halfway between two periods	
6.	Were you able to reduce your menstrual (menstruation-related) pain during your last menstrual period when you needed to?	Yes	
		No	
		I didn't need to reduce pain during my last menstrual period	
7.	If you had a concern about your menstrual period, would you feel comfortable seeking help from a health care provider such as a school nurse, community health worker, or doctor?	Yes	
		No	
8.	Do you have someone who you would feel comfortable asking for support (advice, resources, emotional support) for your period if needed?	Yes	
		No	
		Not applicable, do not needed	
9.	Getting my period does not impact my day.	Yes	
		No	
10.	During your most recent period, did you have trouble participating in class due to your period?	Yes	
		No	
11.	Do any national policies and plans include provision for menstrual health and hygiene? (If yes, please specify)	Yes	
		No	

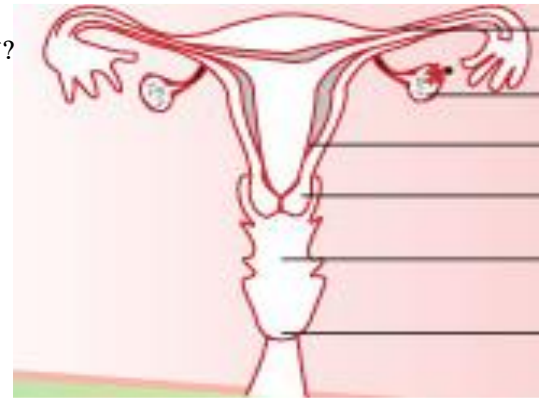
SOCIO-DEMOGRAPHIC CHARACTERISTICS

1.	Current age আপনার বর্তমান বয়স কত?		
2.	How old were you when you started menstruating আপনি কত বছর বয়সে প্রথম মাসিক শুরু করেন?		
3.	Category of studentship আপনি কোন কোর্সে অধ্যয়ন করছেন?	Nursing	
		Midwifery	
4.	Name of Course আপনার কোর্সের নাম কি?	Diploma in Midwifery/ Diploma in Nursing	
		B.Sc in Nursing (Post Basic)	
		B.Sc in Nursing (4 years)	
5.	Year of college আপনি কোন বর্ষের শিক্ষার্থী?	First year	
		Second year	
		Third year	
		Fourth year	
6.	Religion আপনার ধর্ম কী?	Islam	
		Hinduism	
		Buddhism	
		Christian	
		Other	
7.	Fathers Education level আপনার বাবার শিক্ষাগত যোগ্যতা কী?	Graduate or above	
		Higher Secondary	
		Secondary	
		Primary	
		Illiterate	
8.	Mother's Education level আপনার মায়ের শিক্ষাগত যোগ্যতা কী?	Graduate or above	
		Higher Secondary	
		Secondary	
		Primary	
		Illiterate	
9.	Birthplace status আপনি শহরে না গ্রামে জন্মগ্রহণ করেছেন?	Urban	
		Rural	
10.	Resident status আপনি কোথায় থাকেন?	Hostel	
		Own house	
11.	Monthly Family Income আপনার পরিবারের মাসিক আয় কত?	Below 10000/-	
		1000-20000/-	
		20000-30000/-	
		More than 30000/-	
12.	Income Source পরিবারের আয়ের উৎস কী?	Father	
		Mother	
		Both	
		Others	
13.	Weight (kg) আপনার ওজন কত কেজি?		
14.	Height (cm) আপনার উচ্চতা কত সেন্টিমিটার?		
15.	How many days did you miss the school/Class in the last menstrual period due to menstruation? সর্বশেষ মাসিক চলাকালে আপনি মাসিকজনিত কারণে কতদিন ক্লাস মিস করেছেন?		

