

UNIVERSITY OF GHANA
COLLEGE OF HEALTH SCIENCES



**CLUSTER-RANDOMISED TRIAL OF MENSTRUAL HYGIENE INTERVENTIONS
TO IMPROVE HEALTH AND EDUCATIONAL OUTCOMES AMONG ADOLESCENT
GIRLS IN THE BINDURI AND PUSIGA DISTRICTS OF GHANA**

BY

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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN
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DECLARATION

I, Emmanuel Anongeba Anaba, declare that this thesis titled “Cluster-randomised trial of menstrual hygiene interventions to improve health and educational outcomes among adolescent girls in the Binduri and Pusiga Districts of Ghana” submitted to the University of Ghana, Legon is a record of an original work that I completed under the guidance of my supervisory committee. I also declare that all references cited in this thesis have been fully acknowledged. This thesis is submitted in partial fulfilment of the requirement for the award of a Doctor of Philosophy in Public Health degree. The findings presented in this thesis have not been submitted to any other academic institution for recognition of any degree.

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ABSTRACT

Background: Globally, there are 1.8 billion menstruators, including girls, women, transgender men and non-binary persons. About 500 million menstruators worldwide face challenges in managing their menstruation effectively. The challenges include limited access to soap, water, private spaces, disposal facilities, and safe menstrual products. Poor menstrual hygiene management can lead to infections and school absenteeism. In Ghana, 95% of adolescent girls miss school during menstruation due to inadequate access to safe menstrual materials, water, sanitation and hygiene facilities. Furthermore, 15 unique taxes have been imposed on commercial sanitary pads, including a 20% import tax and a 15% value-added tax, making them expensive. There is limited and inconsistent evidence on the effectiveness of menstrual hygiene interventions.

Objectives: The primary aim of this study was to evaluate the effectiveness of a multi-component menstrual hygiene intervention on educational and health outcomes among adolescent girls in the Binduri and Pusiga Districts of Ghana.

Design: This study employed an exploratory sequential mixed-methods approach. Phase one was a qualitative study using a phenomenology design (formative study). Phase two was a quantitative study employing a two-arm parallel cluster-randomised trial.

Participants: In phase one, 36 adolescent girls and 11 teachers were interviewed regarding barriers and facilitators to optimal menstrual hygiene management. In phase two, 22 public junior high schools (clusters) and 686 adolescent girls (participants) were randomly assigned to the intervention group (11 clusters and 343 participants) and the control group (11 clusters and 343 participants).

Control arm: No intervention was given to the participants or clusters in the control group.

Intervention arm: A multi-component menstrual hygiene intervention was implemented in the intervention clusters. The intervention included providing subsidised sanitary pads, menstrual hygiene booklets and training, soap, Veronica buckets, dustbins, and sensitization against period teasing.

Randomization: The sequence for allocation was generated using a computer-programme. Randomization was carried out after collecting the baseline data and prior to the implementation of the interventions.

Primary outcome measure: The primary outcome was menstruation-related school absenteeism. The secondary outcomes were engagement in school activities during menstruation and self-reported symptoms of urogenital infections.

Data collection and analysis: Qualitative data were collected through focus group discussions and in-depth interviews, and analysed using a deductive thematic analysis approach. Quantitative data were collected using a structured questionnaire. Female research assistants administered the questionnaire to the same participants at baseline and post-intervention. Quantitative data were analysed with the aid of SPSS, version 23, and STATA/MP, version 17. Descriptive statistics were presented using frequency, proportion, mean, and standard deviation. Also, Chi-square test, Student's t-test, univariable, multivariable, and mixed-effect binary logistic regression were employed to analyse the data.

Results: The formative study found five main themes and twenty sub-themes as barriers to optimal menstrual hygiene management. The barriers included menstrual pain, inadequate access to sanitary pads, soap, handwashing facilities and privacy in school. Teachers and adolescent girls shared similar views regarding barriers to optimal menstrual hygiene management. Regarding facilitators to optimal menstrual hygiene management, two main themes and four sub-

themes emerged. The facilitators included availability of water in schools and parental and peer support. The findings were congruent with the socio-ecological model, and informed the design of the intervention. In the cluster-randomised trial, the average age of the participants was 15.5 years (SD = $\pm$ 1.2). The average age of menarche was 13.7 years (SD = $\pm$ 1.4). At baseline, the prevalence of school absenteeism, low engagement in school activities and symptoms of urogenital infections were 32.1%, 68.4% and 72.5%, respectively. At post-intervention, the participants in the intervention group had reduced odds of school absenteeism (AOR = 0.54, 95% CI: 0.29–0.98) compared to those in the control group. Additionally, the participants in the intervention group had higher odds of engaging in school activities when menstruating (AOR = 5.80, 95% CI: 1.60–20.93) compared to those in the control group. When compared to the control group, the participants in the intervention group had a lower (statistically non-significant) likelihood of reporting symptoms of urogenital infections (AOR = 0.86, 95% CI: 0.46-1.62).

Conclusion: This study has demonstrated that adolescent girls in the Binduri and Pusiga Districts encounter multiple barriers to optimal menstrual hygiene management. Providing subsidised sanitary pads, as part of a behaviour change communication intervention, was effective in reducing menstruation-related school absenteeism, and increased engagement in school activities during menstruation. However, the intervention was ineffective in reducing self-reported symptoms of urogenital infections among in-school adolescent girls. The findings of this study provide valuable insights that can inform menstrual hygiene policies, programming and future research.

DEDICATION

“Enter His gates with thanksgiving and His court with praise; give thanks to Him and praise His name. For the LORD is good, and His love endures forever; His faithfulness continues through all generations” (Psalms 100:4-5, NIV). Amen.

Firstly, this thesis is dedicated to the Almighty God for making the PhD journey successful.

Secondly, I dedicate this work to my late uncle, Timothy Azotiba Ndego.

Thirdly, I dedicate this work to my children, siblings and parents.



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LIST OF ABBREVIATIONS

MH	Menstrual Hygiene
MHM	Menstrual Hygiene Management
CRT	Cluster randomised trial
SDG	Sustainable Development Goal
WASH	Water, Sanitation and Hygiene
SEWS	Subsidised sanitary pads, education, WASH and sensitization
UGI	Urogenital infections
SHEP	School Health Education Programme
SEM	Social-Ecological Model
UNICEF	United Nations International Children's Emergency Fund
LMICS	Low- and Middle-Income Countries
WHO	World Health Organization
IDI	In-depth Interview

FGD	Focus Group Discussion
CONSORT	Consolidated Standards of Reporting Trials
TOC	Theory of Change
MPQ	Menstrual Practices Questionnaire
VIF	Variance Inflation Factor
ECH	Ethic Committee for Humanities
HRP	Human Reproduction Programme
JHS	Junior High School
SHS	Senior High School
AOR	Adjusted Odd Ratio
COR	Crude Odd Ratio
CI	Confidence interval
ICC	Intra-Cluster Correlation
AIC	Akaike Information Criterion
SPSS	Statistical Package for Social Sciences



CHAPTER ONE

1.0: INTRODUCTION

1.1: Background

Menstrual hygiene (MH) is increasingly being recognised as a global public health priority (Sommer et al., 2020). Menstrual hygiene management (MHM) refers to “women and adolescent girls using a clean menstrual management material to absorb or collect menstrual blood that can be changed in privacy as often as necessary for the duration of a menstrual period, using soap and water for washing the body as required and having access to safe and convenient facilities to dispose of used menstrual management materials”(WHO/UNICEF Joint Monitoring Programme., 2012). Menstrual hygiene is linked to the United Nations Sustainable Development Goals (SDGs), particularly goals three (good health and wellbeing), four (quality education), five (gender equality), and six (clean water and sanitation) (Loughnan et al., 2020).

Access to adequate MH facilities and a supportive environment are crucial for optimal MHM and menstrual health. A supporting environment that promotes menstrual health includes access to accurate and timely information, available, safe, and affordable menstrual materials, informed health professionals, referral and access to health services, sanitation and washing facilities, positive social norms, safe and hygienic disposal facilities, coupled with advocacy and policy (UNICEF, 2019).

However, 500 million out of the 1.8 billion menstruators worldwide lack access to basic MHM facilities. This is known as period poverty (World Bank., 2019). Adolescent girls in developing countries are more vulnerable to menstruation-related challenges and their deleterious effects

(World Bank., 2019). Existing evidence shows that girls lack access to timely and accurate information about menstrual hygiene (Chandra-Mouli & Patel, 2017). In many settings, menstruation is shrouded in a culture of silence and secrecy; hence, it is usually not discussed at home or school (Benshaul-Tolonen et al., 2020; MacLean et al., 2020). Additionally, adolescent girls are unable to afford safe menstrual materials, such as commercial sanitary pads, due to their high cost (Boakye-Yiadom et al., 2018; Garikipati & Boudot, 2017).

Girls in school experience further challenges because the school environment is generally not menstruation-hygiene-friendly (Sharma et al., 2020). Schools lack adequate MHM facilities, including clean toilets, water, soap, disposal facilities and private changing places for girls to change their menstrual materials (Asumah et al., 2022; Mohammed & Larsen-Reindorf, 2020). Period teasing by classmates and teachers also makes the school environment unsupportive for menstruating girls (Benshaul-Tolonen et al., 2020).

Consequently, adolescent girls frequently engage in unhygienic MHM practices, including infrequent handwashing and the use of unsafe menstrual materials, which are prevalent in Sub-Saharan Africa (Anbesu & Asgedom, 2023). The reported prevalence rates of unhygienic menstrual practices range from 54% in Ethiopia (Shallo et al., 2020), 75% in Nigeria (Fehintola et al., 2017) to 90.5% in Uganda (Hennegan et al., 2016). A recent systematic review and meta-analysis found that the pooled prevalence of good menstrual hygiene practices in Sub-Saharan Africa was 45%. This implies that more than half of the girls in Sub-Saharan Africa engage in unhygienic menstrual practices (Anbesu & Asgedom, 2023).

Unhygienic menstrual practices and inadequate access to menstrual hygiene facilities have several public health consequences (Sommer et al., 2015). For instance, unhygienic menstrual practices are associated with reproductive and urinary tract infections, and pelvic inflammatory diseases (Ademas et al., 2020; Torondel et al., 2018). Poor menstrual hygiene contributes to vaginal pH imbalance and engenders infections such as bacterial vaginosis and vulvovaginal candidiasis (Das et al., 2015). These infections can cause vaginal discharge, an unpleasant odour and irritation (Torondel et al., 2022). Untreated infections in the reproductive tract may be associated with prenatal infection, ectopic pregnancy, low birth weight and reduced quality of life (Hema et al., 2017; Weckman et al., 2019).

Another notable concern is that lack of access to safe and affordable sanitary products predisposes girls to risky sexual behaviours, including transactional sex (Austrian et al., 2019). There is a growing public health concern about adolescent girls exchanging sex for money to buy sanitary pads (Phillips-Howard et al., 2015; Ranganathan et al., 2016). This risky sexual behaviour predisposes girls to unplanned pregnancies, sexually transmitted diseases and sexual violence (Murphy-Graham et al., 2020; Sekine & Hodgkin, 2017).

In addition, inadequate access to menstrual hygiene facilities is associated with school absenteeism, poor concentration in the classroom and low participation in school activities (Hasan et al., 2021; Hennegan et al., 2021). Poor condition of water and sanitation facilities in schools compelled girls to leave school and go home to meet their menstrual hygiene needs (Hennegan et al., 2020). Period teasing and stigma are linked to school absenteeism during menstruation, which can have a negative impact on academic performance and increase the risk

of school dropout (Tegegne & Sisay, 2014). Girls who drop out of school are vulnerable to child marriage, unwanted pregnancy and early childbirth (Birchall, 2018; Murphy-Graham et al., 2020). Again, period teasing and stigma contribute to psychosocial problems, including low self-esteem, anxiety, stress and depression (Benshaul-Tolonen et al., 2020).

1.2: Problem statement

In Ghana, females constitute more than half (50.6%) of the population. Adolescent girls (10–19 years) represent 22.2% of the total female population (Ghana Statistical Service, 2021). However, menstrual hygiene has been largely neglected and under-prioritised in Ghana (Asumah et al., 2022). Limited attention has been given to the challenges and needs of menstruating girls in school. As part of the National WASH Implementation Model, changing and washroom facilities were to be provided in selected public schools (Ghana Education Service., 2014). The Adolescent Health Service Policy and Strategy (2016–2020) also aimed to provide advocacy for menstrual hygiene management (Ghana Health Service., 2016). Further, the School Health Education Unit of Ghana Education Service aims to inculcate good MHM practices in students. These policies have resulted in the inclusion of MHM education in junior high school curriculum. Despite these efforts, the prevalence of poor MHM practices and menstruation-related school absenteeism is still unacceptably high. It is problematic that Ghana's health and education policies have not sufficiently addressed the menstrual health and hygiene needs of women and girls (Acheampong et al. 2018).

In most Ghanaian communities, menstruation is either taboo or stigmatised, hence, it is not openly discussed (Asumah et al., 2022; Nsemo et al., 2020). Moreover, commercial sanitary pads attract 15 unique taxes, including an import tax of 20% and a value-added tax of 15% (Iddrisu,

2020). These taxes make sanitary pads expensive and inaccessible to menstruators. At the time of this study, Ghana had no policies or standards to regulate the prices and supply of menstrual materials. Additionally, some basic schools lack water, disposable facilities, private changing rooms and menstrual materials for emergencies (Asumah et al., 2022).

Existing studies have reported a high prevalence rate of unhygienic menstrual practices among adolescent girls in Ghana, ranging from 38.6% in the Talensi District (Kumbeni et al., 2020) to 68.9% in the Yendi Municipal (Boakye-Yiadom et al., 2018). Girls use unsafe and non-absorbent materials, including toilet paper, pieces of mattress or foam materials, cotton, leaves, and old fabric, to collect menstrual blood. Girls also practise poor hand and body washing during menstruation coupled with inappropriate disposal of sanitary products and cleaning of reusable menstrual materials (Baku et al., 2020; Mohammed & Larsen-Reindorf, 2020).

Additionally, Ghana has a high prevalence of menstruation-related school absenteeism, ranging from one to seven days per menstrual cycle (Kumbeni et al., 2020). Between 27% and 95% of Ghanaian girls miss school during menstruation (Boakye-Yiadom et al., 2018; Kumbeni et al., 2020; Mohammed & Larsen-Reindorf, 2020). Notable reasons for menstruation-related school absenteeism include fear of staining uniforms, period teasing, menstrual pain, lack of access to sanitary pads, privacy and WASH facilities in schools (Mohammed et al., 2020).

Effective MH interventions are crucial for promoting girls' health, engagement in education, and well-being. Hennegan and Montgomery (2016) argued that combining both 'software' and 'hardware' interventions are more likely to be effective. The hardware interventions focus on

improving access to safe menstrual materials, including sanitary pads, water, sanitation, and hygiene facilities. On the other hand, the software interventions focus on increasing awareness and understanding about menstrual hygiene through health education.

However, there are significant research gaps regarding menstrual hygiene interventions in low- and middle-income countries. For instance, few studies have investigated the effectiveness of combining software and hardware interventions (Tembo et al., 2023). Further, there is inconsistent evidence regarding the effectiveness of menstrual hygiene interventions. Some studies have shown that menstrual hygiene interventions improve knowledge, menstrual hygiene practices and school attendance (Haque et al., 2014; Montgomery et al., 2012). These findings, however, contradict the findings of other similar studies (Austrian et al., 2021; Valizadeh et al., 2017).

Additionally, systematic reviews and meta-analyses have shown that existing MH intervention studies have several weaknesses, including a small sample size, non-random assignment into study groups and no control group. Other flaws in existing studies are inappropriate statistical analysis and noncompliance with standard guidelines for reporting trials (Hennegan & Montgomery, 2016; Tamiztousi et al., 2019). While subsidy interventions have shown effectiveness in improving dietary behaviours (An, 2013), there is a paucity of literature on the impact of subsidised sanitary products on educational and health outcomes among adolescent girls.

In Ghana, there have been several appeals to the government to subsidise the price of sanitary pads. So far, only one study in Ghana has investigated the impact of providing free sanitary pads (Montgomery et al., 2012). It remains the only study published in a peer-reviewed journal that has reported on MH interventions and school attendance in Ghana. According to Montgomery et al. (2012), the study is the first MH intervention in Africa. The authors revealed that providing free sanitary pads and puberty education were effective in increasing school attendance and self-confidence and reducing insecurity among adolescent girls (Dolan et al., 2014; Montgomery et al., 2012). However, their study lacked randomization, limiting its ability to demonstrate causality between the treatment and outcomes. The limited literature, contradictions in evidence, and shortfalls in existing studies warrant further investigations on the subject matter.

Prior studies have recommended cluster randomised trials, which can help reduce contamination problems (Hennegan & Montgomery, 2016; Rastogi et al., 2019; Tamiztousi et al., 2019). To the best of the researcher's knowledge, this is the first cluster-randomised trial (CRT) in Ghana to investigate the effectiveness of menstrual hygiene interventions. The rationale for employing a CRT was that the interventions were implemented in schools. Hence, randomization of individuals may be practically impossible or lead to contamination.

1.3: Research objectives

1.3.1: General objective

The general objective of this study was to explore barriers and facilitators to optimal MHM and evaluate the effectiveness of a multi-component menstrual hygiene intervention on educational

and health outcomes among adolescent girls in the Pusiga and Binduri Districts of Ghana. The objectives of the present study pertained to the individual participant.

1.3.2: Specific objectives

The specific objectives of this study include:

- I. To explore barriers and facilitators to optimal MHM among adolescent girls in junior high school.
- II. To evaluate the effectiveness of providing subsidised sanitary pads, education, WASH facilities and sensitization (SEWS) on girls' engagement in school activities during menstruation.
- III. To evaluate the effectiveness of providing SEWS on self-reported symptoms of urogenital infections among adolescent girls in junior high school.
- IV. To evaluate the effectiveness of providing SEWS on menstruation-related school absenteeism among adolescent girls in junior high school.

1.4: Research questions

The following research questions were investigated to address the study objectives:

- I. What are the barriers and facilitators to optimal menstrual hygiene management among adolescent girls in junior high school?
- II. Does providing SEWS increase girls' engagement in school activities during menstruation?
- III. Does providing SEWS reduce self-reported symptoms of urogenital infections among adolescent girls in junior high school?

IV. Does providing SEWS decrease menstruation-related school absenteeism among adolescent girls in junior high school?

1.5: Hypotheses of the study

Hypothesis 1: At post-intervention, adolescent girls in the intervention group will demonstrate higher engagement in school activities than those in the control group.

Hypothesis 2: At post-intervention, adolescent girls in the intervention group will report less symptoms of UGI than those in the control group.

Hypothesis 3: At post-intervention, there will be a significant decrease in menstruation-related school absenteeism among adolescent girls in the intervention group than those in the control group.

1.6: Justification of the study

Menstrual hygiene interventions are important for adolescent girls, especially in low- and middle-income countries where access to menstrual hygiene facilities is limited. There have been various efforts to address menstrual hygiene challenges. However, the existing evidence on the effectiveness of these interventions is insufficient and often incongruous. Given the limited evidence, it is crucial to conduct further research to understand the barriers and facilitators to optimal menstrual hygiene management among adolescent girls. By understanding these factors, we can develop interventions that are tailored to the specific needs and contexts of the target population.

The findings of this study would help improve stakeholders' understanding of the effectiveness of menstrual hygiene interventions. Further, it would add to the literature regarding the

effectiveness of menstrual hygiene interventions, thereby providing valuable insights to inform pertinent menstrual hygiene and health policies, research and programming. Improving menstrual hygiene can have significant positive impacts on the physical and mental health of adolescent girls, as well as their academic performance and engagement in school. The development of effective and scalable interventions can help address the school-level factors that engender discrimination and exclusion of girls in education.

Furthermore, investing in menstrual hygiene may help in achieving the Sustainable Development Goals, especially goals 3, 4, 5 and 6. For instance, Goal 3 seeks to ‘ensure healthy lives and promote well-being for all ages’, and Goal 4 aims to ‘ensure inclusive and equitable quality education and promote lifelong learning opportunities for all’. Moreover, Goal 5 seeks to ‘achieve gender equality and empower all women and girls’, while Goal 6 seeks to ‘ensure the availability and sustainable management of water and sanitation for all’. Therefore, addressing menstrual hygiene concerns can help put Ghana on the verge of achieving the Sustainable Development Goals. Overall, the present study is important and justified as it aims to fill a critical gap in the existing literature and has the potential to improve the health and well-being of adolescent girls as well as their educational outcomes. Finally, the intervention can be scaled up or integrated into the School Health Education Programme (SHEP) and the Adolescent Health Service Policy and Strategy.

The link between girl-child education and socio-economic development has been well established in the literature. Therefore, addressing barriers to girls' education has numerous public health and developmental advantages. For instance, when women have more educational

opportunities, they are more likely to be productive and empowered. Besides, keeping girls in school has several public health benefits, including reducing child marriage, unwanted pregnancies, infant malnutrition and maternal deaths (Ainul et al., 2022; Sampa et al., 2021).

1.7: Organisation of the study

This study is divided into six chapters. Chapter one describes the background of the study, the research problem, the objectives, and the research questions. The chapter also highlights the justification of the study. The second chapter of the study presents a review of the literature, including the effectiveness of menstrual hygiene interventions on infections, school absenteeism and engagement as well as the theoretical underpinning and conceptual framework. Chapter three presents the methods, which describes the study design, location, population and sampling techniques. Chapter three also describes the content, allocation, implementation, and evaluation of the interventions. The data collection instruments, ethical considerations and statistical analysis have been explained in chapter three. Chapter four presents the results of the study using tables and graphs. The qualitative and quantitative results have been reported in chapter four. Chapter five discusses the results according to the objectives, while chapter six looks at the conclusions and recommendations.

1.8: Chapter Summary

This chapter highlighted the fact that menstrual hygiene has public health implications. Inadequate access to menstrual hygiene facilities poses a threat to girls' education, health and wellbeing. Therefore, this study sought to evaluate the effectiveness of a multi-component menstrual hygiene intervention on school absenteeism, engagement and symptoms of urogenital infections.

CHAPTER TWO

2.0: LITERATURE REVIEW

2.1: Introduction

This chapter examines existing scholarly works with the aim of synthesizing the current state of knowledge regarding menstrual hygiene management and effectiveness of menstrual hygiene interventions among adolescent girls. The literature review focuses on identifying key concepts, controversies, gaps in the literature and provide valuable insights for future research directions.

2.2: Overview of menstruation

The word menstruation is derived from the Latin word menses, connoting the moon, thus the lunar month (El-Meselhy et al., 2020). Menstruation has been described with different terminologies, including ‘period’, ‘menses, and ‘flow’. Menstruation is the process of releasing blood and associated matter from the uterus through the vagina as part of the menstrual cycle (UNICEF, 2020). The menstrual duration typically ranges between two and seven days, with an average of five days (Achmad et al., 2021). However, it varies from context to context. For example, Indian girls experience a menstrual duration of three to seven days (Kapoor & Khari, 2016), whereas in Nepal, girls experience a menstrual duration of four to seven days (Poudel & Gautam, 2020). In Ghana, girls experience a menstrual duration of three to five days (Osonuga & Ekor, 2018).

The menstrual cycle ranges between 25-35 days, with a mean of 28 days (Yu et al., 2022). The menstrual cycle varies from woman to woman. The menstrual cycle is similar across geographical locations. For instance, studies in Ghana and Nepal found a cycle length of 21-35 days among girls (Gumanga & Kwame-Aryee, 2012; Kapoor & Khari, 2016). The menstrual

cycle is controlled by an intricate interaction of four reproductive hormones, including oestrogen, luteinising hormone, progesterone and follicle-stimulating (Iacovides et al., 2015). These hormones prepare the uterus for ovulation and pregnancy and contribute to the shedding of the uterine lining in the absence of implantation (Hennegan et al., 2019). Between menarche and menopause, a female may experience an average of 455 menstrual cycles (Hennegan et al., 2019). This suggests that females spend eight years of their lifetime menstruating, which is equivalent to 3,000 days (Dündar & Özsoy, 2020). The menstrual cycle can be irregular or associated with blood clots (Gumanga & Kwame-Aryee, 2012).

2.3: The average age at menarche and associated factors

Menarche refers to the onset of menstruation and is a crucial milestone in adolescence (Tey et al., 2019). The average age of menarche varies across settings and socio-economic statuses (Ibitoye et al., 2017). For instance, the mean age of menarche is estimated to be between 12 and 13 years in LMICs but earlier among girls in urban areas, the middle class, and those with highly educated parents (Kapoor & Khari, 2016). Girls from poor households may experience menarche at a later age, around the ages of 14 and 15, due to poor nutrition (Ramaiya et al., 2019). Adolescent girls in urban areas and those of middle class may have access to good nutrition, diet with high calorie and processed foods, which can impact the regulation of hormones and lead to early menarche.

In urban Ghana, the average age of menarche is decreasing due to improved socio-economic status in households. Aryeetey et al. (2011) estimated the average age of menarche to be 12.7 years in Madina, which is less than what an earlier study reported (13.98 years) (Adadevoh et al., 1989). A year later, Gumanga and Kwame-Aryee (2012) reported a mean menarcheal age of 12.5

years in Accra. Later, a study in Accra reported a mean age of 11.9 years (Emmanuel & Yawson, 2019). This suggests a decreasing trend in the average menarcheal age. The decline in the average age of menarche was estimated to be 0.11, compared with the first study in 1989 (Ameade & Garti, 2016).

2.4: Experiences during menarche

Girls experience a wide range of emotional distress during the onset of menstruation (Chandra-Mouli & Patel, 2017). Lack of understanding of the menstrual cycle and the skills to use menstrual materials at menarche predisposes girls to anxiety, confusion, distress, surprises and unpreparedness (Emmanuel & Yawson, 2019; Fehintola et al., 2017; Poudel & Gautam, 2020; Ramathuba, 2015). Other negative emotional experiences at menarche include shame and embarrassment (Sommer et al., 2015). For instance, 48% and 72% of girls in India and Ethiopia, respectively, were unaware of menstruation at menarche (Shallo et al., 2020).