KNOWLEDGE, ATTITUDE AND PRACTICE (KAP) QUESTIONNAIRE

For Knowledge (Alam *et al.,* 2022)

1. Do you know what is the average age of a girl's first period/menarche?
   আপনি কি জানেন একটি মেয়ের গড়ে কত বছর বয়সে প্রথম মাসিক শুরু হয়?
   a. Year
   b. Don't know
2. During menstruation, what is the reason or purpose for the monthly bleeding? **(multiple responses allowed here)**
   মাসিক চলাকালে রক্তপাতের উদ্দেশ্য বা কারণ কী? (একাধিক উত্তর দিতে পারবেন)
   a. To cleanse toxins from the body
   b. To pass the old lining of the uterus from the body so a fresh lining can be formed
   c. To indicate that there is a problem with the girl's reproductive organs
   d. To indicate that the girl is sick
   e. Others
   f. Don't Know
3. Some girls and women have longer menstruation cycle, others have shorter menstruation cycle. On **average**, how often does a girl or woman typically get a period (in other words, how long is the entire cycle)?
   গড়ে একটি মেয়ে/নারীর কত দিন পর পর মাসিক হয়?
   a. …….Days
   b. Don't know
4. Some girls and women have longer periods of bleeding, others have shorter periods of bleeding. On **average**, how long is each period of bleeding?
   গড়ে মাসিক চলাকালে রক্তপাত কতদিন স্থায়ী হয়?
   a. 1-3 days
   b. 3-7 days
   c. 7-10 days
   d. More than 10 days
   e. Don't know
5. Could you please identify the name of the body part from the following picture? (Please show the photo to the respondent and tick whether she could mention following; If respondent can't say any then tick on don't know)
   আপনি কি নিচের ছবিতে প্রদর্শিত শরীরের অঙ্গাগুলোর নাম বলতে পারবেন?
   a. Ovaries
   b. Fallopian tubes
   c. Uterus
   d. Vagina
   e. Don't know



6. Can you list at least three methods for reducing pain if a girl experiences any physical discomfort during her period? **(multiple responses allowed here)**
   মাসিক চলাকালে ব্যথা হলে ব্যথা কমানোর অন্তত তিনটি উপায় বলুন।
   a. Pain medication
   b. Exercise
   c. Hot fomentation
   d. Cold fomentation
   e. Sleeping
   f. Rest
   g. Others
7. What is the proper way to wash and dry reusable sanitary products (cloths)? **(multiple responses allowed here)**
   পুনঃব্যবহারযোগ্য স্যানিটারি কাপড় পরিষ্কার ও শুকানোর সঠিক পদ্ধতি কী?
   a. Wash with water
   b. Wash with water and soap
   c. Clothes are dried in such a way that they can dry completely
   d. Others
8. What is the proper way to dispose of disposable sanitary products? **(multiple responses allowed here)**
   ব্যবহারযোগ্য স্যানিটারি পণ্যের সঠিক নিষ্পত্তি পদ্ধতি কী?
   a. Dispose in the waste bin
   b. Wrapped and placed in a dustbin
   c. Tossed into the pit of the latrine
   d. Tossed in a canal
   e. Incinerated
   f. Thrown outside in the bush
   g. Others
9. How often should sanitary products be changed?
   স্যানিটারি পণ্য কতবার ঘন ঘন পরিবর্তন করা উচিত?
   a. As needed, according to blood flow, but AT LEAST every six hours
   b. Every hour, regardless of blood flow
   c. Once per day
   d. As needed, but AT LEAST every 9 hours
   e. Others

For Attitude: Menstrual Attitudes Questionnaire (MAQ) (Brooks & Ruble 1980)