Aside from the psychosocial problems associated with menarche, early menarche is associated with risky sexual behaviours (Tey et al., 2019). Girls who experience early menstruation are more likely to kiss the opposite sex or engage in sexual intercourse (Tey et al., 2019), kiss the same sex, or have sexual intercourse with the same sex compared to girls who experience menarche at a later age. Moreover, girls who attain early menarche are at higher risk of sexual abuse, unprotected sex, and early pregnancy (Ibitoye et al., 2017). Girls who have early menarche are more likely to contract sexually transmitted infections (Ibitoye et al., 2017) or experience poor health and high stress (Yu et al., 2020). Drivers of early menarche include frequency of fast food and fat consumption, physical activity, access to funds, nutritional status, mother's age at menarche, household wealth, place of residence and body mass index (Aryeetey

et al., 2011; Nia et al., 2019). The consumption of adequate calories is a protective factor against early menarche (Nia et al., 2019). There is a relationship between early menarche, menstrual duration and the menstrual cycle (Ziba et al., 2019). Early menarche is also associated with long menstrual duration, family history (Midilli et al., 2015), coffee intake, an irregular menstrual cycle (Acheampong et al., 2019), heavy bleeding and menstrual pain (Osonuga & Ekor, 2019).

2.5: Sources of information about menstruation

Adolescent girls access menstrual hygiene information from multiple sources (Chandra-Mouli & Patel, 2017). Girls in LMICs access information about menstruation from their mothers (Chandra-Mouli & Patel, 2017; Kapoor & Khari, 2016; Poudel & Gautam, 2020). Some girls access information from teachers and friends (Diamond-Smith et al., 2020; Fehintola et al., 2017; Ramathuba, 2015). The internet is another source of menstrual hygiene information among adolescent girls (Srinivasan et al., 2019). Some girls depend on books, grandmothers, sisters, aunts, nurses, and the mass media for information about menstrual hygiene (Fehintola et al., 2017; Thakur et al., 2014).

2.6: Menstrual hygiene management among adolescent girls

Menstrual hygiene management refers to “women and adolescent girls using a clean menstrual management material to absorb or collect blood that can be changed in privacy as often as necessary for the duration of the menstruation period, using soap and water for washing the body as required, and having access to facilities to dispose of used menstrual management materials”(WHO/UNICEF Joint Monitoring Programme., 2012).

There are two main types of menstrual management materials, including disposable and reusable. Disposable sanitary pads and tampons are examples of disposable menstrual materials, while menstrual cups and reusable sanitary towels are examples of reusable menstrual materials (Hennegan et al., 2017; Torondel et al., 2018). Preference for menstrual materials is associated with age, affordability, comfort and availability (Mohammed & Larsen-Reindorf, 2020). For instance, Kambala et al. (2020) found that adult women preferred reusable menstrual materials, while young women preferred disposable sanitary pads. Community leaders and teachers endorse disposable pads (Kambala et al., 2020).

Unhygienic menstrual practices are common among adolescent girls in low- and middle-income countries (Hennegan et al., 2019). Adolescent girls use unsafe menstrual materials to collect menstrual blood (Hennegan et al., 2016). For instance, four in ten Nigerian girls used old cloth or rags, while three in ten girls used toilet paper to collect menstrual blood (Fehintola et al., 2017). The use of unsafe menstrual materials can cause leakages and staining of the outer garment (Anee et al., 2020).

Additionally, adolescent girls practise poor personal hygiene during menstruation (Nabwera et al., 2021). Fehintola et al. (2017) reported that girls in Nigeria failed to clean their genitalia during menstruation. Similarly, evidence from Ethiopia indicates that about half of girls cleaned their genitalia once a day, while three in ten girls did not clean their genitalia until the end of the menstrual cycle (Shallo et al., 2020). A similar study revealed that most girls in rural Ghana only washed their hands after changing menstrual materials (Boakye-Yiadom et al., 2018). For instance, eight in ten girls in the Volta Region practised poor handwashing (Baku et al., 2020).

However, some studies have shown that more than half of girls in Nepal clean their genitalia with clean water (Bhusal, 2020; Poudel & Gautam, 2020). Evidence from Ghana also suggests that the majority of girls in rural and urban areas washed their hands and genitalia during menstruation (Emmanuel & Yawson, 2019; Mohammed et al., 2020).

Another important issue that cannot be underestimated is the fact that some girls do not change their menstrual materials as frequently as expected (Nsemo et al., 2020). It is recommended that girls change their menstrual materials at least three to four times daily (Sommer & Connolly, 2012). A study in Nigeria, however, revealed that most girls changed their menstrual materials once a day (Fehintola et al., 2017). Similarly, studies from rural and urban Ghana demonstrated that most girls changed their sanitary pads less than three times a day (Boakye-Yiadom et al., 2018). Studies have shown that less than half of Ghanaian girls change their pads at least twice a day (Baku et al., 2020; Mohammed et al., 2020). Additionally, evidence on the management of reusable absorbents is inconsistent (Anaba et al., 2022). In Uganda, for example, more than half of adolescent girls dried their reusable menstrual materials indoors (Hennegan et al., 2016). The above findings, however, contradict findings in Nepal, where more than half of girls dried their reusable materials in the sunlight (Bhusal et al., 2020).

Moreover, there is a growing public concern about the inappropriate disposal of menstrual materials. Menstruators flush sanitary pads and tampons in water closets, which can cause blockages in sewage systems (Elledge et al., 2018; Kaur et al., 2018). Research conducted in Nigeria reported that a majority of girls disposed of sanitary pads in the toilet (Fehintola et al., 2017). In Ghana, junior high school girls disposed of used sanitary pads in the toilet (Nsemo et

al., 2020). On the contrary, many adolescent girls in Nepal dispose of pads in the trash (Bhusal et al., 2020). In Ghana, the majority of senior high school girls dispose of sanitary pads in dustbins (Baku et al., 2020). There is a paucity of literature on how Ghanaian girls manage reusable menstrual materials. In summary, available evidence shows that adolescent girls engage in unhygienic menstrual hygiene practices. The inconsistencies and lacunae in the literature warrant further investigation of the subject matter.

2.7: Barriers and facilitators to optimal menstrual hygiene management

Adolescent girls face many barriers in their quest to manage menstruation with dignity. This affects their inclusion in work, education, and social activities. There are multiple barriers to menstrual hygiene management, comprising biological, personal, interpersonal, environmental, and societal factors (Long et al., 2013).

2.7.1: Biological challenges during menstruation

The literature shows that biological factors, such as menstrual pain, affect optimal menstrual hygiene management (Davis et al., 2018). Menstrual pain is prevalent among girls in LMICs (Osonuga & Ekor, 2019; Wijesiri & Suresh, 2013). In Ghana, more than eight in ten basic school girls in Accra reported menstrual pain. In the Upper East Region, the prevalence of menstrual pain was estimated to be 85% among adolescent girls (Ziba et al., 2019).

Menstrual pain can be mild, moderate, or severe (Midilli et al., 2015). Menstrual pain may start a week before menstruation (Aziato et al., 2015), within the first two days of menstruating or throughout the menstrual duration (Aziato et al., 2014). Menstrual pain could be associated with severe pain, fatigue and lower back pain (Aziato et al., 2014). Besides, menstrual pain is

associated with depressive disorders, insomnia (Kapoor & Khari, 2016; Wijesiri & Suresh, 2013), diarrhoea, loss of appetite, constipation (Wijesiri & Suresh, 2013), headache and vomiting (Aziato et al., 2014).

Adolescent girls adopt different coping strategies to manage menstrual pain. Notable among them is the use of pharmacological and non-pharmacological therapies (Wijesiri & Suresh, 2013). For instance, some girls employ yoga, exercise, relaxation and heat therapy (Aziato et al., 2015; Midilli et al., 2015) to manage menstrual pain (Wijesiri & Suresh, 2013). Existing evidence shows that girls indulge in self-medication and abuse painkillers such as paracetamol and Ibuprofen (Midilli et al., 2015). Some menstruators use substances like coffee and coriander water to manage menstrual pains (Wijesiri & Suresh, 2013). Girls also employ interventions such as herbal concoctions, water and food therapies or condition their minds to bear menstrual pain (Aziato et al., 2015).

Many adolescent girls with menstrual pains are reluctant to seek medical care (Farotimi et al., 2015; Poudel & Gautam, 2020). A meta-analysis of studies across the globe revealed that only eleven percent of girls with menstrual pain sought medical care (Armour et al., 2019). Adolescents with menstrual pain do not seek care due to the negative attitudes of healthcare providers (Aziato et al., 2015). Consequently, girls employ ineffective and unsafe pain management strategies (Armour et al., 2019).

In addition, menstrual pain affects girls' participation in academic and domestic activities and relationships with peers. Regarding engagement in academic work, menstrual pain affects girls'

concentration in the classroom, disrupts participation in educational activities and increases school absenteeism (Fehintola et al., 2017; Osonuga & Ekor, 2018). Menstrual pain is prevalent among adolescent girls, yet prior intervention studies failed to include its management in menstrual hygiene and health interventions. There is a need to raise awareness of menstrual pain and effective pain management strategies among adolescent girls to help improve their health and participation in socio-economic activities.

2.7.2: Personal-level factors associated menstrual hygiene management

Adolescent girls lack adequate knowledge about menstruation and menstrual hygiene management. A systematic review of studies across LMICs revealed that girls attained menarche with a limited understanding of menstruation (Chandra-Mouli & Patel, 2017). Some girls only learned about menstruation after menarche (Coast et al., 2019). Thus, girls attain menarche with little preparation and information about menstrual hygiene, leading to anxiety, shame and depression (Shrestha et al., 2020).

Adolescent girls also lack the skills to use menstrual materials and an understanding of the menstrual cycle and fertility issues (Hennegan et al., 2017; Wall et al., 2018). For example, Ramathuba (2015) found that many girls in South Africa were unaware of the source of menstrual blood (Fehintola et al., 2017). In Nigeria, a majority of girls indicated that menstruation was a disease, while four in ten girls were unaware of the duration of a normal menstrual cycle (Fehintola et al., 2017). In Ghana, a similar study revealed that many girls demonstrated inadequate knowledge about menstruation. Exactly nine in ten girls failed to identify the right source of menstrual blood. A majority of the respondents had a poor

understanding of the relationship between dietary behaviours and menstruation (Mohammed & Larsen-Reindorf, 2020).

Another personal-level factor associated with MHM is attitude or beliefs towards menstruation. Adolescent girls have negative beliefs and perceptions regarding menstruation (Aluko et al., 2020; Osborne, 2020). In Ghana, Boakye-Yiadom et al. (2018) found that more than half of adolescent girls felt that it was shameful to talk about menstruation. The majority also believed that girls were unclean or dirty during menstruation, and more than two-thirds of participants thought that certain foods should be avoided during menstruation. Additionally, more than half of female students in India perceived menstrual blood as poisonous (Srinivasan et al., 2019). Also, adolescent girls in Bangladesh perceived menstruation as a disease or a curse (Anee et al., 2020). Some girls believe that if they do not comply with menstrual taboos and restrictions, deities would curse them and their families. Girls also believed that men touched by menstruating girls would become ill (Yadav et al., 2017). Besides, adolescents believed that menstruating girls must not participate in social and domestic activities, touch flowers or trim their hair. Students in China perceived menstruation as unpleasant and annoying (Wong et al., 2013). Girls in India were uncomfortable asking questions about menstruation or studying menstruation in school (Kapoor & Khari, 2016). In summary, it is crucial to educate and sensitise adolescent girls to help reduce misconceptions, myths and negative attitudes about menstruation.

2.7.3: Interpersonal-level factors associated with menstrual hygiene management

Interpersonal relationships are crucial to promoting healthy behaviours and preventing diseases. The family is the first social unit; hence, parents have a major role to play in educating

adolescent girls about menstrual hygiene (Mohammed et al., 2017). There is evidence to show that parent-daughter communication improves girls' knowledge, attitudes and behaviours about reproductive health, including menstruation. Mother-daughter communication is a protective factor against unhygienic menstrual practices among adolescent girls (Rana & Jami, 2018).

However, the quality of parent-daughter communication about menstruation remains poor and contributes to inadequate knowledge, negative attitudes and unhygienic menstrual practices (Chandra-Mouli & Patel, 2017). Mothers communicate untimely, inadequate and inaccurate information to adolescent girls (Zakaria & Jarin, 2020). Few mothers pass on positive experiences about menarche to adolescent girls. Mothers passed on menstrual taboos to their daughters. They instruct them to conform to the menstrual taboos that they suffered themselves (Bennett & Harden, 2014). Furthermore, parents mostly provide piecemeal and selective information about menstruation. They give little information about the physiological process of menstruation and issues related to pregnancy (Ramathuba, 2015).

Parents play a major role in creating misconceptions about menstruation (Rana & Jami, 2018). A study reported that mothers restricted adolescent girls from eating certain foods during menstruation (Rana & Jami, 2018). Besides, mothers limited their communication to personal hygiene and the significance of menstruation (Mohammed et al., 2017). Also, mothers cautioned adolescent girls to abstain from sexual activities without explaining the consequences of such behaviours.

Mothers mostly do not inform girls about menstruation before menarche (Ramathuba, 2015). Zakaria and Jarin (2020), for instance, revealed that a majority of mothers in Bangladesh started talking about menstruation after menarche. Some parents presented menstruation as a disease and warned girls not to use sanitary pads, touch anyone, or attend school during their period. Mohammed et al. (2017) also found that mothers in Egypt imposed restrictions on their daughters. The restrictions include not having a relationship with the opposite sex, not returning home late, not going out, not seeing movies with peers, and not chatting for long hours on the phone. Mothers also warned their daughters not to wear tight clothing, not to stay in relatives' homes, not to visit the internet café, and not to leave home without permission.

Furthermore, the opinions of adults who have relationships with adolescents may influence their menstrual hygiene practices. For instance, female teachers have a strong influence on girls' decisions and choice of menstrual products. Girls trust their teachers and are more likely to work with any information from their teachers (Hyttel, 2017). Studies have revealed unsupportive attitudes among teachers, including punishing girls for missing school or attending school late due to menstruation (Hennegan et al., 2016). Some teachers are uncomfortable discussing menstruation with students (Rajagopal & Mathur, 2017).

Evidence suggests that peers sometimes provide menstrual materials in cases of emergency or close toilet doors for colleagues to change pads. Some peers provide cover (i.e., give their jackets out) for girls who stain their uniforms with menstrual blood (Hennegan, 2017; Hyttel, 2017). Friends' recommendations influence girls' adoption of menstrual materials (Mason et al., 2015).

In summary, the support of parents, teachers and peers is crucial in promoting optimal menstrual hygiene management among adolescent girls.

2.7.4: Societal factors associated with menstrual hygiene management

Menstruation is shrouded in a culture of silence, secrecy, stigma and taboos. Girls experience several restrictions during menstruation, ranging from diet to participating in socio-economic activities (Caruso et al., 2017). For instance, a qualitative study in three countries, including Fiji, Papua New Guinea and Solomon Island, revealed that menstruating girls were restricted from participating in school, work, cooking and religious activities (Kapoor & Khari, 2016). Adolescents were informed to secretly practise personal hygiene and wash and dry reusable sanitary towels (Mohammed et al., 2017). Fehintola et al. (2017) noted that menstruating girls in Nigeria were banned from participating in festivals and prayers (Poudel & Gautam, 2020).

Restrictions imposed on girls during menstruation are risk factors for poor menstrual hygiene practices (Chandra-Mouli & Patel, 2017). Menstrual stigma contributes to poor health-seeking behaviours, school absenteeism and social exclusion among girls (Chandra-Mouli & Patel, 2017). Menstrual restrictions affect girls' dignity and violate their fundamental human rights (Hennegan, Shannon, et al., 2019).

Restrictions imposed on menstruating girls are linked to period teasing (Benshaul-Tolonen et al., 2020). Research has shown that period teasing is common in developing countries. For example, a cross-sectional survey in Tanzania revealed that girls were teased during menstruation. Moreover, a majority of the girls expressed fear of being teased during menstruation (Benshaul-Tolonen et al., 2020). Period teasing contributes to unhygienic menstrual practices, gender

inequities and school absenteeism. Benshaul-Tolonen et al. (2020) revealed that girls who were at risk of being teased adopted negative coping strategies, including missing school and reducing their participation in class activities.

2.7.5: Environmental factors associated with menstrual hygiene management

Menstrual hygiene facilities are items and structures for managing menstruation. These include sanitary products, water, sanitation and hygiene facilities. Inadequate access to water, sanitation and hygiene facilities and privacy at home, school and the workplace contribute to unhygienic menstrual practises. The school environment is usually not menstrual hygiene-friendly. Studies have shown that schools in LMICs lack adequate water supplies, handwashing facilities and privacy (Mohammed & Larsen-Reindorf, 2020; Rajagopal & Mathur, 2017).

Inadequate access to basic menstrual hygiene facilities affects optimal MHM. For instance, girls in India preferred reusable materials to disposable pads because of the absence of disposal facilities (Garikipati & Boudot, 2017; Shah et al., 2013). Another study in rural Uganda found that girls had difficulties managing menstrual cups. The difficulties include a lack of equipment, time, and space to boil menstrual cups, as well as a lack of equipment to carry water to the toilet to wash the menstrual cup (Gade & Hytti, 2017). Women and girls who face water shortages interchange menstrual materials based on the availability of water. Gade and Hytti (2017) found that menstruators used menstrual cups in the rainy season and sanitary pads in the dry season.

Lack of clean and functioning water and sanitation facilities and menstrual materials in schools contributes to absenteeism (Hennegan, Shannon, et al., 2019). For instance, menstruating girls in

Nigeria missed school due to the lack of water, sanitary pads, disposal and toilet facilities in schools (Fehintola et al., 2017; Poudel & Gautam, 2020). A study in Tanzania found that the school environment was not conducive for menstrual hygiene management due to shortage of soap, lack of toilet and handwashing facilities and lack of pads for emergencies (Kimwaga et al., 2014). Boakye-Yiadom et al. (2018) reported that the majority of menstruating girls in northern Ghana missed school because of lack of access to menstrual materials, privacy and water in schools. Teachers in basic schools in the Northern region of Ghana expressed concerns about the lack of disposal facilities in schools (Mohammed & Larsen-Reindorf, 2020). There is evidence to show that places for changing menstrual materials in schools lack regular water and soap supplies and handwashing facilities (Mohammed & Larsen-Reindorf, 2020). Studies in Uganda and Ghana revealed that girls expressed concerns about the lack of privacy in schools (Boakye-Yiadom et al., 2018; Hennegan et al., 2016).

Furthermore, adolescent girls in LMICs are unable to afford safe menstrual materials. The cost of a menstrual cup compared to a disposable pad over time was a significant predictor of uptake (Hyttel, 2017; Mason et al., 2013). Hyttel (2017) noted that the cost of menstrual cups was perceived as a disincentive for some girls in Uganda. Boakye-Yiadom et al. (2018) found that girls in northern Ghana missed school due to their inability to afford commercial sanitary pads.

Some countries have implemented policies to make sanitary pads affordable. For example, Colombia, Scotland, the United Kingdom, Canada, Ireland, Germany and Australia have either reduced or completely removed taxes on sanitary products to make them affordable. In Africa, Ethiopia has reduced taxes on sanitary pads, while Rwanda abolished eighteen percent of the

value-added tax on sanitary pads. In Kenya, value-added tax on sanitary pads and import duties on sanitary pads have been removed, coupled with free distribution of sanitary pads in public schools. In South Africa, 14% of the value-added tax on sanitary pads was removed, while in Nigeria, locally manufactured sanitary products are tax-free (Bryn, 2020). However, there has been little commitment from the government of Ghana to make sanitary products affordable and accessible to girls and women. In Ghana, sanitary pads attract fifteen different taxes, including an import tax of 20% and a value-added tax of 15% (Iddrisu, 2020).

In conclusion, several factors influence menstrual hygiene management. There is a lack of comprehensive evidence on the barriers and facilitators to optimal menstrual hygiene management among girls. Therefore, it is crucial to explore the barriers and facilitators of menstrual hygiene management among adolescent girls to help inform menstrual hygiene interventions and policies.

2.8: Association between menstrual hygiene management and educational outcomes

The relationship between MHM and educational outcomes has been investigated. The prevalence of menstruation-related school absenteeism in LMICs is unacceptable. In Africa, the prevalence of menstruation-related school absenteeism ranges from 11% in South Africa (Khamisa et al., 2022) to 54.5% in Ethiopia (Tegegne & Sisay, 2014). A similar prevalence of menstruation-related school absenteeism has been found in Southern Asia, including Bangladesh (41%) (Alam et al., 2017), India (40%) (Vashisht et al., 2018) and Nepal (22%) (Ranabhat et al., 2019).

The literature shows that menstruation-related school absenteeism is associated with multiple factors. A study in Ethiopia reported that girls who lacked access to sanitary pads were more

likely to miss school during menstruation (Tegegne & Sisay, 2014). In Bangladesh, girls who believed that menstruation affected their performance at school and those who were uncomfortable during menstruation were at a higher risk of school absenteeism. A lack of lockable toilet rooms at school and menstruation-related restrictions were associated with school absenteeism (Alam et al., 2017). A similar study revealed that poor menstrual hygiene practices and unawareness of menstruation before menarche were risk factors for school absenteeism during menstruation (Hasan et al., 2021). A related study among adolescent girls in Indonesia demonstrated that there was a statistically significant association between negative beliefs about menstruation, menstrual pains, lack of access to WASH facilities, and school absenteeism (Davis et al., 2018).

A study in India found that girls who lacked adequate information about menstruation and privacy, experienced restrictions and used unsafe menstrual materials were more likely to miss school during menstruation (Vashisht et al., 2018). Khamisa et al. (2022) research demonstrated a significant relationship between inappropriate disposal of menstrual materials, inadequate knowledge about menstruation, and school absenteeism among adolescents in South Africa. Protective factors against menstruation-related school absenteeism include access to sanitary pads, availability of soap and clean toilets in schools (Kumbeni et al., 2020; Shah et al., 2022).

2.9: Association between menstrual hygiene practices and infections

Research has shown a link between poor menstrual hygiene practices and infections in the female reproductive system (Ademas et al., 2020; Torondel et al., 2018). A previous study found a prevalence rate of 62.4% for reproductive tract infections among women. Bacterial vaginosis, *Candida* and *Trichomonas vaginalis* had a prevalence rate of 41%, 34% and 5.6%, respectively.

Previous studies found a positive association between the usage of reusable menstrual materials, poor personal hygiene, drying sanitary towels indoors, keeping menstrual materials in the toilet room, and reproductive tract infections (Torondel et al., 2018). Inadequate access to safe absorbents predisposes girls to the risk of infections in the female reproductive tract (Torondel et al., 2018). Anand et al. (2015) demonstrated that unhygienic menstrual hygiene practices increased the risk of vaginal discharge. Women who used reusable menstrual materials were more likely to report urogenital infections. Related research also found a lack of access to safe menstrual materials and symptoms of reproductive tract infection among women in India (Vishwakarma et al., 2021). In The Gambia, Nabwera et al. (2021) found a link between menstrual pain, insufficient access to water and sanitary pads, heavy menstrual flow, and urinary tract infections.

Protective factors against bacterial vaginosis include access to water and hygiene facilities (Das et al., 2015). Nabwera et al. (2021) showed that the risk of urinary tract infection was lower among girls in schools with soap for handwashing and a private place for changing menstrual materials. In brief, there is a relationship between menstrual hygiene management and the risk of infections in the reproductive and urinary tracts.

2.10: Effectiveness of menstrual hygiene interventions on knowledge, attitudes, and menstrual hygiene practices

Over the years, researchers have focused on determining the effectiveness of menstrual hygiene interventions in promoting knowledge, attitudes and hygienic practices among adolescent girls (Agbede & Ekeanyanwu, 2021; Nastiti et al., 2023). Menstrual hygiene interventions can be

classified into two main categories, including software and hardware. The former involves the provision of education or information, while the latter comprises providing WASH facilities and menstrual materials (Hennegan & Montgomery, 2016). Studies have shown that menstrual hygiene education has the potential to increase knowledge, attitudes and hygienic practices among adolescents (Arora et al., 2013; Retnowuni et al., 2017). A study that assessed the effect of a menstrual hygiene programme among secondary school girls found higher mean scores on knowledge, attitudes and menstrual practices in the intervention group (Fetohy, 2007). Similar findings have been reported in India, where a majority of school girls demonstrated adequate knowledge about menstruation and menstrual hygiene practices post-intervention. For instance, more than half of the participants dried their reusable materials in the sunlight. Also, hand and genital washing practices improved during post-intervention (Santhanakrishnan & Athipathy, 2018). Ekong (2015) revealed that the use of cloth to collect menstrual blood decreased significantly among urban and rural girls at post-intervention coupled with an increase in sanitary pad use among urban residents. The use of reusable menstrual materials also declined significantly, while the frequency of changing pads and bathing during menstruation increased significantly after a menstrual hygiene intervention.

Blake et al. (2018) distributed puberty booklets to adolescent girls in schools. They found the intervention to be effective in improving knowledge and attitudes towards menstruation. Besides, Khodakarami et al. (2020) revealed that both midwife-led and mother-led puberty education increased knowledge and attitudes about menstruation compared to no intervention. Another study discovered that girls who received hygiene training from school health trainers had better hygiene practices than girls who received hygiene training from their parents (Djalalinia et al.,

2012). A randomised controlled trial also showed that training girls directly was more effective in promoting menstrual attitudes than training mothers to transfer the information to adolescent girls (Afsari et al., 2017). In addition, Dorgbetor (2015) found that a role-play approach has the potential to improve adolescents' knowledge, attitudes and personal hygiene compared to no intervention.

It is recommended that menstrual health interventions focus on promoting social support, knowledge and skills, and access to materials, facilities and services (UNICEF, 2019). However, prior studies across the globe focused largely on promoting knowledge and skills. Therefore, little is known about the effectiveness of menstrual hygiene interventions that focus on addressing multiple barriers simultaneously. In recent times, researchers have underscored that public health interventions that focus on increasing knowledge and skills through menstrual hygiene education and increasing access to WASH facilities and affordable menstrual materials are more likely to improve menstrual hygiene practices among adolescent girls (Ssewanyana & Bitanirwe, 2019).

2.11: Effectiveness of MH interventions on school absenteeism and engagement in school activities during menstruation

The literature on menstrual hygiene interventions and school absenteeism is mixed. Some previous studies have shown that both software and hardware interventions are effective in reducing school absenteeism during menstruation. On the other hand, similar studies found no significant association between menstrual hygiene interventions and a reduction in school absenteeism during menstruation (Hennegan & Montgomery, 2016). For instance, in the study

of Montgomery et al. (2012), it was found that combining puberty education with free sanitary pads increased school attendance at three months post-intervention. Puberty education alone also increased school attendance at five months post-intervention.

A qualitative assessment of a randomised controlled trial in Kenya showed that girls who received menstrual cups or sanitary pads did not report issues of school absenteeism, poor concentration in class, or restricted movement in school compared to girls who were using traditional materials (Mason et al., 2015). Also, in Kenya, Mucherah and Thomas (2017) reported that girls who received reusable sanitary pads had less school absenteeism, missed fewer school activities, and were more comfortable in school compared to girls who did not receive reusable sanitary pads. Another cluster randomised controlled feasibility study in 2021 found that providing sanitary pads reduced school absenteeism among adolescent girls in 30 schools in Western Kenya (Benshaul-Tolonen et al., 2021). In addition, a recent qualitative assessment of a four-arm randomised controlled trial in Kenya showed that cash transfers coupled with menstrual cups were effective in reducing school dropout, while menstrual cups alone were effective in reducing school absenteeism compared to usual practices (Mason et al., 2022). A similar study in Ethiopia by Belay et al. (2020) demonstrated that providing underwear, reusable sanitary pads and period education had a positive effect on school attendance among adolescent girls. In Uganda, Kansiime et al. (2020) did a qualitative assessment of a longitudinal study comprising the provision of analgesics, puberty education, reusable pads, drama kits, WASH facilities and training of teachers. The authors found that girls were more likely to attend school during menstruation post-intervention than at baseline. Additionally, another study in

Bangladesh revealed that school attendance increased among adolescent girls after receiving menstrual hygiene packs and puberty education for six months (Alam et al., 2022).

However, similar studies in LMICs have shown that menstrual hygiene interventions were not effective in increasing school attendance and engagement among adolescent girls. The earliest of these studies was conducted in Nepal. The study found that providing menstrual cups to adolescent girls did not reduce school absenteeism significantly during the 12-month follow-up period (Oster & Thornton, 2011). In 2012, a related study revealed that providing water treatment, hygiene promotion and sanitation facilities were not effective in reducing school absenteeism among adolescent girls in Kenya. Also, a prior study in Uganda found no statistically significant difference in school attendance among girls who received puberty education alone, reusable pads alone, or reusable pads with puberty education and no intervention (Montgomery et al., 2016). Moreover, a randomised controlled trial among 3,489 grade seven girls in Kenya concluded that providing sanitary pads with reproductive health education did not improve school attendance or school engagement at 18 months of follow-up (Austrian et al., 2021). Benshaul-Tolonen et al. (2021) also found that after 14 months of follow-up, school absenteeism did not reduce significantly among Kenyan girls in a menstrual cup arm compared to a no-intervention arm.

Previous studies on menstrual hygiene interventions and school attendance and engagement have limitations. For instance, some of the studies had a small sample size and a short follow-up period, which limited the generalizability of the findings. In addition, there were issues with no comparison group and no randomization, which impeded the application of the findings. Some of

the studies used less reliable measurement scales, had a high attrition rate, had recall bias and lacked blinding. Some of the studies employed qualitative designs, which are subjective. Lastly, none of the existing menstrual hygiene intervention studies in Ghana explored school engagement among adolescent girls. Therefore, further studies that take into consideration these limitations are needed.

2.12: Effectiveness of menstrual hygiene interventions on reproductive infections

There is contradictory evidence regarding the effectiveness of menstrual hygiene interventions and reproductive tract infections. The earliest study on MH intervention and infections was conducted among adolescent girls in rural India using a pre-test and post-test design. The authors found that providing menstrual materials did not significantly reduce self-reported symptoms of reproductive tract infections (Shah et al., 2013). Moreover, a quasi-experimental study in Egypt showed that providing reproductive health education was ineffective in reducing symptoms of reproductive tract infections among adolescent girls after a three-month follow-up period (Mohamed, 2018). A recent cohort study among households in India reported that an improvement in water, sanitation and hygiene facilities was not effective in reducing symptoms of urogenital infections (Torondel et al., 2022).

On the contrary, other studies found menstrual hygiene interventions to be effective in reducing infections in the reproductive tract. Notable among such studies was the one conducted by Phillips-Howard et al. (2016) in Kenya using a three-arm randomised controlled trial. The researchers revealed that providing menstrual cups to adolescent girls was associated with a lower risk of sexually transmitted infections and bacterial vaginosis. Additionally, a non-randomized trial demonstrated that weekly lectures and interactive classes significantly reduced

genitourinary tract morbidities among primary school girls in India (Pal et al., 2017). Furthermore, a prospective cohort study of 240 adolescent girls in Rwanda demonstrated that girls who received sanitary pads reported fewer symptoms of vulvovaginal infections after six months (Janoowalla et al., 2020). In conclusion, studies on the effectiveness of menstrual hygiene interventions are limited. Besides, the existing studies have several methodological limitations. Few menstrual hygiene intervention studies have been conducted in Ghana, with none of them focusing on urogenital infections or school engagement. The paucity of literature, limitations in existing studies and inconclusive evidence necessitate further research on menstrual hygiene interventions.

2.13: Theoretical underpinning

This study was underpinned by the Social Ecological Model (SEM), a widely known health promotion model developed from behavioural and social sciences (Golden & Earp, 2012; Sharma et al., 2022). The American psychologist Urie Bronfenbrenner, who advanced ecological systems theory, first introduced SEM in the 1970s, and it received official recognition in the 1980s. Social Ecological Model has been recognised by global health promotion institutions as pivotal to designing constructive health promotion interventions (Glanz et al., 2015).

The proponents of the SEM model argue that health behaviours are shaped by complex systems with interlinking factors. Thus, the adoption of health behaviours is influenced by factors at the individual, interpersonal, community, institutional, and policy levels (Kilanowski, 2017). However, these factors overlap, indicating that one level influences the other. UNICEF's adapted version of SEM was employed in this study. The UNICEF version has five levels, including biological, personal, interpersonal, environmental and societal factors (UNICEF, 2019).

Social Ecological Model has been adopted to investigate barriers to menstrual hygiene management practices among young women in India (McCammon et al., 2020) and differently-abled people (Wilbur et al., 2019). Blake et al. (2018) also adopted the SEM to study the effect of puberty education on knowledge and attitudes about menstruation and factors shaping girls' menstrual experiences in rural Ethiopia.

The literature shows that barriers and facilitators to optimal menstrual hygiene management are multi-layered. These include biological, personal, interpersonal, environmental, and social factors (Maulingin-Gumbaketi et al., 2022; Sharma et al., 2022). Biological factors comprise the physical health issues associated with menstruation that affect girls' ability to manage menstruation. These include menstrual pains or cramps, heavy menstrual bleeding, and irregular menstrual cycles. Personal-level factors focus on an individual's knowledge and skills about a health problem or phenomenon. In the context of menstrual hygiene, improving knowledge about menstrual hygiene and skills in managing menstruation, coupled with changing negative attitudes and misconceptions about menstruation, are crucial to promoting menstrual hygiene. Interpersonal-level factors, which look at an individual's relationship with other people, including friends, family members and social networks, are crucial in influencing the adoption of health behaviours. In the context of menstrual hygiene, teachers, parents and peers can help provide support, including information, safe menstrual materials and emotional support for girls during menstruation. Societal-level factors emphasise relationships between organisations within a social system, including traditional or cultural beliefs, gender norms and taboos about health issues. Menstruation is one of the health issues shrouded in a culture of silence and secrecy

coupled with taboos and discrimination against menstruating women and girls (MacLean et al., 2020). Regarding environmental-level factors, an enabling environment is critical for the adoption of healthy behaviours. Therefore, promoting access to water, sanitation and hygiene facilities, as well as access to adequate and safe menstrual materials, is crucial for menstrual hygiene (WHO/UNICEF Joint Monitoring Programme., 2012). Additionally, the availability and effective implementation of policies are crucial for promoting healthy behaviours. Regarding menstrual hygiene, there is a need for international and national policy guidelines and strategies to promote menstrual hygiene management, such as eliminating taxes on menstrual materials to make them affordable and improving access to WASH facilities in schools (UNICEF, 2019).

2.14: Conceptual framework

The conceptual framework for this study was developed based on empirical literature and SEM. The researcher conceptualised that adolescent girls may face biological, personal, interpersonal, environmental, and societal barriers during menstruation. Therefore, a multi-component menstrual hygiene intervention that combines software and hardware interventions has the potential to address multi-level barriers (Sharma et al., 2022). As a result, it can lead to an increase in good knowledge, attitude, and menstrual practises. An improvement in MHM may increase school engagement and attendance as well as reduce the symptoms of UGI among adolescent girls. Also, addressing the barriers can directly lead to increased school engagement and attendance and reduce the symptoms of urogenital infections. Effect modifiers, such as participant and school characteristics, can affect the outcomes. Hence, these factors should be controlled. Figure 2.1 shows the conceptual framework for this study.

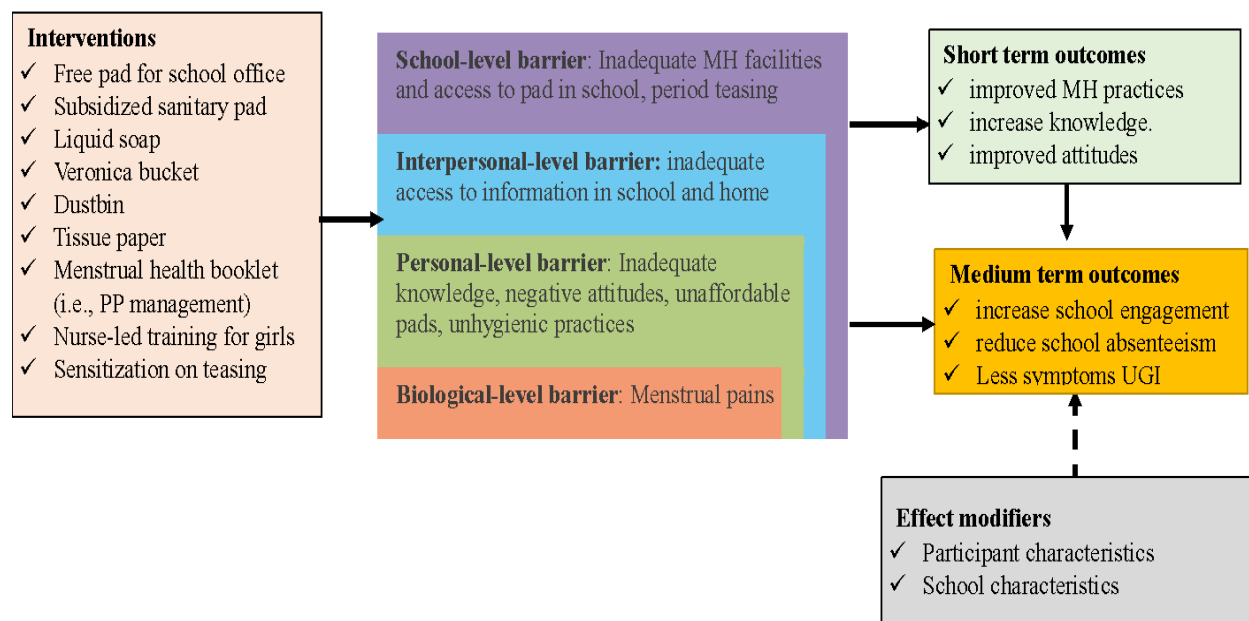


Figure 2.1: Conceptual framework for this study. Author constructed based on literature



CHAPTER THREE

3.0: METHODS

3.1: Introduction

This chapter outlines the various methods employed in conducting the study. The chapter begins with an overview of the study setting, approach and research paradigm. Additionally, it provides details on the study design, the different phases of the study, sampling techniques, data collection, management and analysis. The chapter also describes the measures taken to ensure ethical integrity.

3.2: Study setting

The study was conducted in northern part of Ghana due to the high prevalence of menstruation-related school absenteeism. Studies conducted in northern Ghana found that between 22.2 % - 40.4% of adolescent girls miss school during menstruation (Mohammed et al., 2020; Kumbeni et al., 2021; Asumah et al., 2023). By investigating the impact of menstrual hygiene interventions on menstruation-related school absenteeism, this study seeks to promote health and educational equity as well as create a supportive school environment where all students, irrespective of their gender, have access to equal opportunities to succeed.

Specifically, this study was conducted in the Binduri and Pusiga Districts of Ghana. These are two of the fifteen districts and municipalities in the Upper East Region (Figure 3.1). With a population of 1,301,226 (Ghana Statistical Service, 2021), the Upper East Region is the third smallest of Ghana's 16 regions and the second largest region in northern Ghana. The region is located in the north-eastern part of the country and shares borders with two countries, Burkina

Faso to the north and the Republic of Togo to the east. The region also shares borders with the Upper West Region to the west and the Northern Region to the south.

The Binduri District shares borders with the Bawku West District to the west, the Bawku Municipal to the east, and the Garu District to the south (Ghana Statistical Service., 2014a). The Pusiga District shares borders with the Bawku Municipality to the west, the Tempene District to the south, Burkina Faso to the north, and the Republic of Togo to the east (Ghana Statistical Service., 2014b).

3.2.1: Population

According to the 2021 Population and Housing Census, the Binduri District has a total population of 76,679, representing 5.9% of the total population in the region. The majority of the population is female (51.8%) (Ghana Statistical Service, 2021). The district has a youthful population and is all rural. Adolescents (10-19 years) constitute a quarter of the total population of the district. According to the 2021 Population and Housing Census, the Pusiga District has a total population of 80,533, accounting for 6.1% of the total population in the region. Females represent 51.8% of the total population (Ghana Statistical Service, 2021). The Pusiga District has a youthful population and is largely rural. Adolescents represent about a quarter of the total population of the district.

3.2.2: Education and literacy

The majority of the population in the selected districts is non-literate (Pusiga: 62.9% and Binduri: 57.8%). A higher proportion of the literate population is male. The majority of the people in the Pusiga District aged 3 years and above have no formal education, 3 in 10 are in school and less than

10% have attended school in the past. In the Binduri District, half of the population aged 3 years and above has never been to school, about four in ten have been to school and 10% are in school (Ghana Statistical Service, 2014a, 2014b).

3.2.3: Water and sanitation conditions

Housing conditions are crucial in promoting menstrual hygiene management, especially access to WASH facilities and privacy. The main sources of drinking water and water for domestic use in the selected districts include borehole/tube wells, protected wells, unprotected wells, and pipe-borne outside and inside the dwelling. Regarding toilet facilities, 82.2% of the households in the Pusiga Districts have no toilet facility, while 83.7% in the Binduri District have no toilet facility. Hence, they resort to open defecation. Concerning bathing facilities, 25.7% of households in the Pusiga District have bathrooms for exclusive use, 33.5% share separate bathrooms in the same house, 20% share an open cubicle and 9.7% bathe in open spaces around the house. In the Binduri District, 28.8% of households own bathrooms for exclusive use and 26.6% of households share separate bathrooms in the same house. Exactly 17.9%, 15.5%, and 9.8% use private cubicles, share an open cubicle, and bathe in open space around the house, respectively. The main methods of managing solid waste in the selected districts include the use of open space, public dumps, burning, burying and indiscriminate disposal, while liquid waste is disposed of in the compound, street and drainage pits (Ghana Statistical Service, 2014a, 2014b).



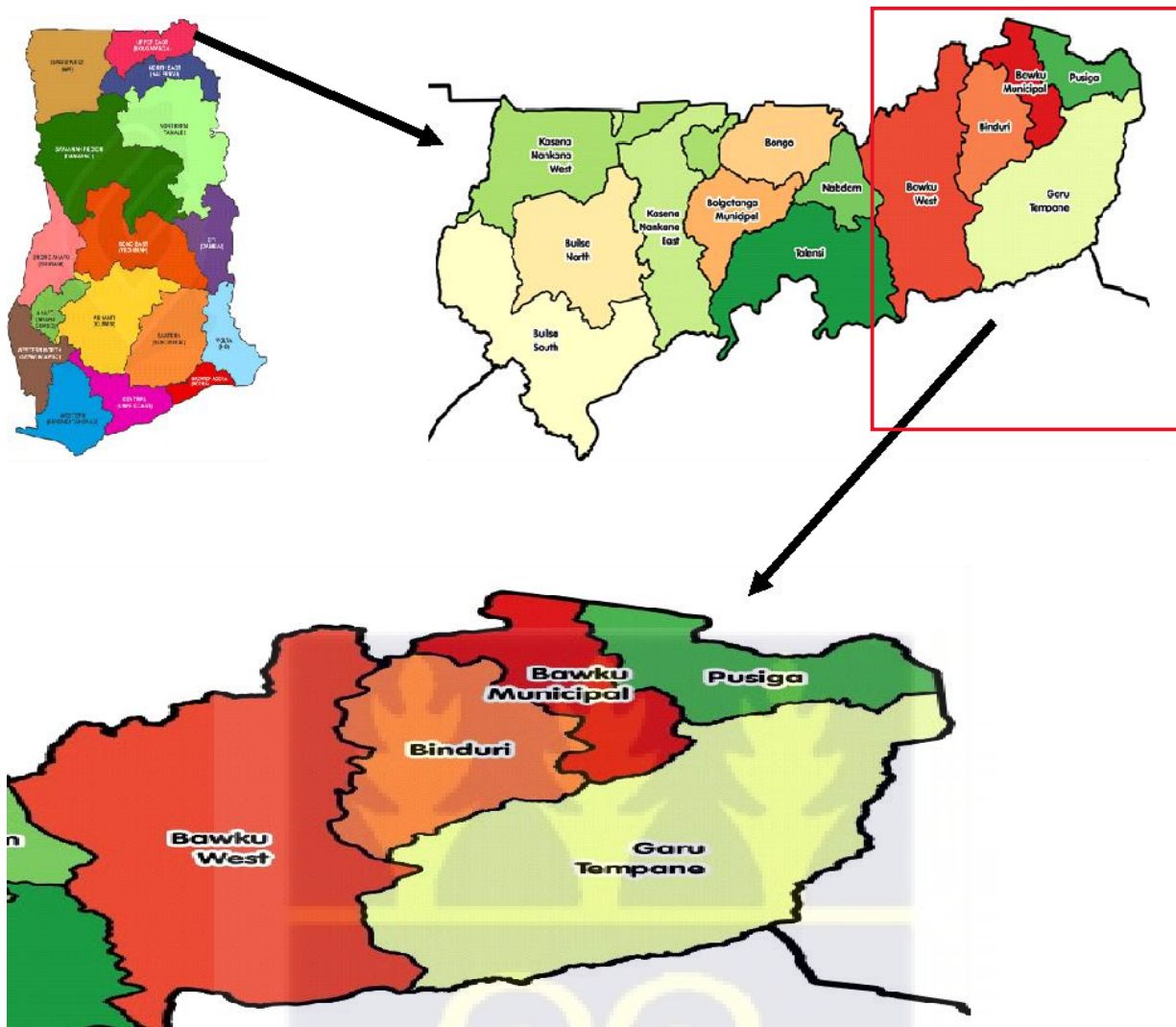


Figure 3:1 Maps of Ghana, the Upper East Region, and the Bawku enclave.

Source: https://commons.wikimedia.org/wiki/File:Districts_of_the_Upper_East_Region_%282012%29.svg

3.3: Research paradigm

It is crucial for researchers to make clear the philosophical worldview they espouse since it informs their research methods. A philosophical worldview or research paradigm is a basic set of beliefs that guide action (Creswell, 2009). According to Creswell (2009), there are four main research paradigms, including pragmatism, post-positivism, social construction and advocacy/participatory.

This study is underpinned by Pragmatism (Creswell, 2009). Pragmatism allows researchers to employ multiple approaches to comprehend the research problem (Morgan, 2007). Pragmatism is not subjected to a single system of reality but is more liberal and employs mixed methods in scientific inquiries. It gives researchers the freedom to choose methods and approaches that best fit their research purpose. The proponents of the Pragmatic paradigm do not believe that there is absolute unity in the world. They argue that truth is time-bound and that researchers should collect both quantitative and qualitative data to best comprehend a research problem. They also argue that research is conducted within a context and researchers should focus on the ‘what’ and ‘how’ of the subject of interest instead of a single method that may not provide the required depth of understanding. Pragmatism provides an ideal framework for conducting mixed-methods research (Creswell, 2009).

3.4: Study Approach

The current study employed a mixed-methods research approach. According to Creswell et al. (2007), employing qualitative and quantitative approaches helps the researcher collect generalizable, context-specific and detailed information from study participants. Both quantitative and qualitative approaches have limitations. Therefore, combining the two can help neutralise the biases of each approach (Creswell, 2009). Specifically, an Exploratory Sequential mixed-methods design was employed. This design begins with a qualitative study and is followed by a quantitative study.

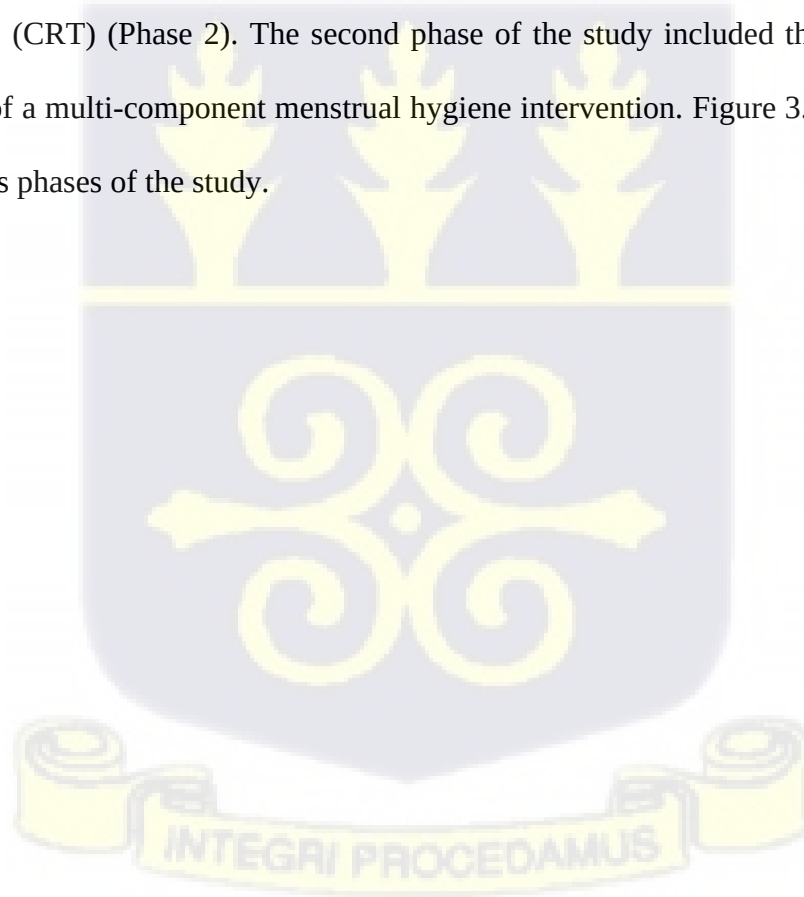
3.4.1: Rationale for the mixed methods

The rationale for combining both qualitative and quantitative methods was to help provide a comprehensive and nuanced understanding of the research problem. This will help in developing

tailored and sustainable menstrual hygiene interventions. Unbiased empirical evidence from a rigorously conducted menstrual hygiene experiment can inform decision-making. The experiment can be scaled up to improve menstrual hygiene management among adolescent girls. In this study, qualitative and quantitative methods of data collection and analysis were conducted to help get an in-depth understanding of the research problem. The findings of the qualitative study informed the quantitative study.

3.5: Phases of the study

This study was divided into two phases, including a formative study (Phase 1) and a cluster-randomised trial (CRT) (Phase 2). The second phase of the study included the implementation and evaluation of a multi-component menstrual hygiene intervention. Figure 3.2 provides details about the various phases of the study.



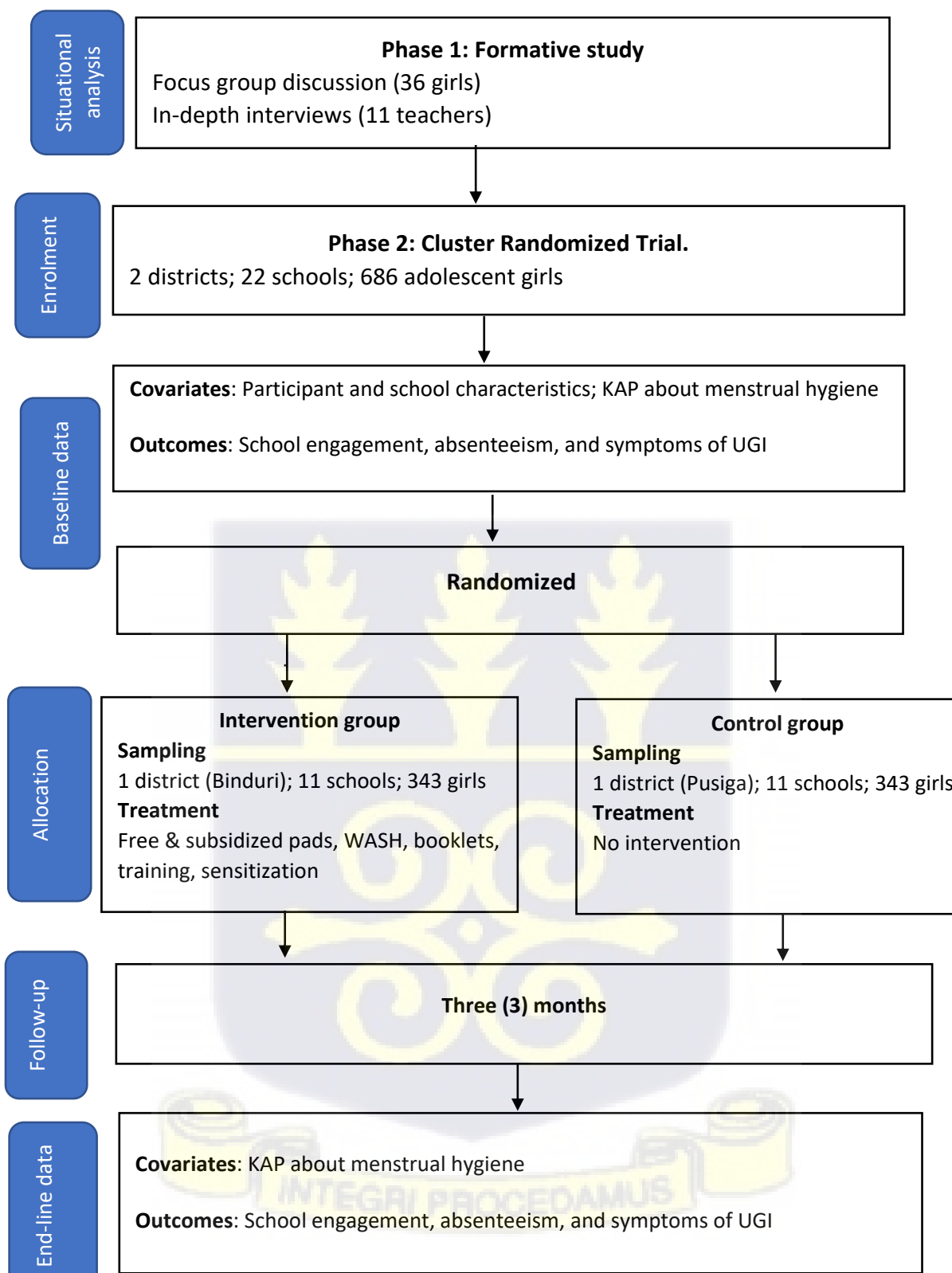


Figure 3:2 Flow chart for phases one and two of the study

Note: UGI: Urogenital infections; KAP: Knowledge, attitude and practices; WASH: Water, sanitation and hygiene

3.6: Phase one: Formative study

In Phase one, a formative study was conducted in the Binduri and Pusiga Districts. A formative study is used to develop effective strategies, including communication channels for influencing behaviour change. It helps researchers identify and understand the characteristics, interests, behaviours, and needs of a target population that influence their decisions and actions. A formative study is essential for developing new and improving existing interventions (Gittelsohn et al., 2006). It also assists researchers in developing culturally and contextually sensitive interventions. Researchers conduct formative research to build friendly relationships with community members and determine the best channel for delivering interventions. In this regard, a formative study was conducted to identify context-specific barriers and facilitators to optimal menstrual hygiene management among adolescent girls in school. Through the formative study, the views of relevant stakeholders were considered in the design of the MH interventions.