	Variables	**Strongly Disagree** *একমত নই*						**Strongly Agree** *একমত*
		1	**2**	**3**	**4**	**5**	**6**	**7**
Menstruation as a debilitating event								
10.	A woman's performance in sports is not affected negatively by menstruation. খেলাধুলায় নারীদের পারফরম্যান্স মাসিকের কারণে নেতিবাচকভাবে প্রভাবিত হয় না।							
11.	Women are more tired than usual when they are menstruating. নারীরা মাসিক চলাকালে সাধারণের চেয়ে বেশি ক্লান্ত বোধ করেন।							
12.	I expect extra consideration from my friends when I am menstruating. মাসিক চলাকালে আমি বন্ধুদের কাছ থেকে বাড়তি যত্ন আশা করি।							
13.	Menstruation can adversely affect my performance in sports. মাসিক আমার খেলাধুলার পারফরম্যান্সে নেতিবাচক প্রভাব ফেলতে পারে।							
14.	I feel as fit during menstruation as I do during any other time of the month. মাসিক চলাকালেও আমি স্বাভাবিকের মতো সুস্থ বোধ করি।							
15.	I don't allow the fact that I'm menstruating to interfere with my usual activities. আমি মাসিক চলাকালেও স্বাভাবিক কার্যক্রম চালিয়ে যাই।							
16.	Avoiding certain activities during menstruation is often very wise. মাসিক চলাকালে কিছু কাজ এড়ানো প্রয়োজন।							
17.	I am more easily upset during my premenstrual or menstrual periods than at other times of the month. মাসিক বা প্রাক-মাসিক সময়ে আমি বেশি আবেগপ্রবণ হই।							
18.	I don't believe my menstrual period affects how well I do on intellectual tasks. আমি বিশ্বাস করি না যে মাসিক আমার বুদ্ধিবৃত্তিক কাজে প্রভাব ফেলে।							
19.	I realize that I cannot expect as much of myself during menstruation compared to the rest of the month. মাসিক চলাকালে আমি নিজের কাছ থেকে স্বাভাবিকের মতো পারফরম্যান্স আশা করি না।							
20.	Women just have to accept the fact that they may not perform as well when they are menstruating. নারীদের মেনে নিতে হবে যে মাসিক চলাকালে তারা স্বাভাবিকভাবে কাজ করতে নাও পারে।							
Menstruation as a bothersome event								
21.	Menstruation is something I just have to put up with. মাসিক এমন কিছু যা আমাকে সহ্য করতেই হয়।							
22.	In some ways I enjoy my menstrual periods. কিছুটা হলেও আমি মাসিক উপভোগ করি।							

	Variables	Strongly Disagree *একমত নই*						Strongly Agree *একমত*
		1	**2**	**3**	**4**	**5**	**6**	**7**
23.	Men have a real advantage in not having the monthly interruption of a menstrual period. মাসিক না হওয়া পুরুষদের একটি বড় সুবিধা।							
24.	I hope it will be possible someday to get a menstrual period over within a few minutes. আমি আশা করি ভবিষ্যতে মাসিক কয়েক মিনিটেই শেষ হয়ে যাবে।							
25.	The only thing menstruation is good for is to let me know I'm not pregnant. মাসিক কেবল গর্ভধারণ হয়নি তা জানানোর মাধ্যম।							
26.	Menstruation provides a way for me to keep in touch with my body. মাসিক আমাকে নিজের শরীর সম্পর্কে সচেতন করে তোলে।							
Menstruation as a natural event								
27.	Menstruation is a reoccurring affirmation of womanhood. মাসিক নারীসত্ত্বার একটি বারবার ফিরে আসা প্রমাণ।							
28.	Menstruation allows women to be more aware of their bodies. মাসিক নারীদের শরীর সম্পর্কে আরও সচেতন করে তোলে।							
29.	Menstruation provides a way for me to keep in touch with my body. মাসিক আমাকে নিজের শরীরের সাথে সংযোগ বজায় রাখতে সহায়তা করে।							
30.	Menstruation is an obvious example of the rhythmicity which pervades all of life. মাসিক জীবনের ছন্দময়তা প্রকাশ করে।							
31.	The recurrent monthly flow of menstruation if an external indication of a woman's general good health. নিয়মিত মাসিক নারীর স্বাস্থ্যের বাহ্যিক সূচক।							
Anticipation and prediction of the onset of menstruation								
32.	I can tell my period is approaching because of breast tenderness, backache, cramps, or other physical signs. স্তনব্যথা, পিঠব্যথা, পেটব্যথা ইত্যাদি দিয়ে আমি মাসিকের আগমন বুঝতে পারি।							
33.	I have learned to anticipate my menstrual period by the mood changes which precede it. মন মেজাজের পরিবর্তন দিয়ে আমি মাসিক আগমনের আগাম ধারণা পাই।							
34.	My own moods are not influenced in any major way by the phase of my menstrual cycle. মাসিক চক্রের কারণে আমার মেজাজে কোনো বড় পরিবর্তন হয় না।							