3.6.1: The research team and reflexivity for phase one

Reflexivity means that researchers reflect on how their biases, values and personal background, such as gender, history, culture, and socioeconomic status, shape their interpretations formed during a study. Female research assistants conducted the interviews and focus group discussions. Because the research assistants were female, they were familiar with the topic and understood the context in which menstruation occurs. They were also fluent in Kusaal (the local dialect) and English, which aided them in engaging the participants to gather the necessary data.

The researcher holds a bachelor's degree in Psychology and a Master's degree in Health Services Management. He is currently pursuing a PhD degree in Public Health. Moreover, the researcher has conducted previous studies among adolescent girls. The diverse experiences of the researcher

were employed to help generate accurate data. No relationship was established with the participants before data collection. A formal relationship existed between the interviewers, the researcher and the participants during the study. Conscious efforts were adopted to reduce researcher bias by reflecting on personal biases, assumptions and preconceptions. Participants did not have any prior knowledge of the interviewers. The research team declared all conflicts of interest and made the purpose of the study known to the participants before the study commenced. Also, background information about the interviewers, including their profession, educational status and interest in the study, was provided to the participants before the interviews were conducted.

3.6.2: Study design for the formative study

A research design is the set of plans and procedures a researcher employs to investigate, including the research paradigm, data collection techniques and analysis (Creswell, 2009). The researcher conducted a formative study using phenomenology design to explore the lived experiences of participants regarding MHM (Creswell, 2009). Employing reflexivity, the researcher set aside his personal biases and emotions to carefully understand the underlying determinants of participant's experiences, beliefs, behaviours and barriers regarding MHM (Creswell et al., 2007).

3.6.3: Study population and sampling for the formative study

The target population for the formative study included adolescent girls and teachers. Purposive and convenience sampling techniques were employed to recruit teachers and girls, respectively. Participants were contacted face-to-face at their schools.

3.6.4: Data collection for the formative study

Data were collected in public junior high schools in the Pusiga and Binduri Districts from August 2 to September 3, 2021. Qualitative data collection methods, including in-depth interviews (IDI) with teachers and focused group discussions (FGD) with adolescent girls, were employed to collect data. Interview and focus group guides were used for teachers and adolescent girls, respectively. The guides had the key questions and probes to solicit further information where necessary. The data collection instruments were pilot tested among a similar population in the Garu District prior to data collection.

Interviews were conducted in the presence of only the interviewee and the interviewer. Interviews were audio recorded after seeking the participant's consent. On average, an interview session lasted 45 minutes for FGD and 25 minutes for IDI. Interviews were conducted using the English Language or the local language (Kusaal). Data collection was terminated when the researcher realised that no new information was obtained from new participants (data saturation). The number of participants per FGD was six adolescent girls. Previous studies have recommended a minimum of six participants for FGD (Johnson & Christensen, 2019). The total number of participants interviewed at data saturation was 36 adolescent girls in six FGDs and 11 male and female teachers in IDI, constituting the sample size for the formative study. Five to twenty-five participants are adequate for phenomenological studies (Guetterman, 2015).

3.6.5: Data analysis for the formative study

Thematic analysis was conducted to identify themes within the data. A deductive approach based on SEM was used. Braun and Clarke's thematic analysis guided the analysis (Braun & Clarke,

2014). Experts in the local language transcribed the audio recordings after listening to them several times. The transcripts were verified by the researcher and a neutral person who was fluent in the local language. The transcripts were compared with the recordings. To achieve data immersion as well as document initial impressions, the transcripts and the notes were read several times. Afterwards, the transcripts were coded manually to identify the main themes. Codes that fit were grouped into themes after serious scrutiny and revision to safeguard consistency between themes and related data. Lastly, the themes were organised into main themes and sub-themes. The themes and sub-themes were analysed independently by another researcher who was not a member of the original research team. The qualitative findings are presented according to the main and sub-themes, and verbatim quotes are selected at random to support each sub-theme.

3.7: Phase two: Cluster-randomised trial

3.7.1: Study setting

The cluster randomised trial was conducted in junior high schools in the Pusiga and Binduri Districts. Details about the study setting are provided in Section 3.1 and Figure 3.1.

3.7.2: Study design: The design was a pragmatic, parallel, two-arm cluster randomised trial with a 1:1 allocation ratio. In this study, clusters were junior high schools (mixed-sex) with menstruating girls aged 10–19 years located in the Pusiga and Binduri Districts. The objective was to determine the effectiveness of menstrual hygiene interventions on health and educational outcomes among adolescent girls. The two groups allocated were the intervention arm (multi-component MH interventions) and the control arm (no intervention). The clusters remained in the same arms throughout the trial. There were no significant changes in the methods after the trial

started. The Consolidated Standards of Reporting Trials (CONSORT) guidelines were used to guide the reporting of phase two of this study (Butcher et al., 2022).

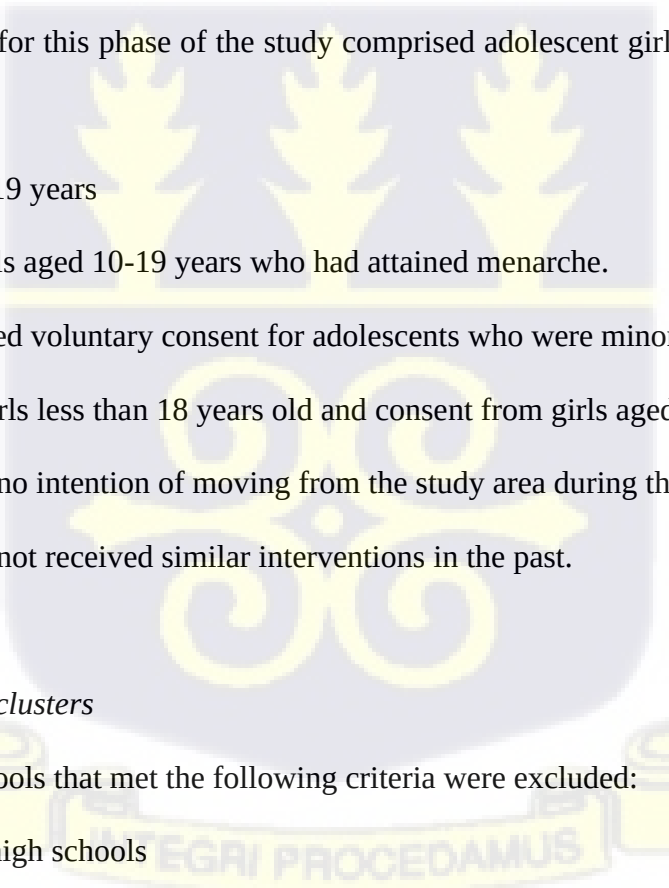
3.7.3: Eligibility criteria for cluster and participants

Inclusion criteria for clusters

To ensure that the clusters were similar, this study focused on only public junior high schools located in the Binduri and Pusiga Districts.

Inclusion criteria for participants

The target population for this phase of the study comprised adolescent girls in public junior high schools.

- 
- I. Girls aged 10-19 years
 - II. Adolescent girls aged 10-19 years who had attained menarche.
 - III. Parents provided voluntary consent for adolescents who were minors.
 - IV. Assent from girls less than 18 years old and consent from girls aged 18 and 19 years old.
 - V. Girls who had no intention of moving from the study area during the study period.
 - VI. Girls who had not received similar interventions in the past.

Exclusion criteria for clusters

Public junior high schools that met the following criteria were excluded:

1. Single-sex junior high schools
2. Schools that ever or had a similar intervention ongoing

Single-sex schools were excluded because period teasing may be more common in mixed-sex schools compared to single-sex schools. Schools with similar interventions were excluded to help reduce biases.

Exclusion criteria for participants

Adolescent girls who meet the following criteria were excluded from the study:

- I. Adolescent girls who were critically ill
- II. Adolescent girls who were not mentally sound
- III. Adolescent girls who were pregnant
- IV. Girls in JHS 3 were excluded because they were not going to be available during post-intervention. The girls in JHS 3 were about to graduate or complete junior high school.

3.7.4: Sample size determination

The minimum sample size to detect an effect was determined based on the following assumptions.

- i. The proportion of adolescent girls in Ghana who miss school due to menstruation was estimated at 40% based on a previous study in a rural community in the Northern Region of Ghana (Mohammed et al., 2020).
- ii. The desired level of reduction in menstruation-related school absenteeism following the intervention was at least 20% (prevalence difference).
- iii. The probability that this study will be able to detect a true difference between the intervention and control groups is 95% or a margin of error of 5%
- iv. Power of 80%.

- v. Intra-cluster correlation of 0.10 based on a previous study (Aninanya et al., 2015).
- vi. Equal cluster sizes of 25 menstruating adolescent girls were assumed.
- vii. 10% for non-response
- viii. 15% for loss to follow-up based on a previous study in Ghana (Montgomery et al., 2012).

The calculated sample size was 538 adolescent girls for the intervention and control groups. To adjust for non-response, 10% ($n = 54$) of the estimated sample size was added. To adjust for possible loss to follow-up, 15% ($n = 81$) of the calculated sample size was added. The required sample size for this study was 673 adolescent girls. To increase the statistical power, generalizability and precision of the findings, 686 participants (343 per arm) were interviewed. An equal allocation ratio (1:1) and assumed equal cluster sizes were used to estimate the sample size; hence, the two groups had an equal number of participants. There was no interim analysis or stopping. Details about the sampling are provided in Table 3.1.

Table 3. 1: Sample Size Determination

		Source
p_1 = proportion of school absenteeism in control group	40% (0.40)	Literature
p_2 = proportion of school absenteeism in intervention group	20% (0.20)	Hypothesis
α = level of significance	0.05	Literature
$1-\beta$ = power	0.80	Literature
$Z_{1-\alpha/2}$ = standard normal deviation for a two-tailed test based on alpha level (relates to the confidence interval level).	1.96	Calculated
$Z_{1-\beta}$ = standard normal deviation for a one-tailed test based on beta-level (relates to the power level)	0.84	Calculated
n_1 = sample size for group 1	79	Calculated
n_2 = sample size for group 2	79	Calculated
$(n_1 + n_2)$ = sample size for both groups	158	Calculated
(ρ) = intra-cluster correlation	0.10	Literature
(m) = number of individuals in each cluster (equal cluster sizes assumed)	25	Researcher defined
DE = design effect	3.40	Calculated
n_1 Required minimum sample size (n)	538	Calculated
10% for non-response	54	Literature

Table 3. 1: Sample Size Determination		Source
15% for loss in follow-up from a previous study in Ghana	81	Literature
Required sample size	673	Calculated
Number of clusters (11 per group)	22	Calculated
Actual sample size (343 per group)	686	Researcher defined

The formula for determining a minimum sample size for binary outcomes is:

$$n_1 = \frac{(Z_{1-\alpha/2} + Z_{1-\beta})^2 p_1 (1-p_1) + p_2 (1-p_2)}{(p_1-p_2)^2} \dots\dots\dots (1) \text{ (Hayes \& Moulton, 2017)}$$

$$n_1 = \frac{(1.96 + 0.84)^2 0.4 (1-0.4) + 0.2 (1-0.2)}{(0.4-0.2)^2} = 78.4 \approx 79$$

$$DE = 1 + p(m-1) \dots\dots\dots (2)$$

$$DE = 1 + 0.1 (25-1) = 3.4$$

$$n_1 = DE * (n_1 + n_2) \dots\dots\dots (3)$$

$$n_1 = 3.4 * 158 = 537.2 \approx 538$$

$$k = n_1/m \dots\dots\dots (4)$$

$$k = 538/25 = 21.5 \approx 22$$

where:

n_1 = sample size for individual randomised control trial

$Z_{1-\alpha/2}$ = standard normal deviation for a two-tailed test based on alpha level (relates to the confidence interval level).

$Z_{1-\beta}$ = standard normal deviation for a one-tailed test based on beta-level (relates to the power level)

p_1 = proportion of school absenteeism in the control group

p_2 = proportion of school absenteeism in the intervention group

α = level of significance

$1-\beta$ = power

n_1 = sample size for group 1

n_2 = sample size for group 2

$(n_1 + n_2)$ = sample size for both groups

(ρ) = intra-cluster correlation

(m) = number of individuals in each cluster

DE = design effect

Required minimum sample size (n)

k = number of clusters

3.7.5: Study population and sampling

The target population for the cluster-randomised trial was adolescent girls in junior high school. The participants were recruited using a multi-stage sampling technique.

Step 1: Sampling of the region: Firstly, the Upper East Region was purposefully selected due to its rural nature and high prevalence of menstruation-related school absenteeism. This approach has been used in similar studies (Addo-Lartey et al., 2019; Ramaiya et al., 2019). Additionally, the Upper East Region is among the regions with a low junior high school completion rate of 31% and a high out-of-school rate of 8% (UNICEF., 2020).

Step 2: Sampling of the districts: This study was conducted in the Bawku enclave of the Upper East region. The Bawku enclave had six administrative districts, including Bawku West, Binduri, Pusiga, Garu and Tempane Districts, and Bawku Municipal. The districts have similar social, cultural and demographic characteristics. Two districts (Binduri and Pusiga) were selected using a simple random sampling technique.

Step 3: Sampling of clusters/schools: The sampling frame for the clusters comprised a list of public junior high schools in the districts. The lists of schools were obtained from the district offices of the Ghana Education Service. The Binduri and Pusiga Districts had a total of 28 and 35 public junior high schools, respectively. Based on the sample size calculation, 22 clusters were required for this study. Using an allocation ratio of 1:1, an equal number of clusters were selected from each district using a random sampling technique (Sverdlov & Ryznik, 2019; Torgerson & Campbell, 2000). A statistician assigned unique identifiers to all the eligible schools in each district. Random numbers were generated using a computer programme, and eleven (11) schools were selected from each district.

Step 4: The schools were stratified into classes or grades, including JHS 1 and JHS 2. The research team met all the girls in the selected schools and informed them about the purpose of the research. Adolescent girls who were eligible and interested in participating in the study were asked to register with a representative in each class. The research team returned to the schools later to recruit the participants. A list of the registered students was obtained from the representatives. The eligible participants were asked to pick a piece of folded paper from an opaque bag. The papers had 'yes' and 'no' written on them. Girls who picked 'yes' were recruited to participate in the study. Before recruiting, the participants and their parents were taken through the informed consent and assent processes.

3.7.6: Randomization

Sequence generation: The allocation sequence was generated using a computer programme. Allocation to the intervention group and the control group was done using unrestricted

randomization. To improve the precision and power of the study, the arms had an equal number of clusters and individual participants (Hayes & Moulton, 2017).

Allocation concealment mechanism: To help minimise selection bias, randomisation was done after baseline data collection and before the implementation of the intervention. This implies that the allocation was concealed from the head-teachers (persons who consented to the schools), study participants and the research assistants who recruited the participants and administered the questionnaire.

Implementation of randomization: The research team enrolled the clusters. Before enrolment, meetings were held with school authorities, parents and adolescent girls to explain the purpose of the study and obtain informed consent. In all, 22 eligible schools were randomly selected for allocation. The schools were stratified into classes. Prior to randomisation, the research assistants selected eligible adolescent girls at random from each class. A statistician generated the random allocation sequence. Written informed consent for the participation and randomization of the schools was obtained from the head-teachers before the randomisation. Before collecting the baseline data, adolescent girls aged 18 and 19 provided written informed consent. Parental consent was obtained from the parents or guardians of minors, while assent was obtained from the minors themselves.

Blinding: This study was a pragmatic trial. Blinding the participants and research team was difficult due to the nature of the intervention. To help reduce communication between the participants in the two arms, information regarding the locations and names of the intervention and control schools was concealed from the participants.

3.7.7: Multi-component menstrual hygiene intervention

A multi-component MH intervention was created through an iterative method, drawing on the findings from the formative study. The interventions aimed to increase girls' knowledge and skills about MHM. Additionally, the interventions aimed to increase access to safe menstrual materials and create a menstrual hygiene-friendly and supportive school environment. Therefore, the interventions pertained to both the school level and the individual level.

1. **Subsidised sanitary pads:** Participants in the intervention group were provided with subsidised disposable sanitary pads monthly for three consecutive months. The “Softcare” sanitary pad, a popular brand in Ghana, was sold to participants. The open market price for “Softcare” sanitary pads at the time of the study was between GH¢ 10 and 12. The Softcare sanitary pad was provided to the participants at a subsidised price of GH¢ 5. Baseline information and the formative study's findings served as the basis for this decision. A pack of Softcare sanitary pads has twelve pieces of disposable sanitary pads and four pants liners.
2. **Free sanitary pads for emergencies:** The schools' offices were provided with five packs of free Softcare sanitary pads per month. The free sanitary pads were to be made available to girls who needed a sanitary pad in school due to sudden menstruation, including girls who were not participants.
3. **Menstrual hygiene education booklets:** Each study participant in the intervention arm received a menstrual hygiene education booklet, which contained text and coloured images about menstruation hygiene-related information. The booklet had eight modules, including the female reproductive system, menstruation, the menstrual cycle, materials and facilities for menstrual hygiene, and managing reusable menstrual materials. Other modules included

personal hygiene, diet during menstruation, menstrual disorders, menstrual pain management and demystifying menstruation. The content of the booklet was obtained from materials developed by the Ghana Education Service, UNICEF, the Commonwealth Secretariat and the Health-Link Worldwide Gender and Relationships Handbook.

4. **Nurse-led menstrual hygiene training for girls:** A professional female nurse held a three-hour menstrual hygiene training session for participants in the intervention arm. The nurse explained the content of the menstrual hygiene booklet with demonstrations and examples. All questions and concerns raised by the participants were addressed. The participants were given the opportunity to demonstrate what they had learned during the training session.
5. **Handwashing and disposal facilities:** Each school in the intervention group received a Veronica bucket and a dustbin. Additionally, the schools received a monthly supply of liquid soap and rolls of tissue paper for three months. Posters promoting hand hygiene and safe disposal of sanitary pads were pasted on the buckets and dustbins, respectively. This was to encourage students to practise frequent handwashing and safe disposal practices.
6. **Sensitization against period teasing:** A poster with information against period teasing was pasted in every classroom of the intervention schools. The aim was to help reduce period teasing and stigma in schools and increase peer support for menstruating girls. It also aimed to portray menstruation as a normal biological phenomenon.

Control/comparison group: The participants in the control group adhered to their usual menstrual hygiene practices. In other words, they received no intervention. At the end of the study, participants in the control group received free sanitary pads.

3.7.8: Implementation of the interventions

The menstrual hygiene education booklets and the nurse-led training activities occurred in the first two weeks of the implementation period. The Veronica bucket, dustbins and posters were distributed in the first week of implementation. Subsidised sanitary pads, free sanitary pads for emergencies, liquid soap and tissue papers were supplied every month for three months.

Delivery method

A participant-centred approach was employed during the training sessions. A professional female nurse was in charge of the training activities. She underwent training regarding the content of the menstrual hygiene education booklet. The booklet was used as a guide for the training sessions, coupled with demonstrations and role-play. The booklets were distributed to the participants two weeks before the training session. The nurse delivered the sessions using a face-to-face approach. The same delivery method was employed in all the clusters in the intervention arm. Lessons were delivered using English and the local language in the area (Kusaal). Contact information for the researcher and the nurse was given to the participants to ask questions, report challenges, make inquiries, and seek further information. The researcher conducted monthly monitoring visits to the clusters.

Unit of delivery and setting of training

The training sessions were delivered to the study participants. Training sessions were held at each school or cluster on separate days at a convenient location, such as a classroom or under trees. The location and the channel of delivery were determined during the formative study.

Exposure quantity, duration and compliance

The training sessions comprised eight modules on menstrual hygiene and menstrual pain management. The training sessions lasted for about three hours with intermittent breaks. Schools in the intervention arm were supplied with one Veronica bucket and one dustbin. Also, the schools were supplied with three gallons of liquid soap, fifteen free sanitary pads for emergencies and six rolls of tissue paper. Additionally, the schools were provided with subsidised sanitary pads. Study participants were permitted to buy a maximum of three packs per month. This approach was adopted to help prevent participants from abusing the intervention by buying more than necessary. A female teacher sold the sanitary pads. In schools where there was no female teacher, one adolescent girl or a male teacher was selected to sell the sanitary pads to the participants. The duration of the intervention and follow-up period was three (3) months (September 5 2022, to December 5 2022), which was adopted by a similar study elsewhere (Blake et al., 2018). Participants who attended the training session were given a free snack. Training sessions were conducted at the school premises during non-teaching hours.

3.7.9: Theory of change

A theory of change (TOC) helps describe how a sequence of inputs or activities would generate a series of outcomes that focus on achieving set objectives or impact. The TOC explains how an intervention works through a causal pathway. In this study, the development of the theory of change began with a formative study on barriers and facilitators to optimal MHM. The formative study assisted the researcher in identifying the barriers that needed to be addressed and the enablers that needed to be promoted through tailored interventions. The views of key

stakeholders, including adolescent girls, teachers and school heads, were incorporated into the design of the multi-component menstrual hygiene intervention.

The theory of change presented in this study highlights the inputs, activities, outputs, outcomes, and impacts that are anticipated to cause the desired change. The inputs comprised subsidised sanitary pads, booklets, Veronica buckets, dustbins, soap, posters and a nurse. The provision of soap, Veronica buckets, dustbins, booklets, and sanitary pads for emergencies was free. In addition, sanitary pads were subsidised for participants. Also, the participants received training on menstrual hygiene, including the female reproductive system, personal hygiene, menstrual materials, disorders, and period pain management.

These initiatives were expected to result in improved knowledge and skills, positive attitudes towards menstruation, access to WASH facilities, safe menstrual materials, and social support. These outputs were expected to improve girls' engagement in school during menstruation and reduce menstruation-related absenteeism and symptoms of urogenital infections. Consequently, it was expected that interventions would have an impact on the health and wellbeing of girls, as well as their academic performance, retention in school and empowerment. Equipping adolescent girls with information and skills and increasing access to menstrual hygiene facilities and support will help girls manage menstruation confidently and achieve better health and educational outcomes (Figure 3.3).

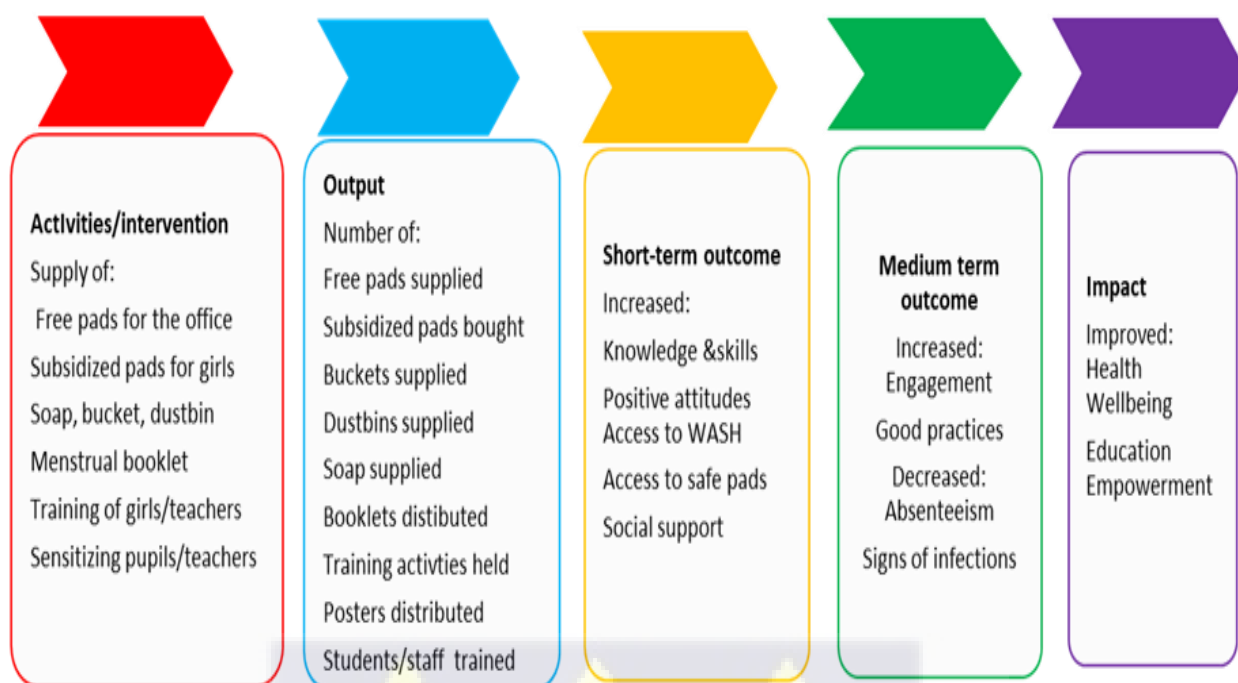


Figure 3:3 Theory of change for the cluster RT

3.7.10: Outcome variables

This study had a primary outcome (menstruation-related school absenteeism) and two secondary outcomes (engagement in school activities during menstruation and symptoms of urogenital infections). All the outcomes pertained to the individual level. The outcomes were measured at baseline and post-intervention and remained the same throughout the study period. Menstruation-related school absenteeism was measured with one item. The item was ‘*In your last period, did you miss school because of menstruation?*’ The responses included “Yes = 1, No = 2, and Don’t Know = 3”. This item was adopted from the 2017–18 Ghana Multiple Indicator Cluster Survey (Ghana Statistical Service., 2018). Some scholars argue that self-reporting is a credible assessment of menstrual experiences (Alam et al., 2017). Studies elsewhere found that using teachers’ records to assess menstruation-related school absenteeism was problematic. This is

because not all school absenteeism may be due to menstruation. Moreover, record-keeping by teachers can be problematic (Freeman et al., 2012). Therefore, prior studies adopted a self-reporting approach to measure menstruation-related school absenteeism (Alam et al., 2022; Mohammed et al., 2020).

The secondary outcomes of this study included self-reported symptoms of urogenital infections and engagement in school activities during menstruation. Engagement in school activities was assessed using six items coded as “Yes = 1, No = 2, and Don’t know = 3”. An example of the items includes ‘*In your last period, was your attention or concentration in class affected due to menstruation?*’ A composite score of 0–6 was computed to estimate overall engagement using the mean split. The composite score was recoded into a binary variable, with 0–3 meaning ‘low engagement’ and 4–6 meaning ‘high engagement’. The items for measuring engagement in school activities during menstruation were adapted from a similar study in Kenya (Austrian et al., 2021). Symptoms of urogenital infections were assessed with four items coded as “Yes = 1, No = 2, and Don’t know = 3”. The items included “*urinate more frequently; burning or itching in the genitalia; abnormal vaginal discharge; and burning or itching while urinating*”. A composite score was computed, with ‘0 symptoms = not infected’ and 1–5 symptoms = infected’. Similar studies have used these items to assess self-reported symptoms of urogenital infections (Das et al., 2015; Torondel et al., 2022).

Independent variable

The independent variable was the study group or arm, coded as “1 = intervention group and 2 = control group”.

Covariates

The covariates were biological, personal, interpersonal, environmental and societal factors. Biological factors comprise the age of the participant, menstrual pain, regularity of the menstrual cycle, and severity of menstrual flow. The age of the participant was a continuous variable, while the other biological factors were categorical variables. The personal factors were knowledge, attitudes and menstrual hygiene practices. Knowledge about menstrual hygiene was assessed with ten categorical variables coded as “Yes = 1, No = 2 and Don’t know = 3”. Attitude towards menstruation was assessed with seven categorical variables coded “Agree = 1, Disagree = 2, and Don’t know = 3”. The items regarding knowledge and attitude were adopted from UNICEF’s guidance for monitoring menstrual health and hygiene (UNICEF, 2020). Menstrual hygiene practices were assessed using twenty-three (23) items comprising ten dimensions. The dimensions are menstrual materials used, changing of materials, handwashing, genital washing, disposal of menstrual materials, storage of materials, urinating practices, washing, drying and ironing of reusable menstrual materials. The items were adopted from the Menstrual Practice Questionnaire (MPQ) developed and validated by Hennegan et al. (2020). All the variables were categorical. Other personal factors were the class of the participant, religion, ethnicity, mother’s education, father’s education, mother’s occupation, father’s occupation, residential status, access to pocket money, radio and television.

Interpersonal factors comprise relationships with parents or caregivers, teachers, and peers. These included access to menstruation-related information and support from parents, teachers, and peers. Environmental factors included access to menstrual hygiene facilities in school. These include access to water, handwashing facilities, soap, tissue paper, privacy, clean toilet rooms,

dustbins and sanitary pads during emergencies, and the affordability of sanitary pads. Societal factors encompassed taboos and restrictions about menstruation. The questionnaire was pilot tested before data collection.

3.7.11: Data collection

The data were collected at the individual and school levels in both the intervention and control schools. Female research assistants collected the data under the supervision of the researcher. The research assistants visited the selected schools and administered a paper-based structured questionnaire using a face-to-face approach at a convenient location. The questionnaire was in English. For participants who did not have a better understanding of the English Language, the research assistants translated the questions into Kusaal. The research assistants were proficient in both languages and trained to accurately translate the questionnaire. This approach gave the participants the opportunity to ask questions and clarify doubts about the questions. This contributed to an increase in the response rate. Moreover, data quality was improved since the research assistants were around to provide an immediate response to participant's queries as well as clarify all doubts and misunderstandings regarding items on the questionnaire. On average, twenty-five (25) minutes were spent completing a questionnaire. Baseline and post-intervention data were collected from the same participants using the same questionnaire and approach. The recruitment and collection of baseline data began on August 1 and ended on August 20, 2022. The collection of post-intervention data began on December 6 and ended on December 15, 2022.

3.7.12: Statistical analysis

All the schools in the intervention group received the intervention. Data from all the schools were included in the analysis. Intention-to-treat analysis was conducted. Quantitative data were analysed with the aid of STATA/MP, version 17 (StataCorp, College Station, Texas, USA) and Statistical Package for Social Science (SPSS), version 23. The completed questionnaires were entered in SPSS and exported to STATA, for cleaning, recoding and analysis. Composite scores were computed for engagement in school activities, symptoms of urogenital infections, knowledge, and attitude towards menstruation. Engagement had a score of 0–6 points. A positive response ('No' for question L1- 4 & L6 and 'Yes' for question L5) was scored 1 and a negative response ('Yes' and 'Don't know' for question L1-4 & L6 and 'No' for question L5) scored as 0. A score of (0-3 = 0: low engagement and 4-6 = 1: high engagement). Regarding school absenteeism (question L7) a 'Yes' response was scored as 1 and 'No' & 'Don't know' responses scored as 0. Symptoms of urogenital infections had a score of 0-5, recoded as (0 = 0: not infected, 1-5 = 1: infected). A 'Yes' response was scored as 1 and a 'No' & 'Don't know' responses scored as 0. Knowledge about menstrual hygiene also had a composite score of 0–10, which was recoded as (0-4 = 1: poor knowledge and 5-10 = 2: good knowledge). A correct response was scored as 1 mark and an incorrect and don't know responses scored as 0 mark (Mohammed & Larsen-Reindorf, 2020). Attitude towards menstruation had a composite score of 0-7, recoded as (0-3 = 1 negative attitude and 4-7 = 2: positive attitude). A 'disagree' was scored 1 and 'agree' and 'don't know' as 0. The cut-offs for the categorization were based on the mean split. The data was checked for outliers and multicollinearity. Predictors with a Variance Inflation Factor (VIF) of 10 or more were dropped from the analysis.

Descriptive statistics were computed using frequency, percentage, mean and standard deviation, and the results were displayed in charts and tables. The Chi-square and independent t-test were used to compare associations between participant and cluster characteristics and the three outcomes at the bivariable level. Three logistic regression models, including univariable, multivariable and multilevel models, were computed for each outcome variable. The first model was a crude analysis of predictors without adjusting for other variables. The second model was a multivariable analysis of predictors without adjusting for clustering. The third model was a multilevel analysis of predictors, adjusting for clustering. The individual (the adolescent girl) was the target of inference. A multilevel mixed-effect analysis was employed to adjust for clustering.

3.8: Data management and quality control

In this study, different measures were adopted to ensure that accurate and quality data were generated and protected. Firstly, research assistants received training on quantitative and qualitative data collection. During the training, research assistants were asked to demonstrate how they would approach participants, go through the consenting process, and conduct interviews, including translating items from the English Language to the local language. The intervention and data collection instruments were pilot tested to ensure validity and reliability.

Academic supervisors and independent researchers reviewed the data collection instruments. The researcher supervised the data collection. He made random visits to the selected schools and checked the questionnaires daily for completeness and accuracy. Besides, periodic meetings were held with the research assistants to discuss and review the work done. In addition, the data were cross-checked for consistency before entry. Also, entered data was randomly sampled and

cross-checked against the questionnaires to help minimise data entry errors. The data were thoroughly cleaned before the final analysis. Data protection strategies were employed to protect the privacy and confidentiality of participants. For example, the computers and devices with the data were password-protected and accessible only to the research team. Questionnaires, transcripts and audio recordings were kept under lock and key. The completed questionnaires will be kept by the researcher for ten years before being destroyed. This was disclosed to the participants during the consent process.

3.9: Training of research assistants

The researcher recruited and trained four female research assistants prior to data collection. This is because menstruation is a sensitive and feminine subject; hence, the participants may be more comfortable interacting with a female. The training focused on questionnaire administration, conducting interviews and focus group discussion. The duration of the training was four hours. All the research assistants had tertiary education, including a degree or diploma in nursing. The research assistants were residents of the study areas. They were fluent in English and the predominant local language (Kusaal). The assistants were also trained in research ethics, including informed consent, privacy, confidentiality, and voluntary participation. The purpose of the study was highlighted during the training. The assistants were taken through all the items in the data collection instruments and asked to demonstrate them through a role play. All the research assistants participated in the piloting and the main study.

3.10: Pilot-testing

This study was piloted among junior high school girls in the Garu District of the Upper East Region. The pilot testing comprised one intervention school and one control school. A total

sample of sixty adolescent girls participated in the pilot testing. Pilot testing should be conducted in a non-selected district with 10% of the sample size (Arora et al., 2013; Fetohy, 2007). Based on the results of the piloting, the data collection instruments and interventions were reviewed.

3.11: Challenges on the field

The initial plan was to provide free menstrual cups instead of subsidised disposable sanitary pads. A menstrual cup is a reusable, non-absorbent bell-shaped device that is inserted into the vagina to collect menstrual blood. The menstrual cup is held in position by the walls of the vagina, which help create a seal to prevent leakages. Menstrual cups are usually made of medical grade silicone and must be emptied between 6 and 12 hours of use (Heidi, 2020). During the pilot-testing, many adolescent girls were unwilling to use the menstrual cup. They were unwilling to insert the device into their vagina. Therefore, the menstrual cup was replaced with disposable sanitary pads after amending the protocol and obtaining ethics approval from the Ethics Review Committee. Additionally, the duration of this study coincided with an ethnic conflict around to the study areas. This resulted in the imposition of a curfew; causing the project to be delayed for two weeks. Furthermore, public school teachers went on strike during the study period, causing school activities to come to a halt. The strike action also delayed the study for three weeks.

3.12: Ethical considerations

Ethical approval: Ethical approval was sought from the University of Ghana Ethics Committee for the Humanities (ECH 175/ 20-21). Permission was sought from the District Chief Executive, District Director of Ghana Education Service, and school heads before the commencement of the study. *Voluntary Participation:* Participation in this study was purely voluntary, and no

participant was coerced or lured with incentives to participate. *Informed consent:* The participants were asked to sign a written informed consent form or assent form. Participants who were less than 18 years old signed a written assent form, while their caregivers/parent signed or thumb printed a written consent form. The research assistants visited the homes of minors to discuss the study with their parents and obtain their consent. Participants who were 18 years of age and older signed a written consent form. Teachers who participated signed a written informed consent form. The participants had the freedom to opt out of the study at any stage. *Privacy and confidentiality:* The privacy, anonymity and confidentiality of participants were protected or maintained by using non-identifiable strategies like assigning codes instead of collecting their names. *Risk:* This study was associated with minimal risk or harm. Participants were required to respond to interview questions. Recalling past menstrual experiences may be associated with minimal psychological risk. Participants were given the researcher's and counsellor's contact information to channel their concerns. Also, the research team visited the intervention schools every month to document complaints. All participants' concerns were promptly addressed. Participants in the control group received free disposable sanitary pads at the end of the study. *Compensation:* There was no monetary compensation associated with this study. *Community entry procedure:* Before the study commenced, permission was sought from community leaders, including the chiefs, elders and the District Chief Executive. Meetings were held with teachers and students in each school. An overview of the study, the research objectives, methods, participation, risks and benefits, and expectations from teachers and students were highlighted during the meetings. *Funding:* The World Health Organisation (WHO) Human Reproduction Programme (HRP) Alliance hub, which is based in the School of Public Health at the University of Ghana, funded this study.

CHAPTER FOUR

4.0: RESULTS

4.1: Introduction

This chapter presents the results from the two phases of the study. The first section of the chapter presents qualitative findings from the formative study (phase one). The second section of the chapter presents quantitative results from the cluster-randomised trial (phase two).

4.2: Results of the formative study

4.2.1: Characteristics of adolescent girls in the focus group discussion (FGD)

Adolescent girls who participated in the FGDs were between 14 and 18 years old. A large proportion of the participants were 15-year-olds. The proportions of 14-year-olds and 16-year-olds were the same. Half of the participants were in their third year of junior high school (JHS), and the rest were divided equally between JHS 1 and JHS 2. A majority (67.7) of the participants professed Islam (Table 4.1).

Table 4. 1: Characteristics of adolescent girls in FGDs

Characteristic	Frequency	Percentage
Age (years)		
14	8	22.2
15	14	38.9
16	8	22.2
17	4	11.1
18	2	5.6
Total	36	100
Class		
JHS 1/grade 7	9	25.0
JHS 2/grade 8	9	25.0
JHS 3/grade 9	18	50.0
Total	36	100
Religion		
Christian	12	33.3
Muslim	24	66.7
Total	36	100

4.2.2: Characteristics of teachers in the in-depth interview

The teachers were between 27 and 37 years old. The proportions of teachers aged 30 and 35 were the same. Nine of the teachers were married. More than half of the teachers were Christians. More than two-thirds were female (Table 4.2).

Table 4. 2: Characteristics of teachers in the IDIs

Characteristic	Frequency	Percentage
Sex		
Male	3	27.3
Female	8	72.7
Total	11	100
Age (years)		
27	1	9.1
29	1	9.1
30	3	27.3
33	2	18.1
35	3	27.3
37	1	9.1
Total	11	100
Marital status		
Married	10	90.9
Single	1	9.1
Total	11	100
Religion		
Christian	6	54.5
Muslims	5	45.5
Total	11	100

4.2.3: Barriers and facilitators to optimal menstrual hygiene management

Five themes emerged from the thematic analysis of barriers to MHM (Table 4.3). This included biological, individual, interpersonal, school and societal factors. In addition, 20 sub-themes on barriers were identified. The sub-themes for barriers to MHM comprised menstrual symptoms, negative social norms, inadequate access to menstrual information and menstrual hygiene facilities. Two main themes (school and interpersonal) and four sub-themes on facilitators of MHM were identified. Facilitators at the school level included the availability of water and

sanitation facilities. Facilitators at the interpersonal level were parental and peer support. Both teachers and adolescent girls expressed similar perspectives regarding barriers to optimal menstrual hygiene management. The barriers and facilitators identified in this study aligned with the dimensions of the SEM (Figure 4.1).

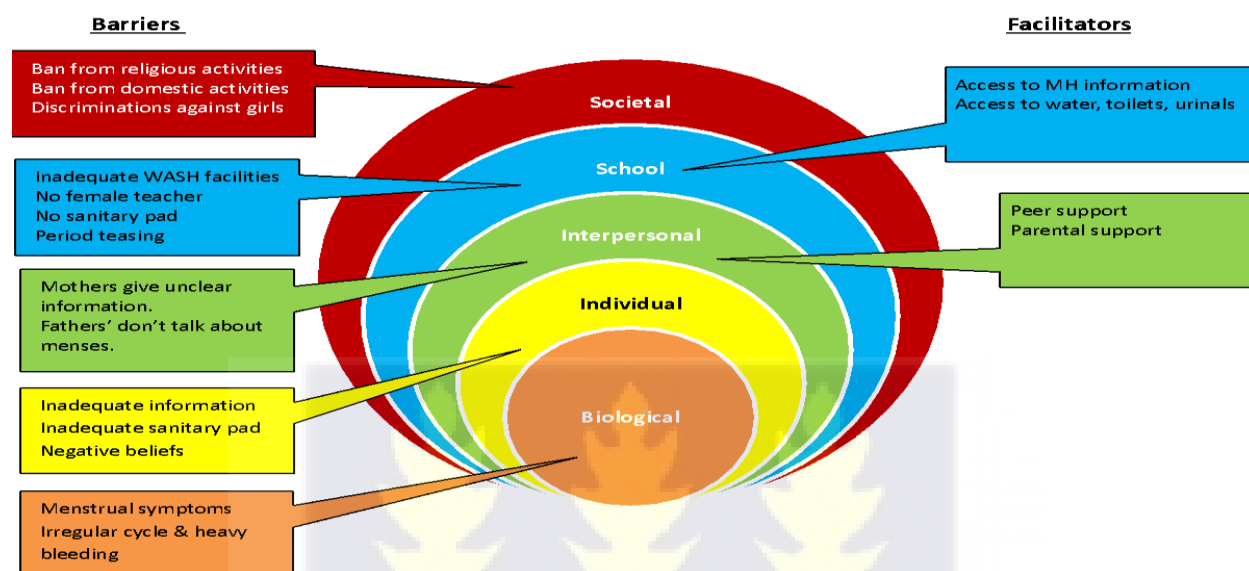


Figure 4.1 Barriers and facilitators of optimal MHM

4.2.4: Biological barriers to optimal menstrual hygiene management

Biological barriers to optimal MHM comprised adverse menstrual symptoms experienced by adolescent girls, including abdominal pains, heavy bleeding, irregular cycle and general body pains, which affected various aspects of their lives, including managing menstruation, school attendance and daily activities.

Menstrual symptoms: Adolescent girls expressed concerns about abdominal pains, headaches, breast tenderness, waist pain and general body weakness during menstruation. To address these adverse outcomes, some girls reported taking medications such as paracetamol or visiting a

health facility for treatment. Some girls used home remedies, such as placing a warm towel on their abdomen or drinking warm water. Painful menstrual symptoms contributed to the infrequent changing of menstrual materials and bathing during menstruation. Additionally, menstrual pain affected girls' appetite, movement, concentration in the classroom, school attendance and participation in physical and domestic activities. For instance, an adolescent girl said:

“When it comes, it hurts my abdomen, stomach, and waist. Because of that, I cannot come to school. Your whole body is weak; when you stand up, you cannot walk. You cannot pay attention because your abdomen is hurting, and you have to put your head on the table; you cannot sit straight.” (Adolescent girl, 14 years old, JHS 3, Muslim).

Irregular menstrual cycle: Some adolescent girls described their menstrual flow as irregular ; sometimes miss their period or menstruate twice in a month. Girls who menstruated twice a month were scared because they did not understand the changes in their bodies. This made it difficult for adolescent girls to track the menstrual cycle. For example, a **15-year-old girl in JHS 2** stated:

“It comes every month, but sometimes I menstruate twice in a month, but this month I have not seen my period yet... I was really scared because it came two weeks after the previous period. I have never experienced that before.”

4.2.5: Individual level barriers to optimal menstrual hygiene management

Individual-level barriers to optimal MHM comprised the cost disposable sanitary pads, inadequate access to age-appropriate menstrual hygiene information and negative cultural beliefs regarding menstruation. These barriers often forced girls to use unsafe menstrual materials and disposal practices.

Cost of sanitary pads: Adolescent girls experienced inadequate access to sanitary pads, the most preferred menstrual material. The girls expressed concerns about being unable to buy enough sanitary pads because they are expensive. The girls reported that inadequate access to sanitary pads contributed to unsafe menstrual hygiene practices and poor psychosocial well-being. The teachers stated that girls who used pieces of old cloth and tissue paper instead of sanitary pads were inactive in the classroom or missed school due to fear of leakage and period teasing. Both teachers and adolescent girls wanted the price of sanitary pads to be subsidised. One student said:

"At first, when it was 5 cedis, our mothers used to give us money without complaining, but now that it is 10 cedis, they are uncomfortable buying it. For example, if there are three girls in the house and you get your period at the same time and she has to buy for everyone, where will she get the 30 cedis to buy for all the three girls?" (Adolescent girl, 15 years, JHS 2, Christian).

A teacher also said:

"Now, a pad is around GH¢ 10 and above, so most girls cannot purchase it. So, most of them rely on tissue paper or rags. The maximum should be GH¢ 5. If it is down, that is okay. Last year, it was GH¢ 5; you see that absenteeism was not much among the girls. But now that it is GH¢ 10, it is not easy, and the children cannot buy it at GH¢ 10, and not all parents believe in this pad thing" (Female, 31 years old, teacher).

Inadequate access to menstrual information: The adolescent girls indicated that they get information about menstruation at school and at home. However, they felt the information was inadequate to address all their knowledge gaps about menstrual pains, irregular cycles, sex and pregnancy. One girl, for example, had this to say:

"We would be glad to get more information about menstruation. If we can get people from elsewhere to come and teach us about menstruation, we would like that. There are certain things that the masters (male teachers) do not tell us, so we don't know. So, if people come from elsewhere to teach us, they will give us more information, including what our teachers did not tell us. I want to know whether sleeping with a man during your period can make you pregnant." (Adolescent girl, 17 years old, JHS 3, Christian).

Some teachers confirmed that the adolescent girls needed more information about menstrual hygiene. The teachers revealed that the curriculum did not address all aspects of menstrual hygiene. The students needed comprehensive education about menstrual materials, safe disposal practices, and personal hygiene during menstruation. According to the teachers, there was a gap between what was being taught in school and what information was required for optimal menstrual hygiene management.

“The curriculum does not cover everything that the child is supposed to know about menstrual hygiene. Yes, to me, they need a lot of help with it. One, I think they should be educated on the materials to use when they are menstruating and their disposal. Also, how to keep themselves clean so that they would not get infections during their menstrual stage.” (Female, 29 years old, teacher).

Negative beliefs about used menstrual materials: Adolescent girls believed that sanitary pads could be used for rituals (“juju”) to destroy their marriages in the future or stop their menstrual cycle. Moreover, the girls reported that the burning of used menstrual materials could lead to infertility. They mentioned that these beliefs were handed down from parents and adults in the community. This led to inappropriate disposal of menstrual materials among adolescent girls. For instance, the girls indicated that they dispose of used sanitary pads in pit latrines or toilets instead of dropping them in a dustbin. One adolescent puts it this way:

“It is not good to throw your pad in a dustbin or on a refuse dump because people can pick it up for juju or do something against you. They can use it for money rituals or to make you infertile. Some can even prevent you from getting married; they can even stop your menses” (Adolescent girl, 15 years old, JHS 2, Christian).

4.2.6: Interpersonal level barriers to optimal menstrual hygiene management

Mothers communicated unclear information: The adolescents reported that some mothers did not communicate clearly about menstruation. According to the adolescents, when discussing issues of sexual and reproductive health with parents, mothers use vague words instead of using

specific words or phrases that they could easily understand. For example, some mothers used phrases such as “do not play with males”, “be careful with guys”, and “do not sleep with men”, which implied that girls should not have sex. One adolescent reported that:

“My mother told me to be careful with men now that I have my menses. She said, I shouldn’t meet with men because I could get pregnant.” (Adolescent girl, 17 years old, JHS 3, Muslim).

Mothers felt uncomfortable talking about menstruation: The girls reported that some mothers felt uncomfortable discussing menstruation with their daughters. They indicated that their mothers could talk to them about other issues but were unwilling to discuss menstruation. Some girls mentioned that the unwillingness of mothers to talk about menstruation affected girls’ knowledge and skills to manage menstruation as well as their perceptions about menses. As a result, adolescent girls initiated most mother-daughter communication about menstruation. Some adolescents were unaware of menstruation until menarche. For example, two girls said:

“My mother doesn’t like talking about menstruation, but she will advise you about certain things. It was the first time I had my menses, and that was when she sat me down to explain menstruation to me and how to take care of myself” (Adolescent girl, 15 years old, JHS 3, Muslim).

“I heard about menstruation through my mother. One day, my mother sent me to buy sanitary pads for her, so I asked her about the use of pads because I had heard people talking about them, she then explained to me that when you get to a certain age, you will experience blood and you can use a pad to support yourself” (Adolescent girl, 17 years old, JHS 3, Muslim).

Fathers did not discuss menstruation with daughters: According to the girls, their fathers did not talk to them about menstruation. Some girls stated that it is the mother’s responsibility to socialise the girl-child, while the father socialises the boy-child. Therefore, it was not the father’s

responsibility to talk to girls about menstrual hygiene. The girls said that their fathers often cautioned them about sex and pregnancy. One girl stated:

“The reason why some fathers do not talk about menstruation is that they think it is the responsibility of mothers, and their (the father’s) responsibility is to talk to the boys. But they tell us that if any girl in the house follows men and gets pregnant, they will beat that girl till she gets a miscarriage (laughs)” (Adolescent girl, 17 years old, JHS 3, Muslim).

4.2.7: School level barriers to optimal menstrual hygiene management

No private changing room in school: There was no designated place or room for changing menstrual materials. The girls were therefore compelled to change their menstrual materials in the toilet room or urinal. These were either unclean or had odour. Consequently, some girls reported that they usually go home to change their menstrual materials. One girl stated:

“We do not have a menstruation room in this school. Maybe you are menstruating, and you come to school. You cannot share the urinal with girls who are not menstruating. So, they have to build a room where we can go and change our sanitary pads” (Adolescent girls, 17 years, JHS 3, Christian).

The teachers confirmed that the schools lack menstrual hygiene facilities, including designated rooms for changing menstrual materials. They indicated that the absence of private changing rooms posed a challenge for girls to frequently change their menstrual materials and engage in effective learning. The teachers advised the female students to change their menstrual materials in the toilet rooms. One teacher said:

“Yes, when you look at it, I think this wasn’t in the plan of the government when they were putting up the building, so because of that, there is no specific place or room for menstruation. Sometimes we advise them to use the toilet facilities for those things” (Male, 37 years old, teacher).

Unclean toilet and urinal facilities: Girls in schools with urinal and toilet facilities complained about the poor condition of these facilities. According to the girls, community members shared

toilet facilities with students or defecated in the urinal due to lack of lockable doors. Hence, these facilities were very dirty and unfit for purpose. Some girls reported that they had no alternative but to change menstrual materials in the unclean toilet facilities. This led to a decrease in the frequency of changing menstrual materials while at school.

“Because our school is in the community, some community members defecate in the urinal; sometimes they defecate on the toilet floor instead of sitting in the hole; they urinate and make the toilet room very dirty; we cannot even enter the toilet and change our pads” (Adolescent girl, 15 years, JHS 2, Christian).