	Variables	Strongly Disagree *একমত নই*						Strongly Agree *একমত*
		1	**2**	**3**	**4**	**5**	**6**	**7**
35.	I am more easily upset during my premenstrual or menstrual periods than at other times of the month. মাসিক বা প্রাক-মাসিক সময়ে আমি বেশি আবেগপ্রবণ হই।							
36.	Most women show a weight gain before or during menstruation. অধিকাংশ নারীর মাসিক চলাকালীন ওজন বেড়ে যায়।							
Denial of any effect of menstruation								
37.	Cramps are bothersome only if one pays attention to them. মাসিকের ব্যথা কেবল তখনই কষ্টদায়ক হয় যখন আপনি সেটা নিয়ে চিন্তা করেন।							
38.	A woman who attributes her irritability to her approaching period is neurotic. কেউ যদি মাসিকজনিত মন খারাপের কথা বলে, তবে সে মনোবৈকল্যে ভুগছে।							
39.	I barely notice the physiological effects of my menstrual periods. আমি আমার মাসিকের শারীরিক প্রভাব টেরই পাই না।							
40.	Women who complain of menstrual distress are just using that as an excuse. যারা মাসিকজনিত অস্বস্তির অভিযোগ করে, তারা আসলে অজুহাত খোঁজে।							
41.	Premenstrual tension irritability is all in a woman's head. প্রাক-মাসিক টেনশন বা রাগ কেবল কল্পনাপ্রসূত।							
42.	Most women make too much of the minor physiological effects of menstruation. অধিকাংশ নারী মাসিকের সামান্য প্রভাবকেও অতিরঞ্জিত করে।							

For Practice: Menstrual Practice Questionnaire (MPQ) (Hennegan et al., 2022)

Menstrual Material Use

43. What were all the materials you used to catch/absorb your menstruation when you were at home during your last menstrual period? (select all that apply)
    সর্বশেষ মাসিক চলাকালে আপনি বাসায় কী কী উপকরণ ব্যবহার করেছেন?
    - Cloth/towel
    - Disposable sanitary pad
    - Reusable sanitary pad
    - Toilet paper
    - Cotton wool
    - Mattress or foam
    - Underwear alone
    - Natural material (e.g., leaves, sand, grass)
    - Period underwear
    - Menstrual cup
    - Tampon
    - Other (specify)
44. What were all the materials you used to catch/absorb your menstruation when you were away from home [at school/at work] during your last menstrual period? (select all that apply)
    আপনি স্কুলে/কাজে থাকাকালে কী উপকরণ ব্যবহার করেছেন?
    - Cloth/towel
    - Disposable sanitary pad
    - Reusable sanitary pad
    - Toilet paper
    - Cotton wool
    - Mattress or foam
    - Underwear alone
    - Natural material (e.g., leaves, sand, grass)
    - Period underwear
    - Menstrual cup
    - Tampon
    - Other (specify)
45. [Cloth users] Were your cloths bought to be used for menstruation or used for something else first? (select one)
    আপনি ব্যবহৃত কাপড় কি মাসিকের জন্যই কিনেছেন?
    - Bought to be used during menstruation
    - Used for something else first (e.g., clothes, bedding)
    - Don’t know
46. Did you wash and reuse any of your menstrual materials during your last menstrual period? (select one)
    আপনি কি ব্যবহৃত কাপড় ধুয়ে পুনঃব্যবহার করেছেন?
    - No
    - Yes

Changing menstrual materials

47. During your last menstrual period, how many times did you change your menstrual material on the heaviest day of your period? (day = 24 hours) (select one)
    সর্বশেষ মাসিকের সবচেয়ে ভারী দিনের সময় দিনে কতবার উপকরণ পরিবর্তন করেছেন?
    - 1 time (wear until the next day)
    - 2 times (eg. morning and evening)
    - 3 times (eg. morning, evening and once during day)
    - 4 times (eg. morning, evening, and twice during day)
    - More than 4 times
48. Where did you most often change your menstrual materials when you were at home during your menstrual last period? (select one)
    আপনি বাসায় থাকাকালে সাধারণত কোথায় উপকরণ পরিবর্তন করেছেন?
    - Latrine
    - Bedroom
    - Bathroom/washing space (separate from latrine)
    - Outside/bush/field
    - Other (specify)
49. How often did you change your menstrual materials when you were away from your home [at school/at work] during your last menstrual period? (e.g., school, market, working outside the home) (select one)
    আপনি বাইরে (স্কুল/কাজে) থাকাকালে কতদিন উপকরণ পরিবর্তন করেছেন?
    - Every day of my period
    - Some days
    - One day
    - Never/no days
50. Where did you most often change your menstrual materials when you were away from your home [at school/at work] during your last menstrual period? (select one)
    বাইরে কোথায় উপকরণ পরিবর্তন করেছেন?
    - Latrine
    - A bathroom (separate from latrine)
    - Another room at the location
    - Outside/bush/field
    - Other (specify)