Inadequate access to soap for handwashing at school: According to the girls, the schools did not have soap for handwashing during menstruation. Teachers were unwilling to buy soap for students. Therefore, the girls contributed money to buy soap or borrowed soap from food vendors to wash their hands. The girls stated that they sometimes wash their hands without soap.

According to one girl:

“We don’t have soap, but we informed the headmaster, and he said that he cannot buy soap. So, we contributed money to buy the soap ourselves, but when the soap finished, the girls were unwilling to contribute money to buy the soap. That is why we don’t have soap in the school. If all the girls were in agreement, we could have contributed money to buy enough soap. Sometimes we don’t even get soap to wash; you have to go to the common market/food sellers to beg for soap. The masters don’t care about the soap; we buy the soap ourselves.” (Adolescent girl, 17 years old, JHS 3, Christian).

The teachers stated that previously, students were asked to contribute money to buy soap. However, the teachers were no longer permitted to collect money from students or parents due to a new regulation from the Ghana Education Service. The teachers added that the schools were supplied with soap during the outbreak of the COVID-19 pandemic, but the soap supply had ceased. So, there was no soap in the school for handwashing. One teacher indicated that:

“At first, we used to take money from the students to buy soap, but the government asked teachers not to collect money from students or parents. Now there is no soap in this

school. They provided soap during the peak of the COVID-19 pandemic, but it is finished, and they are not providing it anymore (Female, 32 years old, teacher).

Lack of handwashing facilities: The participants highlighted the lack of handwashing facilities in the schools. The students indicated that the schools were supplied with Veronica buckets when the COVID-19 pandemic broke out. The buckets, however, were destroyed by the wind. As a result, some adolescent girls did not wash their hands before and after changing their menstrual materials in school. One student replied that:

“When COVID-19 was around, they provided Veronica buckets for us to wash our hands because of the infection. But the wind blew and broke some of the Veronica buckets, so they packed them in the office. The cops got broken, so the Veronica buckets are destroyed or not functioning, so we no longer have Veronica buckets” (Adolescent girl, 15 years old, JHS 3, Muslim).

The teachers expressed similar concerns regarding the unavailability of handwashing facilities in the schools. They stated that the Veronica buckets were not properly fitted, resulting in their breakage and subsequent inability to perform their intended function. One teacher stated:

“We were having Veronica buckets, but they were not properly fitted. So, all the Veronica buckets have spoiled” (Female, 32 years old, teacher).

Lack of dustbins in toilet facilities: The students reported that they tied used sanitary pads in plastic bags and dropped them in the toilet pit because the schools had no dustbins in the toilet rooms. They added that the absence of dustbins contributed to the inappropriate disposal of menstrual materials. One student reported that:

“We tie it in a plastic bag and throw it in the toilet pit. We don’t have dustbins in the toilet room” (Adolescent girl: 18 years old, JHS 3, Christian).

The teachers explained that there were no dustbins in the toilet because the students usually dropped their used sanitary pads in the toilet pit. The teachers underscored that it was necessary

for bins to be provided in the toilet rooms to help students practise proper disposal of sanitary pads. They indicated that it is important because the girls may find themselves in an environment where the toilet facility is a water closet. One teacher stated:

“There is no bin there with a cover; what they do is that they put it inside the toilet. Actually, we don’t have a bin in the toilet because they remove it and drop it inside; they don’t soil or litter the place with sanitary pads, which is why it has not come to our attention to provide them with a bin. Well, there is a need for it; they have to learn how to use the bin now because, if it is a water closet, they cannot drop the pad inside. That is why they just drop it directly into the toilet. So, if they have a bin and they are practising, when they get to a place where the toilet is a water closet, they won’t find themselves wanting” (Female, 29 years old, teacher).

No sanitary pad in schools for emergencies: According to the girls, the schools did not have menstrual materials to support girls during unexpected menstruation. The girls indicated that female students who soiled their uniforms were asked to go home and change. This was what one girl said:

“In this school, there are no sanitary pads, so the masters ask girls who soil their uniform to go home and change. She may decide to come back or stay home after changing the pad at home” (Adolescent girl, 17 years old, JHS 3, Muslim).

Teachers also expressed concerns about the lack of sanitary pads for students to use during emergencies. A teacher recounted an experience with a student who had unexpected bleeding while at school. The teachers reported that the lack of sanitary pads in school placed an undue burden on female students and contributed to absenteeism and reduced participation in school activities. The teachers highlighted that it was necessary for sanitary pads to be in schools to help reduce period teasing and shaming. One teacher shared his opinion:

“I have encountered problems like this two times, when I was a teacher in the primary school. So, when I was in primary school, one girl came and told me that she wanted to go home. I asked her the reason, and she was not able to disclose it. She turned her back, and I just saw that all her uniform was soiled with blood. So, I quickly ran back to the classroom, and luckily, we had four clothes for the school. So, I just took one for her to

cover herself. In fact, we don't have pads in the school for emergency cases like this, so whenever it happens, it is a difficult thing" (Male, 37 years old, teacher).

Lack of painkillers (analgesics) in schools: The adolescents reported that there were no medicines in the schools to support girls who experience menstrual pain. The teachers reported that the District Health Directorate had asked teachers to stop prescribing medicines to students because they are not health professionals. A girl said,

"I am the health prefect in this school. Our headmaster said we shouldn't serve any girl with medicine because we may not know what disease the person is having. So, when you have pain, the only thing to do is visit the hospital" (Adolescent girl, 15 years old, JHS 3, Muslim).

Some teachers explained the reasons underlying the lack of painkillers in schools. They indicated that sometime ago, the schools had medicines in their first aid boxes to support students with minor health conditions, including period pain. They indicated that the practice was halted when the health directorate raised concerns about the potential risks associated with administering medication without proper medical supervision. As a result, the teachers reported that they no longer provide painkillers or any other form of medication to students. They indicated that students who experience menstrual pain were given permission to go home for the necessary treatment. One teacher explained:

"Some time ago, we used to have these pain killers, but at one point, the health directorate said it was not advisable for us to have medicines in the school because we may not know the condition. So, we don't have anything like that again" (Male, 37 years old, teacher).

Lack of a female teacher: Girls and teachers were concerned about the absence of female teachers in some schools. The students stated that the male teachers were not approachable or supportive when it came to providing information about menstrual hygiene. Hence, they had to

rely on friends for assistance. According to the girls, the absence of a female teacher led to inadequate support for female students who needed help with issues related to menstruation. This was what a girl said:

“We don’t have a madam in this school, and the masters don’t care if you soil yourself. If we had a madam, we could go to her for help, she knows that mistakes can occur, but since we don’t have a madam, the masters don’t support us. So, if you mistakenly soil yourself, you can speak to a friend whose house is not far and follow her home to get a pad and change” (Adolescent girl, 17 years old, JHS 3, Christian).

Some male teachers also shared their opinions regarding the lack of a female teacher. A male teacher expressed that it is challenging to discuss menstruation-related issues with female students. Girls may feel shy or uncomfortable sharing menstrual information with men. The absence of a female teacher created a barrier to open communication about menstruation. It also made it difficult for the students to address their menstrual hygiene concerns. A teacher said:

“I said it was difficult because we don’t have a lady teacher among us; yeah, we don’t have a female teacher, so when it happens like that, you know, as we are men, the girls will be feeling shy to disclose such a thing” (Male, 37 years old, teacher).

Period teasing: Both the teachers and adolescent girls indicated that period teasing was prevalent in the schools. They added that girls who soiled their uniforms were shamed and teased. Some teachers explained that the teasing was mostly carried out by male students. Period teasing affected girls’ confidence in the classroom and psychosocial well-being. Additionally, the girls indicated that the news sometimes spread to community members who would heckle them. One girl responded that:

“Some of the boys will tease, and some of the girls will tease. But some will tease you everywhere they see you and go into the community to tell other people who will tease you whenever they see you. Some of the boys and girls tease but not all of them do that” (Adolescent girl, 17 years old, JHS 3, Christian).

According to one teacher,

“Oh yes, many times. When it happens, I think I have experienced it at least three times, and I had to talk with those guys and make them understand the way it is supposed to be. They should not always be teasing the girls. I make them understand that it is normal. As a human being, it is not always the case that things will be right for you” (Male, 37 years old, teacher).

4.2.8: Societal level barriers to optimal menstrual hygiene management

Restricted from religious activities during menstruation: Some girls believed that females should not enter the mosque during menstruation. They indicated that it is considered a bad thing to do so, with the possibility of punishment from God. Moreover, the girls indicated that touching ablution containers during menstruation could bring a curse on their lives. The girls were informed about these beliefs by religious leaders. These restrictions made it difficult for girls to use ablution containers to wash their genitals during menstruation. A girl said:

“It is not good for girls to enter the mosque during menstruation. You don’t have anything to do at the mosque when you are menstruating. Also, it is a bad thing to enter the mosque with a period, and you will get punished for that. So, it is not even good to touch the buta (ablution can) when you have your menses. When you touch that buta, there will be a curse on your life” (Adolescent girl, 17 years old, JHS 3, Muslim).

Restricted from domestic activities during menstruation: The girls indicated that some community members had negative perceptions about menstruation. They added that the negative perceptions were rooted in the belief that menstruation is a bad thing. This led to restrictions on participating in some domestic activities, such as cooking food. The girls stated that their parents or other adults in the community imposed these restrictions on them. An adolescent said:

“It is not good because they perceive the source of the blood as a sin or bad thing. If you prepare food for your father, it is not good; if your father is a Muslim, he will not allow you to cook during your menses” (Adolescent girl, 15 years old, JHS 2, Christian).

Discrimination against menstruating girls and women: The girls revealed that it is deemed unacceptable for menstruators to share household items with men. Menstruators were considered dirty or unclean; hence, any item they used was rendered unholy. These discriminations affected girls' self-confidence in managing menstruation and access to buckets to fetch water to wash menstrual materials and bathe during menstruation. This was a response from one girl:

“In our community, they believe that it is fine or good for a man to use a bucket to bathe and a woman to use the same bucket to fetch water for ablution. However, when a woman uses a bucket to bathe even when she is not having her period, that bucket becomes unclean. They believe, for example, that a woman can eat from a bucket in which a man has bathed. A man, however, cannot eat from a bucket that has been used by a woman. They discriminate against women” (Adolescent girl, 15 years old, JHS 3, Muslim).

Facilitators of optimal menstrual hygiene management

The findings showed that the main theme for facilitators of optimal MHM included factors at the interpersonal and school levels. Two sub-themes were found under each main theme (Table 4.4).

4.2.9: Interpersonal-level facilitators of optimal menstrual hygiene management

Parental support during menstruation: The adolescent girls revealed that they received support from their parents during menstruation. They added that their mothers were the main benefactors of sanitary products, including soap for bathing and sanitary pads. Their mothers also encouraged them to maintain good personal hygiene during menstruation. The girls reported that their fathers sometimes provided money for them to buy sanitary pads. Girls who reported parental support said they did not miss school or engage in transactional sex for sanitary pads. One girl shared her view on parental support:

“My mother always gives me money to buy sanitary pads and teaches me how to use a pad. She tells me to change the pad frequently, so that is the support I get from my mother. If I request money from my mother to buy sanitary pads, she will give it to me. If

she doesn't have any money, I go to my father to collect money for sanitary pads”(Adolescent girl, 17 years old, JHS 3, Christian).

Peer support during menstruation: Adolescent girls were willing to support colleagues in need.

The girls indicated that they brought extra pads to school to help other girls who may be in need since there were no sanitary pads in the schools. The girls also assisted peers who soiled their uniforms to clean up or provided their jackets to cover up. One girl stated:

“I always bring a pad to school. It may not be my period that will come, but I can help someone who soils herself. We can take the person and fetch water to the urinal so that she can remove her underwear, wash and use the pad” (Adolescent girl, 17 years old, JHS 3, Christian).

4.2.10: School-level facilitators to optimal menstrual hygiene management

Access to information about menstruation at school: The girls reported that menstrual hygiene management is part of the curriculum. Menstruation-related topics were delivered through multiple taught subjects, including Science, Social Studies, and Religious and Moral Education. The teachers confirmed that MHM was one of the topics in the curriculum. Further, health workers visited the schools to talk to students about health issues, including menstrual hygiene.

An adolescent girl said:

“They teach us about menstruation in school. They teach menstruation in JHS one. The topic includes responsible adolescent behaviour. These topics are covered in courses such as Science, Social Studies, and Religious and Moral Education. They teach us how to manage our menstruation” (Adolescent girl, 15 years old, JHS 2, Christian).

One teacher reported:

“Yes, it happens that the school's location is not far from the clinic. So, from time to time, we do have the nurses come and sit with the girls and talk to them about these things. We also teach them menstruation, which is an aspect of integrated science where we have a topic called reproductive system, and when you enter, definitely all these things will come up” (Male, 37 years old, teacher).

Availability of water in schools: The teachers stated that both governmental and non-governmental organisations provided support to the schools by installing boreholes. The schools also had containers for storing water. According to the teachers, they made sure the students fetched water into the containers every morning to ensure a steady supply of water throughout the day. One participant said:

“We also have a borehole in the school compound; we have gallons and ablution cans that you can use when you want to change your pads” (Adolescent girl, 15 years old, JHS 3, Muslim).

One teacher indicated:

“We have containers that we fetch our water in. So, after they change their pads, they get the water from the containers that we have filled here around the school. We make sure that every morning, we get some students to fetch water for the containers. So almost all the time there is water” (Male, 37 years old, teacher).



Table 4. 3: Perspectives of adolescent girls and teachers regarding barriers to optimal menstrual hygiene management

Main theme	Sub-themes	Quotation from students	Quotation from teachers
Biological-level barriers	Menstrual symptoms	When it comes, it hurts your abdomen, stomach and waist. Because of that, you cannot come to school; your whole body is weak when you want to stand up, and you cannot walk. You cannot go to school. You cannot pay attention because your stomach is in pain, and you have to put your head on the table. You cannot sit straight (Adolescent girl, 14 years old, JHS 3, Muslim) .	
	Irregular cycles and heavy bleeding	It comes every month, but sometimes I menstruate twice in a month, but this month I have not seen my period yet. Yes, I was really scared because it came two weeks after the previous period. I have never experienced it before (Adolescent girl, 15 years old, JHS 2, Christian) .	
Individual-level barriers	Inadequate access to menstrual information	We would be glad to get more information about menstruation. If we get people from elsewhere to come and teach us about menstruation, we will like it. There are certain things that the masters (teachers) do not tell us, so we don't know. So if people come from elsewhere to teach us, they will give us more information, including what our teachers did not tell us. I want to know whether sleeping with a man during your period can make you pregnant. (Adolescent girl, 17 years old, JHS 3, Christian)	Actually, it does not cover everything that the child is supposed to know about menstrual hygiene. Yes, to me, they need a lot about it. Okay, one, I think they should be educated on the materials to use when they are menstruating, their disposal when they are menstruating and also how to keep themselves clean so that they would not get infections during their menstrual stage (Female, 29 years old, teacher)
	Negative beliefs about menstruation	It is not good to throw your pad in the dustbin or refuse to dump it because people can pick it up for juju or do something against you. They can use it for money rituals or make you infertile; some can even prevent you from getting married; or they can even stop your menses. I will never drop my pad in the dustbin, even if they provide one (Adolescent girl, 15 years old, JHS 2, Christian) .	
		Yes, they sell pads in this community, but they are expensive. Some are sold for GH¢ 8 and 10. YAZZ is 10 and SOFTCARE is 8 cedis, but some people sell it for 7	Yes, now, a pad is around GH¢ 10 and above, so most of the girls are not able to purchase one. So, most of them rely on this tissue or rags (Female, 31 years old,

Interpersonal-level barriers	Inadequate access to sanitary pads	cedis. Sometimes, I am scared/worried when I am about to have my period because I won't have money to buy a pad (Adolescent girl, 18 years old, JHS 3, Christian) .	teacher).
	Mothers communicate unclear information	She told me to be careful with men now that I have my menses. She said I shouldn't meet with men because you get pregnant. You should not sleep with a man because you will get pregnant and ask me to go and buy a pad to use or else it will soil my dress (Adolescent girl, 15 years old, JHS 1, Muslim) .	
	Fathers don't discuss menstruation with daughters	The reason why some fathers do not talk about menstruation is that they think it is the responsibility of mothers, and their responsibility is to talk to the boys. But they tell us that, if any girls in the house follow men and get pregnant, they will beat that girl till she gets a miscarriage (Adolescent girl, 17 years old, JHS 3, Muslim) .	
	Mothers are uncomfortable talking about menstruation	My mother doesn't like talking about those matters, but she will advise you about certain things. It was the first time I had my menses, and that was when she sat me down to explain menstruation to me and how to take care of myself (Adolescent girl, 15 years old, JHS 3, Muslim) .	
	No menstruation room	We don't have a menstruation room. Maybe you are menstruating, and I don't know, you cannot share the urinal with girls who are menstruating. So, they have to build a room where we can go and change all the things that is needed there (Adolescent girl, 17 years old, JHS 3, Christian)	Yes, when you look at it, I think this wasn't in the plan of the government when they were putting up the building, so because of that, there is no specific place or room for changing pads and sometimes we advise them to use the toilet facilities here for those things (Female, 27 years old, teacher)
	Unclean toilet and urinal facilities	Adolescent girl, 15 years old, JHS 2, Christian: Because our school in the community, some community members defecate in the urinal, sometimes they shit on the toilet floor instead of the shitting in the hole, they urinate and make the toilet room very dirty, we cannot even enter the toilet and clean it. Sometimes, we do not even defecate in the toilet. If you have the urge to defecate, you have to wait till closing and go home to	

defecate.

School-level barriers

Inadequate supply of soap

Adolescent girl, 17 years old, JHS 3, Christian: We don't have soap, but we informed that headmaster, so they should buy soap for us, and they asked us to inform the assistant headmaster and he said that if we cannot buy soap, then we let it go. So, we contributed money to buy the soap ourselves but when the soap finished, the girls were unwilling to contribute money to buy the soap, or they will say you are very rich and they don't need soap for anything. That is why we don't have soap in the school. If all the girls were in agreement, we could have contributed money to buy enough soap. Sometimes we don't even get soap to wash the teachers' bowls; you have to go to the common market/food sellers to beg for soap. The masters don't care about the soap; we buy it ourselves.

Lack of hand washing facilities

When COVID-19 was around, they provided Veronica buckets for us to wash our hands because of the infection. But the wind blew and broke some of the Veronica buckets, so they packed it in the office. The cops got broken, so the Veronica buckets were destroyed or not functioning, so they packed them in the school office, so we no longer have Veronica buckets. **(Adolescent girl, 16 years old, JHS 2, Muslim)**

Lack of dustbins

Adolescent girl, 18 years old JHS 3, Christian: We tie it in a plastic bag and throw it in the toilet. We don't have dustbins in the toilet room.

No sanitary pads in school for emergency

Adolescent girl, 17 years old, JHS 3, Muslim: In this school, there are no sanitary pads, so the masters ask girls who soil their uniform to go home and change. She may decide to come back or stay home after changing the pad at home.

Ok, at first, we used to take money from the students to buy soap, but the new government asked teachers not to collect money from students nor parents. Now there is no soap in this school. They provided soap during the peak of the COVID 19, but it is finished, and they are not providing it anymore **(Female, 32 years old, teacher)**.

We were having Veronica buckets, but they were not properly fitted. So, all the Veronica buckets have spoiled (broken) **(Female, 27 years old, teacher)**

There is no bin there with a cover; what they do is put it inside the toilet. Actually, we don't have a bin in the toilet. So, I think if have a bin and they are practising putting, may be if they get to a place and there is WC, they won't find themselves wanting. Where do I drop my sanitary pad? **(Female, 29 years old, teacher)**

Male, 37 years old, teacher. (Laughing) I have encountered this problem like this two times and that was when I was in the primary school, I taught in the primary school first, so when I was there one girl came and told me that she wanted to go home, I asked her the reason and she was not able to disclose it, she turned her back and I just saw that all her uniform was blood. So, I

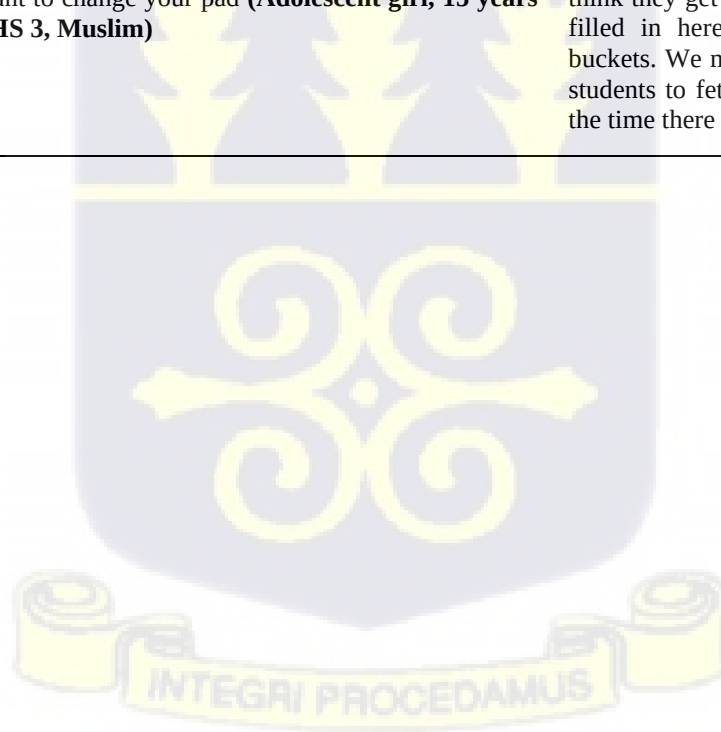
No painkillers in school	Adolescent girl, 15 years old, JHS 3, Muslim: I am the health prefect in this school. Our headmaster said we shouldn't serve any girl with medicines, because we may not know what disease they person is having. So, when you have pain, the only thing to do is to visit the hospital. Male, 35 years old, teacher. Sometime ago, we used to have these painkillers, but it came at a time when the health directorate said it was not advisable for us to have medicines in the school because we may not know the condition. So, we don't have anything like that again. Fortunately, we have never encountered such a problem, and we are praying not to. I think not all of them have the pains when it comes to that. We have not encountered such a thing here.	quickly ran back to the classroom and lucky we were having four clothes for the school, so I just took one for her to cover herself. So, in fact we don't have pads in the school here for emergency like that, so whenever it happens like that, we, it is a difficult thing, is very difficult
Lack of a female teacher/staff	Adolescent girl, 17 years old, JHS 3, Christian: We don't have a madam (female teacher) in this school, and the masters (male teachers) don't care if you soil yourself. If we had a madam, we could go to her for help. She knows that a mistake can occur, but since we don't have a madam, the masters don't support us. So, if you mistakenly soil yourself, you can speak to a friend whose house is not far and follow her home to get a pad to change.	Why I said it is difficult is because we don't have a lady teacher among us, yeah, we don't have a female teacher, so when it happens like that you know as we are men, the girls will be feeling shy to disclose such a thing. We don't have any pad in the school to be given to them in terms of emergency, we always allow them to go home (Female, 35 years old, teacher).
Period teasing	Adolescent girl, 17 years old, JHS 3, Christian: Some of the boys will tease and some of the girls will tease. But some will tease you everywhere they see you and go into the community to tell other people who will tease you whenever they see you. Some of the boys and girls tease but not all of them do that. Adolescent girl, 17 years old, JHS 3, Muslim: it is not good for girls to enter the mosque during menstruation. You don't have anything to do at the mosque when you	Oh yes, many times. When it happens, I think I have experienced it at least three times and I had to sit with those guys teasing them and let them understand the way it is supposed to be. So, I made them understand that it was a mistake. The person is not willing to be like that and it happened So, they should not always be teasing them and whatever, I make them understand that it is normal. As a human being, it is not all the time that things will be right for you (Male, 37 years old, teacher).

Societal level barriers	Restriction from religious activities	are menstruating. Also, it is a bad thing to enter the mosque with period and you will get punished for that. So, it is not even good to touch the ‘buta’ (ablution can) when you have your menses. When you touch that ‘buta’, there will be a curse on your life.
	Restrictions from domestic activities	It is not good because they perceive the source of the blood as a sin/bad thing, because if you prepare food for your father, it is not good, if your father is a Muslim, he will not allow you to cook during menses (Adolescent girl, 15 years old, JHS 2, Christian)
	Discrimination against women	In our community, they believe that it is fine/good for a man to use a bucket to bathe and a woman to use the same bucket to fetch water for ablution. However, when a woman uses a bucket to bathe even when she is not having her period, that bucket becomes unclean. For example, they believe that a woman can even eat from a bucket that has been used by a man to bathe. But a man cannot eat from a bucket that has been used by a woman, no matter how new the bucket looks. They discriminate against the women (Adolescent girl, 15 years old, JHS 3, Muslim)

Table 4. 4: Perspectives of adolescent girls and teachers regarding facilitators of optimal menstrual hygiene management

Main theme	Sub-themes	Quotation from students	Quotation from teachers
Interpersonal level facilitators	Parental support during menstruation	My mother always gives me money to buy sanitary pads and teaches me how to use a pad, she tells me to change the pad frequently, so that is the support I get from my mother. If I request for money from my mother to buy sanitary pad, she will give me, if she doesn't have money, I go to my father to collect money for sanitary pad (Adolescent girl, 17 years old, JHS 3, Christian) I always bring a pad when I am coming to school, it may not be my period that will come, I can help someone	

School level facilitators	Peer support during menstruation	who soils herself, we can take the person and fetch water to the urinal so that she can remove her panty and wash her genitals and panty and use the pad. Yes, we change in the urinal, sometimes in the toilet (Adolescent girl, 18 years old, JHS 2, Christian)	
	Access to menstrual information at school	They teach us about menstruation in school. Teach menstruation in form one. The topic includes responsible adolescent behaviors, adolescence. These topics are in science, social studies and religious and moral education. They teach us how you can manage your menstruation (Adolescent girl, 15 years old, JHS 2, Christian)	Yes, they do get, yes it happens that the school's location is not far from the clinic, so from time to time we do have the nurses come and sit with the girls and talk to them about these things. We also teach them menstruation, is an aspect of integrated science where we have a topic called reproductive system and when you enter there definitely all these things will come up and also give small education to them (Male, 35 years old, teacher)
	Availability of water facilities	We also have a borehole in the school compound, we have gallons and ablution cans which you can use when you want to change your pad (Adolescent girl, 15 years old, JHS 3, Muslim)	We have containers that we fetch our water in, so these containers after they change their pads as you said, I think they get the water from the containers that we have filled in here around the school. They are Veronica buckets. We make sure that every morning, we get some students to fetch into the Veronica bucket, so almost all the time there is water. (Male, 37 years old, teacher)



4.3: Results of the Cluster--Randomised Trial

4.3.1: Characteristics of clusters

A total of 63 public junior high schools in the two districts were assessed for eligibility, of which 61 were eligible. Twenty-two (22) eligible schools were randomly selected and randomised to the intervention and control groups. All the schools in the intervention group received the intervention. None of the schools were lost to follow-up, and data from all the schools were included in the analysis. The analysis was conducted according to the originally assigned groups (intention-to-treat analysis) (Figure 4.2).

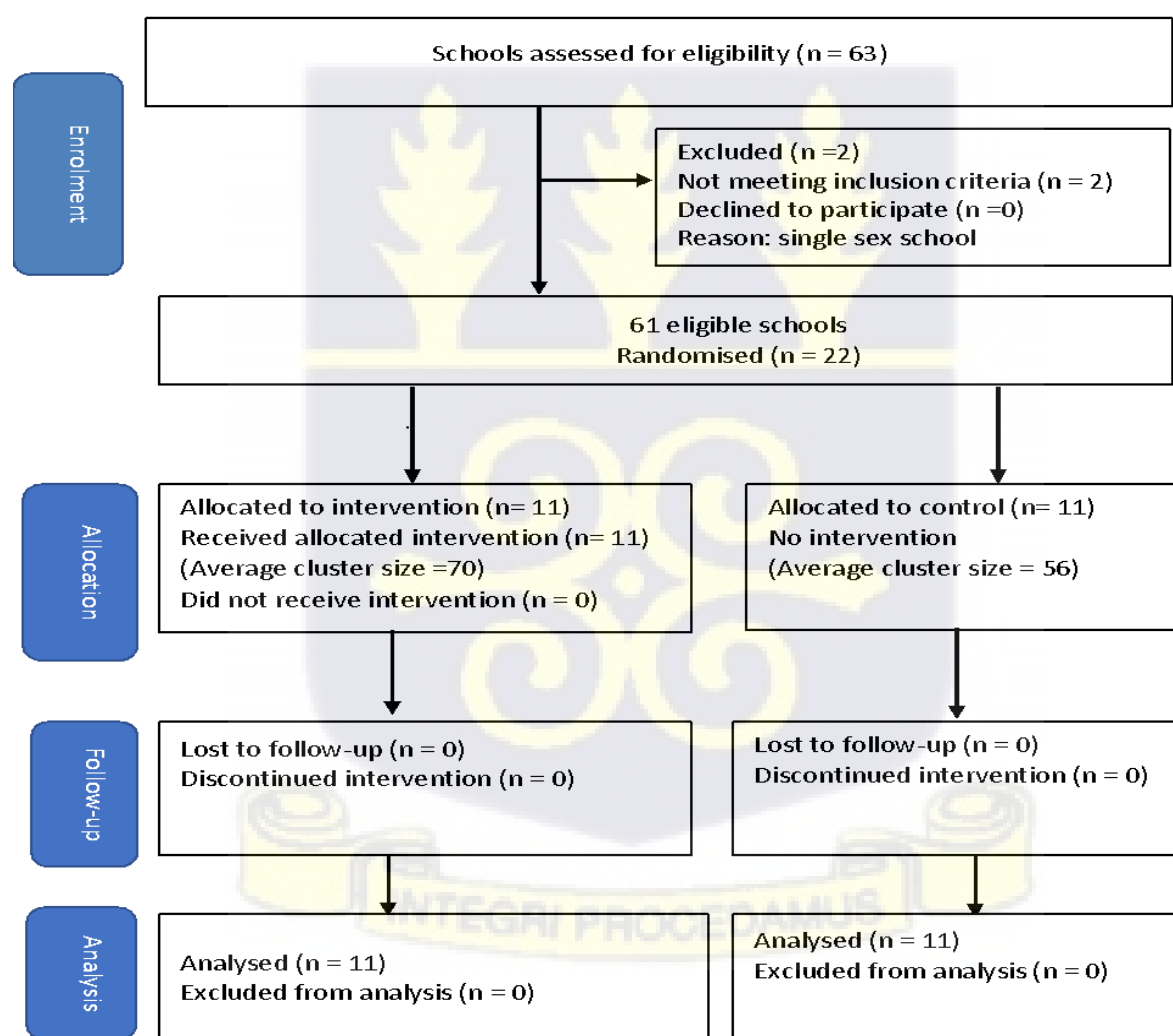


Figure 4:2 Flow chart for clusters

4.3.2: Characteristics of individual participants

Each study group had a total of 343 participants. In the intervention group, 87% of the participants bought the subsidised sanitary pads, 91% received the menstrual health educational booklets, and 80% participated in the menstrual hygiene training activities. About 7% of participants in the intervention group and 6% of those in the control group were lost to follow-up. The response rate for the primary outcome was 93% and about 94% for intervention and control groups, respectively. Figure 4.3 is a flow chart for enrolment, allocation, and follow-up of the participants.

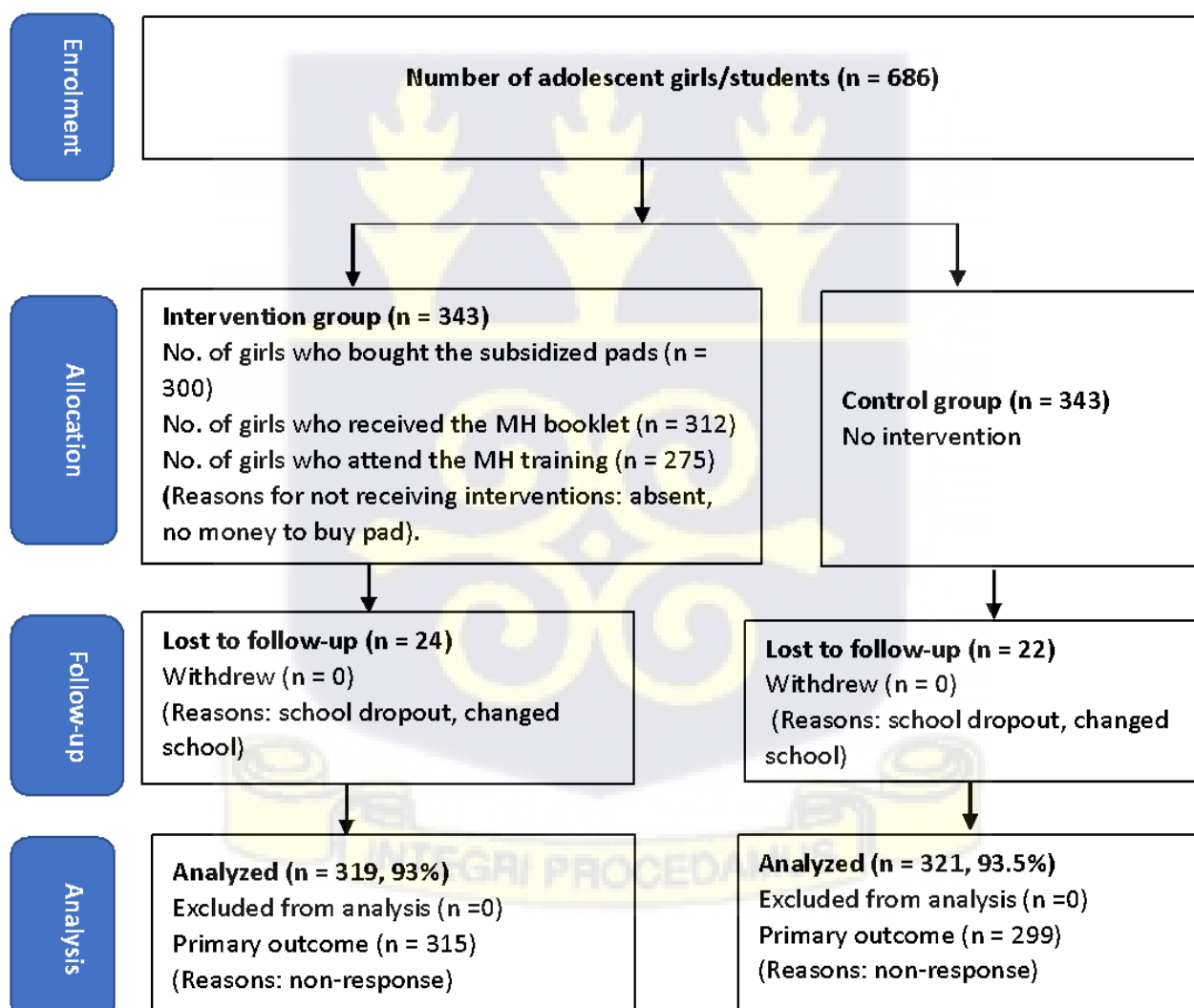


Figure 4:3 Flow chart for individual participants

4.3.3: Characteristics of selected clusters or schools

The average number of teachers per school was eight for the intervention schools and six for the control schools. The average number of male teachers in the intervention and control schools was seven and five, respectively. The average number of female students was 70 and 56 for the intervention and control schools, respectively. Additionally, two schools in each group had a handwashing facility. Three schools in each group had soap for handwashing, while none of the schools had sanitary pads for emergencies (Table 4.5).

Table 4. 5: Characteristics of clusters in intervention and control groups

Characteristics	Intervention (n = 11) <i>m(sd)</i>	Control (n = 11) <i>m(sd)</i>
Mean number of male teachers	7 (1.6)	5(1.6)
<i>Minimum</i>	4	2
<i>Maximum</i>	8	8
Mean number of female teachers	1(0.8)	1(1.1)
<i>Minimum</i>	0	0
<i>Maximum</i>	2	3
Mean number of all teachers	8(1.6)	6(2.2)
<i>Minimum</i>	5	2
<i>Maximum</i>	10	11
Mean of male students	59(14.9)	51(17.1)
<i>Minimum</i>	43	32
<i>Maximum</i>	90	83
Mean of female students	70(24.6)	56(15.6)
<i>Minimum</i>	34	36
<i>Maximum</i>	114	80
Access to menstrual hygiene facilities	n (%)	n (%)
Availability of source of water	5(45.5)	10(90.9)
Availability of veronica bucket	2(18.2)	2(18.2)
Availability of soap	3(27.3)	3(27.3)
Availability of toilet facility	8(72.7)	11(100)
Availability of dustbin in toilet room	3(27.3)	2(18.2)
Availability of urinal facility	10(90.9)	11(100)
Availability of sanitary pad in school	0(0)	0(0)
Availability of changing room	4(36.4)	1(9.1)

4.3.4: Participant characteristics

The mean age of the participants was 15.5 ($\pm$ 1.2) years. A majority (74.3%) of the participants were in middle adolescence (15–17 years). More than half (61.3%) of the participants were in JHS 2. Most of the participants professed Islam (57.3%). Seven in ten participants (70.3%) were associated with the Kusasi ethnic group. Exactly 28.9% of the participants indicated that their mothers had no formal education, and 23% reported that their fathers had attained junior high school education. More than half of the participants stated that their fathers were farmers (64.2%), while 45.7% stated that their mothers were farmers. More than half of the participants were staying with both parents (52.1%). A majority of the participants had access to radio (65.8%) and television (54.2%) at home. About seven in ten participants (68.1%) received pocket money. Missing data could be a result of different factors. Some individuals may have avoided answering certain questions due to discomfort or sensitivity issues. In addition, the research assistants might have unintentionally skipped some questions while they were administering the questionnaire (Table 4.6).

Table 4. 6: Participant characteristics

Characteristics	Intervention n (%)	Control n (%)	Total n (%)
Age of respondent (years)			
13-14	70(20.7)	56(16.7)	126(18.7)
15-17	261(77.2)	239(71.4)	500(74.3)
18-19	7(2.1)	40(11.9)	47(7.0)
Total	338(100)	335(100)	673(100)
Class of respondent			
JHS 1	160(46.8)	105(30.7)	265(38.7)
JHS 2	182(53.2)	237(69.3)	419(61.3)
Total	342(100)	342(100)	684(100)
Religion			
Christianity	194(57.1)	90(26.0)	284(41.7)
Islam	144(42.4)	246(72.1)	390(57.3)
Other (traditional, no religion)	2(0.5)	5(1.5)	7(1.0)

Table 4. 6: Participant characteristics

Total	340(100)	341(100)	681(100)
Ethnicity			
Kusasi	259(76.2)	219(64.4)	478(70.3)
Bissa	35(10.3)	79(23.2)	114(16.8)
Moshie	19(5.6)	35(10.3)	54(7.9)
Others (Fulani, Frafra)	27(7.9)	7(2.1)	34(5.0)
Total	340(100)	340(100)	680(100)
Mother's educational status			
None	94(27.7)	102(30.1)	196(28.9)
Primary	89(26.3)	74(21.8)	163(24.1)
JHS	58(17.1)	67(19.8)	125(18.4)
SHS	35(10.3)	39(11.5)	74(10.9)
Tertiary	16(4.7)	29(8.6)	45(6.6)
Don't know	41(12.1)	17(5.0)	58(8.6)
Other	6(1.8)	11(3.2)	17(2.5)
Total	339(100)	339(100)	678(100)
Father's educational status			
None	67(19.8)	59(17.5)	126(18.6)
Primary	62(18.3)	70(20.7)	132(19.5)
JHS	69(20.4)	89(26.3)	158(23.3)
SHS	51(15.0)	47(13.9)	98(14.5)
Tertiary	42(12.4)	44(13.0)	86(12.7)
Don't know	27(8.0)	12(3.6)	39(5.8)
Other	21(6.1)	17(5.0)	38(5.6)
Total	339(100)	338(100)	677(100)
Mother's main occupation			
Unemployed	40(11.8)	30(9.0)	70(10.4)
Farming	146(42.9)	162(48.5)	308(45.7)
Trading	101(29.7)	108(32.3)	209(31.0)
Seamstress/ hairdresser	43(12.6)	24(7.2)	67(9.9)
Others	10(3.0)	10(3.0)	20(3.0)
Total	340(100)	334(100)	674(100)
Father's main occupation			
Unemployed	28(8.4)	18(5.3)	46(6.8)
Farming	215(64.2)	217(64.2)	432(64.2)
Trading	32(9.6)	50(14.8)	82(12.2)
Capenter/mason	31(9.2)	20(5.9)	51(7.6)
Others	29(8.6)	33(9.8)	62(9.2)
Total	335(100)	338(100)	673(100)
Stays with			
Both parents	188(55.1)	166(49.1)	354(52.1)
Mother only	77(22.6)	75(22.3)	152(22.4)
Father only	9(2.6)	15(4.4)	24(3.5)
Grandmother	60(17.6)	67(19.8)	127(18.6)
Others	7(2.1)	15(4.4)	22(3.4)

Table 4. 6: Participant characteristics

Total	341(100)	338(100)	679(100)
Has access to radio			
Yes	229(67.0)	218(64.7)	447(65.8)
No	113(33.0)	119(35.3)	232(34.2)
Total	342(100)	337(100)	679(100)
Has access to television			
Yes	175(51.3)	194(57.1)	369(54.2)
No	166(48.7)	146(42.9)	312(45.8)
Total	341(100)	340(100)	681(100)
Receives pocket money			
Yes	235(68.7)	230(67.4)	465(68.1)
No	107(31.3)	111(32.6)	218(31.9)
Total	342(100)	341(100)	683(100)

4.3.5: Menstrual characteristics

The mean age of menarche was 13.7 ($\pm$ 1.4) years. The average menstrual duration was 4.8 ($\pm$ 1.3) days, and the average menstrual cycle was 27.8 ($\pm$ 3.3) days. A majority of participants experienced pain during menstruation (76%); heavy menstrual bleeding (61.9%); and a regular menstrual cycle (73.3%). About four in ten participants who experienced menstrual pain sought treatment (Table 4.7).

Table 4. 7: Menstrual characteristics of participants

Characteristics	Intervention	Control	Total
Mean age at menarche (years); m (sd)	13.7($\pm$ 0.1)	13.7($\pm$ 0.1)	13.7($\pm$ 1.4)
Mean menstrual duration (days); m (sd)	4.7($\pm$ 0.1)	4.9($\pm$ 0.1)	4.8($\pm$ 1.3)
Mean menstrual cycle (days); m (sd)	27.7($\pm$ 0.2)	27.7($\pm$ 0.2)	27.8($\pm$ 3.3)
Experience menstrual pains, n (%)	249(72.8)	271(79.2)	520(76.0)
Experience heavy bleeding, n (%)	208(61.0)	214(62.8)	422(61.9)
Experience regular menstrual cycle, n (%)	282(82.7)	217(63.8)	499(73.3)
Sought treatment for menstrual pains, n (%)	116(34.8)	135(40.1)	251(37.5)
Where did you seek care? (multiple responses)			
Hospital/clinic, n (%)	121(36.2)	137(40.7)	258(38.5)
Pharmacy, n (%)	216(64.7)	199(59.1)	415(61.8)
Herbalist, n (%)	52(15.6)	45(13.4)	97(14.5)
Self-medication, n (%)	17(5.1)	12(3.6)	29(4.3)

4.3.6: Menstrual hygiene management practices at baseline

More than half of the participants used disposable sanitary pads to manage menstruation. A considerable proportion of the participants used tissue paper and piece of cloth to collect menstrual blood (Figure 4.4).

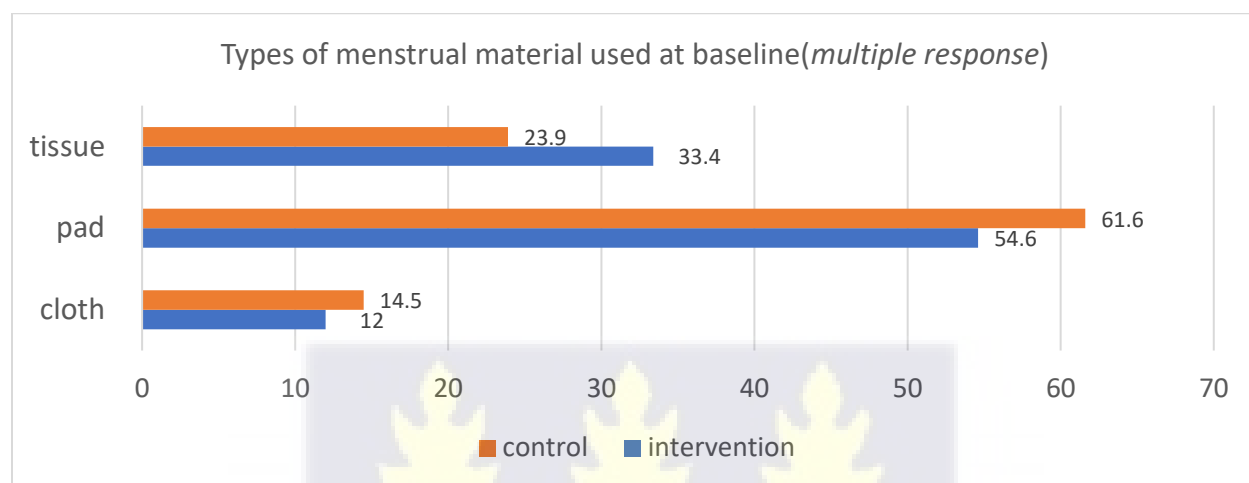


Figure 4:4 Types of menstrual materials used by participants at baseline

Exactly 52.9% of the participants changed their menstrual materials three times daily. At home, most participants changed their menstrual materials in the bathroom (52.2%). At school, 38.7% changed their menstrual materials in the toilet room. A majority of the participants indicated that they always wash their hands before (69.8%) and after (84.4%) changing their menstrual materials. More than half of the participants (54.3%) washed their genitals three times daily, and 58.6% always wash their genitals with soap. The majority of the participants disposed of their menstrual materials in pit latrines. Nine out of ten participants (92.4%) wrapped their menstrual materials in plastic bags prior to disposal. Most of the participants stored their unused menstrual materials in bags (83.3%). Among the participants who use reusable menstrual materials, a majority (87.7%) of them washed their menstrual materials in private (unshared) buckets.

Exactly 41.2% of the participants dry their reusable materials indoors. Exactly 33.5% of the participants did not iron their menstrual materials prior to reuse (Table 4.8).

Table 4. 8: Menstrual hygiene management among participants at baseline

Menstrual hygiene practices	Intervention n (%)	Control n (%)	Total n (%)
Frequency of changing materials			
One time	8(2.3)	16(4.7)	24(3.5)
Two times	120(35.0)	120(35.0)	240(35.0)
Three times	186(54.2)	177(51.6)	363(52.9)
Four or more times	29(8.5)	30(8.7)	59(8.6)
Total	343(100)	343(100)	686(100)
Changing places of materials at home			
Toilet/latrine	40(11.7)	59(17.2)	99(14.5)
Bedroom	138(40.3)	90(26.2)	228(33.3)
Bathroom	164(48.0)	194(56.6)	358(52.2)
Total	342(100)	343(100)	685(100)
Changing places of materials at school			
Toilet /latrine	116(34.0)	148(43.4)	264(38.7)
Urinal	103(30.2)	113(33.1)	216(31.7)
Changing room	122(35.8)	80(23.5)	202(29.6)
Total	341(100)	341(100)	682(100)
Washed hands before changing materials			
Never	28(8.3)	38(11.4)	66(9.9)
Sometimes	79(23.4)	57(17.2)	136(20.3)
Every time	231(68.3)	237(71.4)	468(69.8)
Total	338(100)	332(100)	670(100)
Washed hands after changing materials			
Never	12(3.6)	9(2.6)	21(3.1)
Sometimes	44(13.1)	41(12.0)	85(12.5)
Every time	281(83.3)	292(85.4)	573(84.4)
Total	337(100)	342(100)	679(100)
Frequency of washing genitals per day			
Once per day	18(5.2)	12(3.5)	30(4.4)
Twice per day	156(45.5)	127(37.1)	283(41.3)
Thrice or more per day	169(49.3)	203(59.4)	372(54.3)
Total	343(100)	342(100)	685(100)
Wash your genitals with soap			
Never	96(28.2)	88(25.7)	184(26.9)
Sometimes	51(15.0)	48(14.0)	99(14.5)
Every time	194(56.8)	206(60.3)	400(58.6)
Total	341(100)	342(100)	683(100)
Place for disposing materials at home			
Toilet	188(55.2)	299(87.5)	487(71.3)
Dustbin	143(41.9)	34(9.9)	177(25.9)

Table 4. 8: Menstrual hygiene management among participants at baseline

Never disposed	10(2.9)	9(2.6)	19(2.8)
Total	341(100)	342(100)	683(100)
Place for disposing material at school			
Toilet	204(59.6)	287(84.2)	491(71.9)
Dustbin	120(35.1)	37(10.9)	157(23.0)
Never disposed	18(5.3)	17(5.0)	35(5.1)
Total	342(100)	341(100)	683(100)
Wrapped materials before disposal^a			
No wrapping	7(2.2)	11(3.4)	18(2.8)
Wrapped in plastic	306(94.7)	301(92.9)	607(93.8)
Wrapped in paper	10(3.1)	12(3.7)	22(3.4)
Total	323(100)	324(100)	647(100)
Stored menstrual materials			
Yes	318(93.0)	287(83.9)	605(88.5)
No	24(7.0)	55(16.1)	79(11.5)
Total	342(100)	342(100)	684(100)
Where materials were stored			
In a bag with cloth	264(82.0)	250(84.7)	514(83.3)
Under a bed	47(14.6)	38(12.9)	85(13.8)
Toilet room	11(3.4)	7(2.4)	18(2.9)
Total	322(100)	295(100)	617(100)
Wrapped materials in what			
Plastic	300(92.9)	271(91.9)	571(92.4)
Fabric	13(4.0)	14(4.7)	27(4.4)
No wrapping	10(3.1)	10(3.4)	20(3.2)
Total	323(100)	295(100)	618(100)
Used same location for urinating at home			
Never	110(32.5)	101(30.3)	211(31.4)
Sometimes	151(44.7)	122(36.6)	273(40.7)
All the time	77(22.8)	110(33.1)	187(27.9)
Total	338(100)	333(100)	671(100)
Used same location for urinating at school			
Never	131(39.4)	128(38.6)	259(38.9)
Sometimes	129(38.7)	117(35.2)	246(37.0)
All the time	73(21.9)	87(26.2)	160(24.1)
Total	333(100)	332(100)	665(100)
Where reusable cloth is washed			
Shared bucket	15(10.4)	14(15.2)	29(12.3)
Own bucket	129(89.6)	78(84.8)	207(87.7)
Total	144(100)	92(100)	236(100)
Used soap to wash reusable cloth^b			
Never	9(6.1)	3(3.2)	12(5.0)
Sometimes	31(20.9)	14(14.9)	45(18.6)
Every time	108(73.0)	77(81.9)	185(76.4)
Total	148(100)	94(100)	242(100)

Table 4. 9: Menstrual hygiene management among participants at baseline

Place of drying reusable cloth^b			
Outside hanging	58(40.3)	16(17.0)	74(31.1)
Outside but covered	34(23.6)	32(34.0)	66(27.7)
Inside the room	52(36.1)	46(49.0)	98(41.2)
Total	144(100)	94(100)	238(100)
Reusable cloth dried in the sun^b			
Never	11(7.7)	13(13.5)	24(10)
Sometimes	37(25.9)	28(29.2)	65(27.2)
Every time	95(66.4)	55(57.3)	150(62.8)
Total	143(100)	96(100)	239(100)
Ironed/pressed reusable cloth^b			
Never	37(26.6)	41(43.6)	78(33.5)
Sometimes	37(26.6)	27(28.7)	64(27.5)
Every time	65(46.8)	26(27.7)	91(39.0)
Total	139(100)	94(100)	253(100)

^a Excludes participants who did not dispose any material; ^b applicable to respondents who use reusable menstrual materials

4.3.7: Social support and taboos about menstruation

More than eight in ten (85.8%) participants received menstrual hygiene education from their parents. A majority (87.1%) of the participants received money from their parents to buy sanitary pads. Nine out of ten participants (92.8%) were taught about menstruation at school. 83.7% of the participants indicated that they could ask a teacher about menstruation, and 81.0% of them could ask a classmate. Less than half of the participants indicated that attending school (10.2%) and cooking food (36.6%) during menstruation were taboos. Additionally, 73.7% of the participants indicated that entering the mosque during menstruation was taboo (Table 4.9).