Handwashing

51. Did you wash your hands before changing your menstrual materials during your last menstrual period? (select one)
    উপকরণ পরিবর্তনের আগে আপনি কি হাত ধুয়েছেন?
    - Never
    - Sometimes
    - Every time
52. Did you wash your hands after changing your menstrual materials during your last menstrual period? (select one)
    উপকরণ পরিবর্তনের পরে কি হাত ধুয়েছেন?
    - Never
    - Sometimes
    - Every time

Genital washing

53. How often did you wash your genitals during your last menstrual period? (select one)
আপনি মাসিক চলাকালে কতবার যৌনাঙ্গ পরিষ্কার করেছেন?
    - At the end of my period only
    - Every 2-3 days
    - Once per day
    - Twice per day
    - Three or more times per day
54. When you washed your genitals, did you use soap? (select one)
পরিষ্কারের সময় আপনি কি সাবান ব্যবহার করেছেন?
    - Never
    - Sometimes
    - Every time

Disposal of menstrual materials

55. Where did you most often dispose of your used menstrual materials when you were at home during your last menstrual period? (select one)
বাসায় আপনি ব্যবহৃত উপকরণ কোথায় ফেলেছেন?
    - Into the latrine/toilet
    - Burned
    - Household rubbish (bin in latrine)
    - Household rubbish (bin not in latrine)
    - Taken to community rubbish
    - Buried/bush/waterway
    - Did not dispose of any materials (including reusables)
    - Other (specify)
56. Where did you most often dispose of your used menstrual materials when you were away from your home [at school/at work] during your last menstrual period? (select one)
বাইরে থাকাকালে উপকরণ কোথায় ফেলেছেন?
    - Transported home to dispose or reuse
    - Into the latrine/toilet
    - Bin in the latrine/toilet
    - Bin onsite but outside of the latrine/toilet
    - Community rubbish (not onsite)
    - Bush/buried/waterway
    - Burned
    - Other (specify)
57. When disposing of your used menstrual materials, did you usually wrap them in anything? (select one)
আপনি কি ব্যবহৃত উপকরণ মোড়ানো অবস্থায় ফেলেছেন?
    - No
    - Yes, plastic bag, cover of pad
    - Yes, toilet paper
    - Yes, cloth
    - Yes, other

Storage of menstrual materials

58. After your last menstrual period, did you keep [store] your menstrual materials? (includes leftover disposables or reusables) (select one)
আপনি মাসিক শেষের পর উপকরণ সংরক্ষণ করেছেন কি?
    - No
    - Yes

59. Where did you store your menstrual materials after your last menstrual period? (select one)
আপনি কোথায় সংরক্ষণ করেছেন?
    - Cupboard, cabinet or drawer
    - Under bed
    - In the toilet/latrine room
    - In a bathroom (not latrine/toilet)
    - Other
60. Did you store your menstrual materials inside any wrapping, packaging or case? (select one)
আপনি কি কোনো প্যাকেট/র‍্যাপিংয়ে রেখেছিলেন?
    - Wrapped in plastic or in plastic bag (including disposable pads in original packaging)
    - Wrapped in fabric or in a fabric bag
    - Wrapped in paper
    - Cardboard box
    - No wrapping or container
    - Other

Washing materials

61. Did you soak your materials when washing them during your last menstrual period? How long did you usually soak them for?
আপনি উপকরণ কতক্ষণ ভিজিয়ে রেখেছিলেন?
[Time] 0 is did not soak

62. Where did you most often wash your menstrual materials during your last menstrual period? (select one)
কোথায় উপকরণ ধুয়েছেন?
    - Shared bucket (or similar container)
    - Own bucket (or similar container)
    - Shower/bath
    - Sink/basin (inside home)
    - Sink/basin (outside home)
    - Well, spring, waterway
    - Other
63. Did you use soap or detergent to wash or soak your menstrual materials during your last menstrual period? (select one)
সাবান বা ডিটারজেন্ট ব্যবহার করেছেন?
    - Never
    - Sometimes
    - Every time

Drying materials

64. Where did you most often dry your menstrual materials during your last menstrual period? (select one)
কোথায় উপকরণ শুকিয়েছেন?
    - Outside (hanging)
    - Outside (hidden)
    - Inside (hanging)
    - Inside (hidden)
    - Other

65. When your menstrual materials were drying, did you usually cover them with anything? (select one) শুকানোর সময় ঢেকে রেখেছিলেন?
    - No
    - Yes
66. When your menstrual materials were drying during your last menstrual period, were they in the sun? (select one) রোদে শুকিয়েছেন?
    - Never
    - Sometimes
    - All the time
67. During your last period, were your menstrual materials completely dry before you used them? (select one)
    ব্যবহারের আগে পুরোপুরি শুকনো ছিল?
    - Never
    - Sometimes
    - Every time

Additional sterilisation practices

68. [Fabric reusables] Did you use an iron on your menstrual materials before you reused them during your last menstrual period? (select one)
    আপনি কি কাপড় ইস্ত্রি করেছেন পুনঃব্যবহারের আগে?
    - Never
    - Sometimes
    - Every time

Toilet/latrine practice during menstruation

69. During your last menstrual period, when you were at home did you use the same location for urination as when you do not have your menstrual period? (select one)
    বাসায় আপনি কি মাসিকের সময় স্বাভাবিক সময়ের মতোই টয়লেট ব্যবহার করেছেন?
    - Never
    - Sometimes
    - All the time
70. During your menstrual last period, when you were at work did you use the same location for urination as when you do not have your menstrual period? (select one)
    কাজের জায়গায় আপনি একই টয়লেট ব্যবহার করেছেন?
    - Never
    - Sometimes
    - Every time

Session plans and facilitation guides

Session plan 1

Session	Introduction
Purpose	1. For the facilitators and participants to introduce themselves 2. For all to get a broad understanding of the range of experience and expertise within the group 3. To review the agenda for the workshop 4. To agree principles of working together
Key learning	• The combined experience within the group
Time allowed	30 min
Tips for room layout	• Tables to be arranged in café style (in groups of around 4-6) if possible. If not, boardroom style (u-shaped) is fine • Space for all participants to stand up in a circle and move around to get into smaller groups
Materials	• Workshop agenda • Name badges/stickers • Flip chart paper and marker pen
Methodologies	• Facilitated group discussion
Session outline	• Welcome (5 min) • Introductions (15 min) • Agenda and housekeeping (5 min) • Agree principles for working together (5 min)
Key messages	• The workshop will draw on the experiences of all the participants • The workshop room is a supportive space for people to talk about menstruation and menstrual hygiene without inhibition

Session plan 2

Session	Johari Window
Purpose	1. For the group to think about how different people, or groups, feel about talking about menstruation and menstrual hygiene 2. For the group to consider how this might affect how we talk to people about menstrual hygiene when designing a menstrual hygiene programme 3. An ice-breaker to help the group start talking about menstrual hygiene together
Key learning	• The importance of breaking the silence on menstrual hygiene • The need to consider how open or closed different people are to talking about menstrual hygiene and how creating the right setting can enable people to talk about menstrual hygiene more easily
Time allowed	45-60 min
Tips for room layout	This exercise requires the group to stand around a board/display, so enough space needs to be created for everyone to see
Materials	• 2-4 large sheets of paper (e.g. flipchart paper) and means for fixing to wall/board • Pens • Sticky notes in 4 different colours
Methodologies	• Facilitated group discussion
Session outline	• Exercise – developing the Johari Window (15-20 min) • Discussion (20-30 min) • Summing up (5-10 min)
Key messages	• There is a diversity of cultural/social perspectives that determine whether issues are considered open or secret. We may not all share the same values. This is particularly important to understand when dealing with sensitive issues such as menstruation • Taboos around menstruation and menstrual hygiene result in misinformation, fear, stigma and exclusion • We should consider how we can encourage people to be more open through creating safe spaces for talking about menstruation and menstrual hygiene
Notes and references	The Johari Window technique was created in 1955 in the USA by Joseph Luft and Harrington Ingham, to help people better understand themselves and their relationship with others. It has been adapted here to consider how people feel talking about menstrual hygiene

Session plan 3

Session	Menstrual hygiene basics: what we need to know
Purpose	To ensure that all participants have a shared understanding of menstruation and menstrual hygiene; the key components of menstrual hygiene management (MHM); and how agencies can provide an effective cross-sector response to MHM
Key learning	• What are menstruation and menstrual hygiene • Challenges faced by women and girls • MHM programme components and sectors involved
Time allowed	55-60 min

Materials	• Boards/flip chart paper and markers
	• Computer, projector, screen/white wall
	• *Menstrual hygiene matters* resource book
	• Handouts:
	  ◦ *Menstruation: the basics*
	  ◦ *Menstrual hygiene management: getting started*
	  ◦ *Menstruation and health*
	• Presentation: Menstrual hygiene management: the basics

Methodologies	• PowerPoint presentation • Plenary questions and discussion
Session outline	• Discussion: (5-10 min) • Presentation – *Menstrual hygiene management: the basics* (30 min) • Summing up (20 min)

Session plan 4

Session	Menstrual hygiene materials: options, use and disposal
Purpose	For the group to become familiar with a range of materials that can be used for menstrual hygiene around the world, and how they are used and disposed of hygienically
Key learning	• Learn about a range of menstrual hygiene materials available around the world and what is required to use and dispose of them hygienically • Decide what criteria should be considered when choosing which menstrual hygiene materials to promote
Time allowed	60 min
Tips for room layout	Part of this exercise is done with the group standing up around a table, so there needs to be enough room for all members of the group to see the materials on the table
Materials	• A selection of materials used for menstrual hygiene, e.g. cotton wool, tissue paper, different types of cloth, disposable sanitary pads, re-useable pads, tampons, menstrual cup, underwear • Examples of aids for teaching women and girls how to use materials, e.g. leaflets, menstrual hygiene product packaging • Long table • Labels for the materials • Flip chart and pens • Computer, projector and screen/white wall • Handout 4: *Menstrual hygiene materials: use, supply and disposal* • Presentation: Menstrual hygiene materials
Methodologies	• Display of menstrual hygiene materials • PowerPoint presentation • Plenary discussion
Session outline	• Display and review of menstrual hygiene materials (25 min) • Presentation – *Menstrual hygiene materials* (15 min) • Developing checklist criteria (15 min) • Summing up (5 min)
Key messages	• The choice of menstrual hygiene materials is based on cultural acceptability and user preferences. It is also often influenced by a woman or girl's environment and access to funds, water and sanitation facilities, and affordable options • It is critical that any programme aiming to support women or girls with menstrual hygiene materials involves them in the planning discussions and decisions about the materials and/or products to be supported • Information and facilities should be provided to use and dispose of different materials hygienically

Session plan 5

Session	Barrier analysis: critical gaps
Purpose	To identify and analyse the barriers that create challenges for women and girls to practise good menstrual hygiene
Key learning	• How to analyse the range of barriers that women and girls face in relation to menstrual hygiene in a given context
Time allowed	60-80 min
Tips for room layout	• Tables to be arranged in café style (groups of around 6-8 people) if possible • There needs to be a large wall/board space to display the barriers identified by the group
Materials	• Optional film: *Adolescent school girls in Bangladesh on managing menstruation* • Computer, projector and speakers (if using film) • Coloured cards or sticky notes • Wall or board for displaying cards/notes • Marker pens
Methodologies	• Group work
Session outline	• Introduction (5 min) • Film – *Adolescent school girls in Bangladesh on managing menstruation* / case studies / reflection (5-10 min) • Group exercise (30-40 min) • Discussion (15-20 min) • Summing up (5 min)
Key messages	• Women and girls face a range of barriers in managing menstrual hygiene and we need to find out what these are in the particular context where we are working.
Notes and references	This session is adapted from equity and inclusion resources developed by WEDC in collaboration with WaterAid. The original documents can be accessed at: http://wedc.lboro.ac.uk/resources/learning/EI_AS2_Identifying_barriers_v2.pdf If most of the group have some experience of working with communities, schools or other groups on water, sanitation and hygiene (WASH) including menstrual hygiene management (MHM) they can base this exercise on their own experience and context. If the group does not have much experience the suggested resources can be used. The film suggested for this session was directed and edited by Sara Liza Baumann of Old Fan Films. It can be accessed on YouTube at: www.youtube.com/watch?v=ST683CWXIzw. If it is not possible to show the film (e.g. due to the technology available) then a range of case studies about MHM experiences and challenges faced by women and girls could be used. Extra time may be needed for the participants to read through the case studies. There are a number of case studies in the *Menstrual hygiene matters* resource book at www.wateraid.org/mhm

Session plan 6

Session	Solutions analysis: addressing barriers
Purpose	To identify solutions to remove or reduce the barriers to menstrual hygiene management (MHM) identified in the barrier analysis
Key learning	How to identify a range of solutions that can be included in a menstrual hygiene intervention and the importance of developing a comprehensive approach relevant to the context
Time allowed	70-80 min
Tips for room layout	• Tables to be arranged in café style (groups of around 4-6) if possible • There needs to be large wall/board space to display the solutions identified by the group
Materials	• Coloured cards or sticky notes • Wall or board for displaying cards/notes • Marker pens
Methodologies	• Group work
Session outline	• Introduction (5 min) • Group exercise – Solutions analysis (30-40 min) • Discussion (30 min) • Summing up (5 min)
Key messages	• Tackling the barriers to menstrual hygiene requires a comprehensive approach that incorporates awareness raising, provision of facilities and materials, capacity development and policy. • This means working in collaboration across different sectors including water, sanitation and hygiene (WASH), health and education.
Notes and references	This session should be run after Session 5 – Barrier analysis. This session is adapted from equity and inclusion resources developed by WEDC in collaboration with WaterAid. The original documents can be accessed at: http://wedc.lboro.ac.uk/resources/learning/EI_AS3_Identifying_solutions_v2.pdf The film referred to in this session was directed and edited by Sara Liza Baumann of Old Fan Films. It can be accessed on YouTube at: www.youtube.com/watch?v=ST683CWXIzw

Session plan 7

Session	Communicating confidently
Purpose	1 To discuss the stigma surrounding menstrual hygiene management (MHM) in order to break the silence and build confidence to talk about sensitive and embarrassing issues 2 Build capacity for participants to take an active role in building MHM into water, sanitation and hygiene (WASH) programmes and policies
Key learning	• The importance of communicating with men and boys on MHM as well as women and girls • How to build confidence and capacity to speak about MHM
Time allowed	85-105 min
Tips for room layout	This exercise is done in small groups around tables (café style)
Materials	• Computer, projector and speakers • Film: *Making the invisible visible* • Paper, cards or sticky notes • Flip chart and pens
Methodologies	• A short film on reaching men and boys about MHM in India • Plenary discussion • Group work • Roleplays
Session outline	• Film – *Making invisible, the visible* (8 min) • Discussion (7 min) • Exercise – Discussing embarrassing topics (20-30 min) • Group work (30-40 min) • Discussion (15 min) • Summing up (5 min)
Key messages	• Discussing embarrassing topics gets easier the more you do it. • We may use communication tools to help us – for example, dolls to demonstrate use of materials, diagrams and picture books to explain the menstrual cycle. We can also create spaces where it is easier to talk. • Within the sector we need to build capacity and confidence to talk about MHM.
Notes and references	The film *Making invisible, the visible* was produced by Vatsalya in India: http://vatsalya.org.in/ The participatory session is adapted from International HIV/AIDS Alliance (2006) *TOOLS TOGETHER NOW! 100 participatory tools to mobilise communities for HIV/AIDS*

Session plan 8

Session	Designing a menstrual hygiene intervention
Purpose	For participants to apply learning from the workshop to develop a menstrual hygiene management (MHM) project outline.
Key learning	• How to develop an MHM intervention for a specific context. • Consider which elements of a comprehensive MHM approach to prioritise in a project setting.
Time allowed	65-80 min
Tips for room layout	This exercise is done in small groups around tables (café style)
Materials	• Case studies • Flip chart and pens
Methodologies	• Group exercise
Session outline	• Exercise – Designing an MHM intervention (40-45 min) • Discussion (20-30 min) • Summing up (5 min)
Key messages	• A comprehensive MHM intervention should incorporate knowledge and awareness raising, water and sanitation facilities, and menstrual hygiene materials supply and disposal. • While these are the key components of MHM programming, MHM interventions should be based on the specific context and designed through identifying existing resources, opportunities and gaps to prioritise project components.
Notes and references	Participants need to have some awareness of MHM programming to undertake this session successfully. If the group does not have any prior knowledge and experience of MHM then it is recommended to combine this session with others in this guide. *Session 3: Menstrual hygiene basics: what we need to know* and, if there is time, *Session 4: Menstrual hygiene materials: options, hygienic use, supply and disposal* will be particularly useful to run before this session.