Table 4. 10: Access to support during menstruation

Access to social support during period	Intervention n (%)	Control n (%)	Total n (%)
Parent talk about menstruation			
Yes	296(86.5)	291(85.1)	587(85.8)
No	46(13.5)	51(14.9)	97(14.2)
Total	342(100)	342(100)	684(100)
Parents give money for pad			
Yes	312(91.2)	284(83.0)	596(87.1)
No	30(7.8)	58(17.0)	88(12.9)
Total	342(100)	342(100)	684(100)

Table 4. 10: Access to support during menstruation

Menstruation taught at school			
Yes	321(94.7)	311(90.9)	632(92.8)
No	18(5.3)	31(9.1)	49(7.2)
Total	339(100)	342(100)	681(100)
Can ask teacher about menstruation?			
Yes	295(86.8)	274(80.6)	569(83.7)
No	45(13.2)	66(19.4)	111(16.3)
Total	340(100)	340(100)	680(100)
Can ask classmate about menstruation?			
Yes	269(78.9)	284(83.0)	553(81.0)
No	72(21.1)	58(17.0)	130(19.0)
Total	341(100)	342(100)	683(100)
Is it taboo to attend school during menstruation?			
Yes	42(12.3)	28(8.2)	70(10.2)
No	300(87.7)	314(91.8)	614(89.8)
Total	343(100)	342(100)	684(100)
Is it taboo to enter a mosque during menstruation?			
Yes	209(61.7)	292(85.6)	501(73.7)
No	130(38.3)	49(14.4)	179(26.3)
Total	339(100)	341(100)	680(100)
Is it taboo to cook food during menstruation?			
Yes	119(35.1)	130(38.0)	249(36.6)
No	220(64.9)	212(62.0)	432(63.4)
Total	339(100)	342(100)	681(100)

4.3.8: Access to sanitary pads at baseline

Six in ten participants (61.8%) could afford enough sanitary pads. Almost all the participants (95.6%) wanted the price of sanitary pads to be subsidised. During the baseline assessment, most of the participants indicated a pack of sanitary pads was sold at GH¢ 10. The majority of the participants wanted sanitary pads to be sold at GH¢ 5. About 2.2% of the participants had exchanged sex for money to buy sanitary pads within the last twelve months (Table 4.10).

Table 4. 11: Access to sanitary pads among adolescent girls

Access to sanitary pads	Intervention n (%)	Control n (%)	Total n (%)
Able to buy enough sanitary pads			
Yes	235(68.7)	188(55.0)	423(61.8)
No	107(31.3)	154(45.0)	261(38.2)
Total	342(100)	342(100)	684(100)
Wants pad price subsidised			
Yes	322(95.0)	327(96.2)	649(95.6)
No	17(5.0)	13(3.8)	30(4.4)
Total	339(100)	340(100)	679(100)
Exchanged sex for money to buy pad			
Yes	11(3.2)	8(2.3)	19(2.8)
No	331(96.8)	334(97.7)	665(97.2)
Total	342(100)	342(100)	684(100)
Price of a sanitary pad (GH¢)	m (sd)	m (sd)	m (sd)
Mix = 4 Max = 20, Mode = 10	9.7(±0.1)	9.8 (±0.1)	9.8 (±0.1)
Affordable price of a pad (GH¢)	m (sd)	m (sd)	m (sd)
Mix = 1; Max = 10, Mode = 5	4.1 (±0.1)	3.8 (±0.1)	3.9(±0.1)

4.3.9: Knowledge about menstrual hygiene at baseline

At baseline, more than half of the participants (56.6%) demonstrated poor knowledge about menstrual hygiene. Specifically, less than half of the participants knew the source of menstrual blood (28.8%), factors that regulate menstruation (44.0%), and the average duration of a menstrual cycle (49.3%). Less than half of the participants knew the ovulation period (48.4%) and the appropriate place to dispose of used menstrual materials (23.0%). Three in ten participants (30.4%) knew that the vagina should be washed with only water (Table 4.11).

Table 4. 12: Knowledge about menstrual hygiene among study arms at baseline

Knowledge about menstruation	Intervention n (%)	Control n (%)	Total n (%)
Knows about source of menstrual blood			
No	227(66.4)	261(76.1)	488(71.2)
Yes	115(33.6)	82(23.9)	197(28.8)
Total	342(100)	343(100)	685(100)
Knows about age of menarche			
No	161(46.9)	143(41.7)	304(44.3)
Yes	182(53.1)	200(58.3)	382(55.7)
Total	343(100)	343(100)	686(100)

Table 4. 12: Knowledge about menstrual hygiene among study arms at baseline

Knows about what regulates period			
No	203(59.7)	177(52.4)	380(56.0)
Yes	137(40.3)	161(47.6)	298(44.0)
Total	340(100)	338(100)	678(100)
Knows the average duration of a cycle			
No	179(52.8)	166(48.7)	345(50.7)
Yes	160(47.2)	175(51.3)	335(49.3)
Total	339(100)	341(100)	680(100)
Knows drinking warm water reduces period pain			
No	173(50.6)	170(49.6)	324(50.1)
Yes	169(49.4)	173(50.4)	342(49.9)
Total	342(100)	343(100)	685(100)
Know ovulation period			
No	181(53.1)	171(50.1)	352(51.6)
Yes	160(46.9)	170(49.9)	330(48.4)
Total	341(100)	341(100)	682(100)
Knows the best place to dispose a pad			
No	207(60.5)	319(93.5)	526(77.0)
Yes	135(39.5)	22(6.5)	157(23.0)
Total	342(100)	341(100)	683(100)
Knows direction of washing vagina			
No	247(72.2)	225(65.8)	472(69.0)
Yes	95(27.8)	117(34.2)	212(31.0)
Total	342(100)	342(100)	684(100)
Knows materials for washing vagina			
No	249(72.6)	228(66.7)	477(69.6)
Yes	94(27.4)	114(33.3)	208(30.4)
Total	343(100)	342(100)	685(100)
Normal to bleed for ≥ 8 days			
No	117(34.4)	125(36.4)	242(35.4)
Yes	223(65.6)	218(63.6)	441(64.6)
Total	340(100)	343(100)	683(100)
Overall knowledge			
Poor (0-4 points)	185(56.4)	189(56.8)	374(56.6)
Good (5-10 points)	143(43.6)	144(43.2)	287(43.4)
Total	328(100)	333(100)	661(100)

Note: cutoffs are based on the mean split

4.3.10: Attitude towards menstruation at baseline

At baseline, a majority of the participants (72.7%) had a negative attitude towards menstruation.

For instance, 62.2% of the participants felt that it was embarrassing to buy a sanitary pad; 58.1%

indicated that girls should not cook food during menstruation; and 61.1% felt that menstruation was shameful. Exactly 65.9% stated that it was shameful to dry reusable menstrual materials outdoors, and 74.4% believed that menstruation was a punishment from God for women. Four in ten participants (40.1%) thought that girls were unclean or dirty during menstruation (Table 4.12).

Table 4. 13: Attitudes towards menstruation among study arms at baseline

Attitudes towards menstruation	Intervention n (%)	Control n (%)	Total n (%)
Embarrassing to buy a pad			
Agree	212(62.2)	213(62.3)	425(62.2)
Disagree	129(37.8)	129(37.7)	258(37.8)
Total	341(100)	342(100)	683(100)
Should not cook food during period			
Agree	199(58.9)	196(57.3)	395(58.1)
Disagree	139(41.1)	146(42.7)	285(41.9)
Total	338(100)	342(100)	680(100)
Menstruation should be a secret			
Agree	226(66.9)	250(73.7)	476(70.3)
Disagree	112(33.1)	89(26.3)	201(29.7)
Total	338(100)	339(100)	677(100)
Menstruation is shameful			
Agree	206(60.6)	208(61.5)	414(61.1)
Disagree	134(39.4)	130(38.5)	264(38.9)
Total	340(100)	338(100)	678(100)
Drying materials outside is shameful			
Agree	213(62.3)	236(69.6)	449(65.9)
Disagree	129(37.7)	103(30.4)	232(34.1)
Total	342(100)	339(100)	681(100)
Menstruating girls are dirty			
Agree	120(35.1)	154(45.2)	274(40.1)
Disagree	222(64.9)	187(54.8)	409(59.9)
Total	342(100)	341(100)	683(100)
Menstruation is God's punishment			
Agree	249(73.0)	259(75.7)	508(74.4)
Disagree	92(27.0)	83(24.3)	175(25.6)
Total	341(100)	342(100)	683(100)
Overall attitude			
Negative (0-3 points)	227(68.8)	254(76.5)	481(72.7)
Positive (4-7 points)	103(31.2)	78(23.5)	181(27.3)
Total	330(100)	332(100)	662(100)
<i>Note: cutoffs are based on the mean split</i>			

4.3.11: Engagement in school activities during menstruation at baseline

At baseline, 57.0% of the participants missed school hours during menstruation. Four in ten participants (40.7%) missed a class test or an examination during menstruation. More than half of the participants (57.8%) indicated that their concentration in classroom was affected during menstruation; 61.7% reported that their movement in class was affected; and 40.1% were not comfortable standing up in classroom. More than half of the participants (64.8%) avoided physical activities during menstruation. Overall, 68.4% of the participants reported low engagement in school activities during menstruation. (Table 4.13).

Table 4. 14: Engagement in school activities during among study arms at baseline

Engagement in school activities	Intervention n (%)	Control n (%)	Total n (%)
Went home before closing time			
Yes	183(54.0)	205(59.9)	388(57.0)
No	156(46.0)	137(40.1)	293(43.0)
Total	339(100)	342(100)	681(100)
Missed class test, exercise, exam			
Yes	134(39.5)	143(41.8)	277(40.7)
No	205(60.1)	199(58.2)	404(59.3)
Total	339(100)	342(100)	681(100)
Concentration in class affected			
Yes	194(57.1)	199(58.5)	393(57.8)
No	146(42.9)	141(41.5)	287(42.2)
Total	340(100)	340(100)	680(100)
Movement in class affected			
Yes	217(64.6)	199(58.9)	416(61.7)
No	119(35.4)	139(41.1)	258(38.3)
Total	336(100)	338(100)	674(100)
Comfortable standing in class			
Yes	138(41.1)	133(39.1)	271(40.1)
No	198(58.9)	207(60.9)	405(59.9)
Total	336(100)	340(100)	676(100)
Missed sport/physical activities			
Yes	217(64.4)	221(65.2)	438(64.8)
No	120(35.6)	118(34.8)	238(35.2)

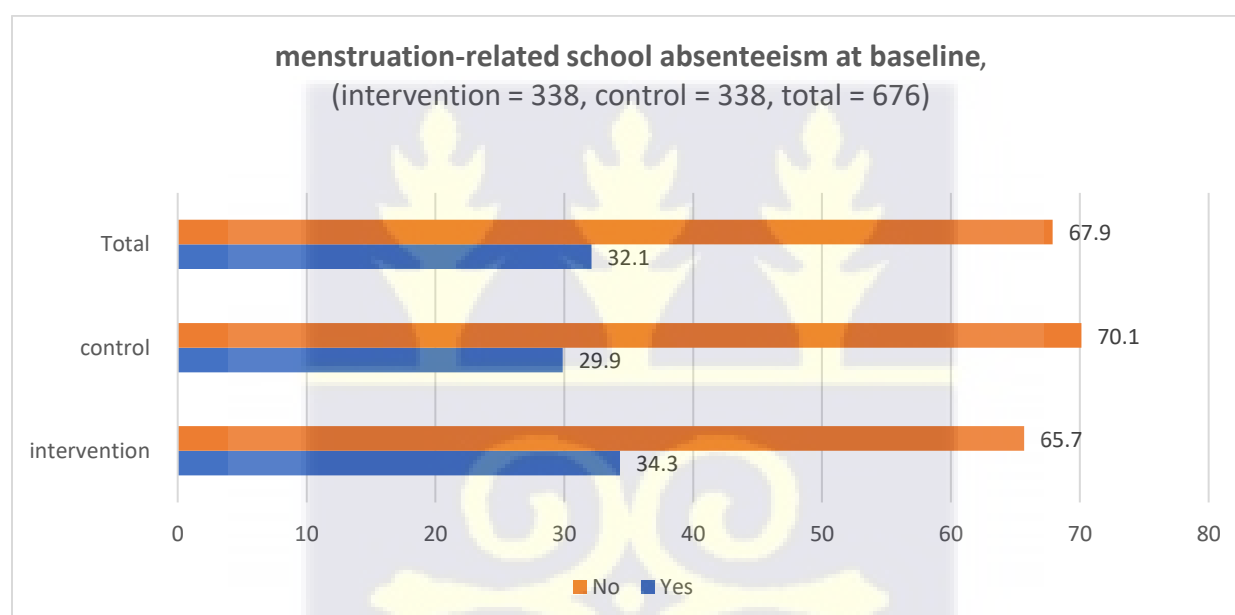
Table 4. 14: Engagement in school activities during among study arms at baseline

Total	337(100)	339(100)	676(100)
Overall engagement			
Low (0-3 points)	218(66.7)	232(70.1)	450(68.4)
High (4-6 points)	109(33.3)	99(29.9)	208(31.6)
Total	327(100)	331(100)	658(100)

Note: cutoffs are based on the mean split

4.3.12: Menstruation-related school absenteeism

On menstruation-related school absenteeism, 32.1% of the participants missed school during their last menstrual cycle. (Figure 4.5).

**Figure 4:5 School absenteeism during menstruation at baseline**

4.3.13: Symptoms of urogenital infections at baseline

At baseline, 72.5% of the participants self-reported at least one symptom of urogenital infections. Exactly 24.9% of the participants reported frequent urination, 43.6% reported burning or itching in the genitalia, 40.9% reported abnormal vaginal discharge, and 34.7% reported burning or itching while urinating (Table 4.14).

Table 4. 15: Symptoms of urogenital infection among study arms at baseline

Symptoms of urogenital infections	Intervention n (%)	Control n (%)	Total n (%)
Urinating frequently			169(24.9)
Yes	90(26.6)	79(23.1)	511(75.1)
No	248(73.4)	263(76.9)	680(100)
Total	338(100)	342(100)	
Burning/itching in the genitalia			
Yes	146(42.7)	152(44.6)	298(43.6)
No	196(57.3)	186(55.4)	385(56.4)
Total	342(100)	341(100)	683(100)
Abnormal vaginal discharge			
Yes	122(35.8)	157(46.0)	279(40.9)
No	219(64.2)	184(54.0)	403(59.1)
Total	341(100)	341(100)	682(100)
Burning or itching while urinating			
Yes	115(33.9)	121(35.5)	236(34.7)
No	224(66.1)	220(64.5)	444(65.3)
Total	339(100)	341(100)	680(100)
Urogenital infection status			
Not infected (0 symptom)	99(29.6)	86(25.4)	185(27.5)
Infected (1-4 symptoms)	235(70.4)	253(74.6)	488(72.5)
Total	334(100)	339(100)	673(100)

4.3.14: Factors associated with engagement in school during menstruation at baseline

The Chi-square test showed that engagement in school activities during menstruation was significantly associated with exposure to television, menstrual pain, heavy bleeding and symptoms of UGI. Other correlates of engagement were perceived taboos, access to sanitary pads, clean toilets, knowledge and attitudes towards menstruation ($p < 0.05$). For instance, a majority of the participants with menstrual pain (74.2%) and heavy menstrual bleeding (72.5%) reported low engagement in school activities. Seven in ten (72.8%) participants with symptoms of urogenital infections had low engagement in school activities. Exactly 73.5% of participants who believed that it was taboo to cook food during menstruation reported low engagement. Eight in ten participants who did not keep extra menstrual materials had low engagement. Participants

in schools with unclean toilet rooms (72.9%) reported low engagement in school activities. Additionally, 71.2% of the participants with negative attitudes and 65.4% of those with poor knowledge of menstrual hygiene reported low engagement in school activities. Table 4.15 shows only variables with a statistically significant association with engagement in school activities.

Table 4. 16: Bivariate association between engagement in school activities during menstruation and participant characteristics

Characteristics	Engagement in school activities		p-value
	Low n (%)	High n (%)	
Television at home			0.02
Yes	230(64.6)	126(35.4)	
No	218(72.9)	81(27.1)	
Taboo to cook food			0.03
Yes	178(73.5)	64(26.5)	
No	271(65.5)	143(34.5)	
Toilet rooms smell bad			0.04
Yes	204(72.9)	76(27.1)	
No	246(65.3)	131(34.7)	
Sanitary pad in school			<0.01
Yes	143(60.8)	92(39.2)	
No	306(73.4)	111(26.6)	
Experience menstrual pains			<0.01
Yes	370(74.2)	129(25.8)	
No	80(50.3)	79(49.7)	
Experience heavy bleeding			<0.01
Yes	293(72.5)	111(27.5)	
No	155(61.5)	97(38.5)	
Kept menstrual material			0.02
No	60(80.0)	15(20.0)	
Yes	390(66.9)	193(33.1)	
Attitude towards menstruation			0.01
Negative	327(71.2)	132(28.8)	
Positive	110(61.1)	70(38.9)	
Knowledge of menstruation			0.04
Poor	236(65.4)	125(34.6)	
Good	203(73.0)	75(24.0)	
Symptoms of UGI			<0.01
Non-infected	99(55.0)	81(45.0)	
Infected	340(72.8)	127(27.2)	

4.3.15: Factors associated with self-reported symptoms of urogenital infections at baseline

Symptoms of UGI were statistically significantly associated with the following: MHM practices, availability of water and sanitation facilities, access to sanitary pads, menstrual pain, heavy menstrual bleeding and exposure to the radio ($p < 0.05$). For instance, 77.3% of the participants with menstrual pain reported symptoms of urogenital infections. Symptoms of UGI were higher among participants who experienced heavy menstrual bleeding (77.7%). Seven in ten participants who changed their menstrual materials once daily and 79.2% of those who could not buy enough sanitary pads reported symptoms of UGI. Additionally, 78.7% of the participants who were not exposed to radio reported symptoms of UGI. About eight in ten (83.3%) participants who did not wash their hands before changing menstrual materials reported UGI symptoms. Further, 78.0% of those who washed their genitals three times a day and 87.2% of those who did not keep extra menstrual materials reported symptoms of UGI. Seven in ten participants in schools without clean toilets (77.7%); soap (77.3%); and tissue paper (77.0%) reported symptoms of UGI. Table 4.16 shows only variables with statistically significant associations with self-reported symptoms of UGI.

Table 4. 17: Bivariate association between self-reported symptoms of urogenital infections and participant characteristics.

Characteristics	Any symptom of urogenital infections		p-value
	No symptom n (%)	≥ one symptom n (%)	
Frequency of changing materials			0.03
One	5(20.8)	19(76.2)	
Twice	71(30.2)	164(69.8)	
Thrice	85(23.9)	270(76.1)	
Four or more	24(40.7)	35(59.3)	
Washed hands before changing material			0.01
Never	11(16.7)	55(83.3)	
Sometimes	47(35.6)	85(64.4)	
Every time	122(26.5)	338(73.5)	
Frequency of washing genitals			<0.01
Once	7(23.3)	23(76.7)	

Table 4. 17: Bivariate association between self-reported symptoms of urogenital infections and participant characteristics.

Twice	97(35.4)	177(64.6)	
Thrice	81(22.0)	287(78.0)	
Kept menstrual materials			<0.01
No	10(12.8)	68(87.2)	
Yes	175(29.4)	420(70.6)	
Experience menstrual pain			<0.01
Yes	116(22.7)	394(77.3)	
No	69(42.3)	94(57.7)	
Experience heavy bleeding			<0.01
Yes	93(22.3)	325(77.7)	
No	92(36.4)	161(63.6)	
Toilet has odour			<0.01
Yes	64(22.3)	223(77.7)	
No	121(31.4)	264(68.6)	
Handwashing facility has soap			0.04
Yes	129(30.2)	298(69.8)	
No	55(22.7)	187(77.3)	
Handwashing facility has tissue paper			0.04
Yes	130(30.3)	299(69.7)	
No	55(23.0)	184(77.0)	
Able to buy all menstrual materials			<0.01
Yes	131(31.7)	282(68.3)	
No	54(20.8)	206(79.2)	
Have a radio at home			0.01
Yes	136(30.7)	307(69.3)	
No	48(21.3)	177(78.7)	

4.3.16: Factors associated with menstruation-related school absenteeism at baseline

Chi-square test showed a statistically significant association between menstrual pain, exposure to television, taboo, access to pocket money, availability of sanitary pads in school, missing religious activities, attitudes and menstrual hygiene practices, and school absenteeism during menstruation. For instance, a higher proportion (34.0%) of participants with negative attitudes towards menstruation missed school. Moreover, 39.2% of the participants without access to pocket money missed school during menstruation. Exactly 37.5% of the participants who were not exposed to television missed school during menstruation. There was also an association

between MHM practices and school absenteeism. Participants who did not urinate at the same location during menstruation (40.6%) and those who did wait for reusable menstrual materials to dry (66.7%) missed school. Specifically, 34.4% of the participants with menstrual pain reported menstruation-related school absenteeism. Moreover, 37.2% of the participants who missed religious activities due to menstruation and 42.5% of those who believed that cooking food during menstruation was taboo missed school during menstruation. Table 4.17 shows only variables with a statistically significant association with menstruation-related school absenteeism.

Table 4. 18: Bivariate association between menstruation-related school absenteeism and participant characteristics

Characteristics	Menstruation-related school absenteeism		p-value
	Yes n (%)	No n (%)	
Television at home			0.01
Yes	100(27.5)	264(72.5)	
No	116(37.5)	193(62.5)	
Access to pocket money			0.01
Yes	131(28.6)	327(71.4)	
No	85(39.2)	132(60.8)	
Taboo to cook food			<0.01
Yes	104(42.5)	141(57.5)	
No	112(26.2)	316(73.8)	
Sanitary pad for emergency			0.01
Yes	63(26.1)	178(73.9)	
No	152(35.6)	275(64.4)	
Experience menstrual pains			0.03
Yes	176(34.4)	336(65.6)	
No	41(25)	123(75)	
Missed church/mosque			<0.01
No	37(18.8)	160(81.2)	
Yes	176(37.2)	297(62.8)	
Reusable materials dried			0.03
Never	6(66.7)	3(33.3)	
Sometimes	3(15.8)	16(84.2)	
Every time	69(33.3)	138(66.7)	
Same location for urinating			<0.01
Never	104(40.6)	152(59.4)	

Table 4. 18: Bivariate association between menstruation-related school absenteeism and participant characteristics

Sometimes	62(25.5)	181(74.5)	0.02
Every time	44(27.9)	114(72.1)	
Attitude			
Negative	162(34.0)	314(66.0)	
Positive	44(24.6)	135(75.4)	

4.3.17: Participants' knowledge about menstrual hygiene at post-intervention

At post-intervention, a higher proportion of the participants in the intervention group (84.3%) demonstrated adequate knowledge about menstrual hygiene compared to their counterpart (38.9%) ($p < 0.01$). For instance, compared to the control group, a higher proportion of the participants in the intervention group knew the source of menstrual blood (72.7% vs. 18%; $p < 0.01$), the age of menarche (71.8% vs. 64.2%, $p = 0.04$), what regulates menstruation (69.5% vs. 44.5%, $p < 0.01$), and the average duration of a menstrual cycle (72.4% vs. 52.8%, $p < 0.01$). Moreover, a higher proportion of the participants in the intervention group knew about the ovulation period (68.8% vs. 40.1%, $p < 0.01$), the appropriate place to dispose of used pads (74.5% vs. 7.6%, $p < 0.01$), and the normal duration of menstruation (75.5% vs. 59.8%, $p < 0.01$) (Table 4.18).

Table 4. 19: Knowledge about menstrual hygiene among study arms at post-intervention

Knowledge about menstrual hygiene	Intervention n (%)	Control n (%)	p-value
Source of menstrual blood			< 0.01
Incorrect	87(27.3)	260(82.0)	
Correct (uterus)	232(72.7)	57(18.0)	
Age of menarche			0.04
Incorrect	90(28.2)	114(35.8)	
Correct (10-19 years)	229(71.8)	204(64.2)	
Regulator of menstruation			< 0.01
Incorrect	97(30.5)	176(55.5)	
Correct (hormones)	221(69.5)	141(44.5)	
Average duration of cycle			< 0.01

Table 4. 19: Knowledge about menstrual hygiene among study arms at post-intervention

Incorrect	88(27.6)	149(47.2)	
Correct (28 days)	231(72.4)	167(52.8)	
Warm water reduces period pain			< 0.01
Incorrect	94(29.6)	153(48.3)	
Correct (yes)	224(70.4)	164(51.7)	
Ovulation period			< 0.01
Incorrect	99(31.2)	188(59.9)	
Correct (middle of cycle)	218(68.8)	126(40.1)	
Best place to dispose of a pad			< 0.01
Incorrect	81(25.5)	292(92.4)	
Correct (dustbin)	237(74.5)	24(7.6)	
Direction of washing vagina			< 0.01
Incorrect	127(39.8)	225(70.8)	
Correct (front to back)	192(60.2)	93(29.2)	
Materials for washing vagina			< 0.01
Incorrect	90(28.2)	220(69.6)	
Correct (only water)	229(71.8)	96(30.4)	
Normal to bleed for ≥ 8 days			< 0.01
Incorrect	78(24.5)	127(40.2)	
Correct (no)	240(75.5)	189(59.8)	
Overall knowledge			< 0.01
Poor (0-4 points)	49(15.7)	187(61.1)	
Good (5-10 points)	264(84.3)	119(38.9)	

4.3.18: Participants' attitude towards menstruation at post-intervention

A higher proportion of the participants in the intervention group had positive attitudes towards menstruation compared to the control group (61.7% vs. 29%, $p < 0.01$). Particularly, a lower proportion of the participants in the intervention group agreed that it was embarrassing to buy sanitary pads (52.7% vs. 62.9, $p < 0.01$) and that girls should not cook food during menstruation (37.7% vs. 50%, $p < 0.01$). In addition, compared to the control group, a lower proportion of the participants in the intervention group agreed that menstruation should be kept secret (42.6% vs. 71.6%), shameful (45% vs. 64.4%), and dirty (21.6% vs. 50%). A majority of participants in the

control group (81.0%) agreed that menstruation was God's punishment for females compared to their counterparts (59.6%) ($p < 0.01$) (Table 4.19).

Table 4. 20: Attitudes towards menstruation among study arms at post-intervention

Attitudes towards menstruation	Intervention n (%)	Control n (%)	p-value
Embarrassing to buy a pad			0.01
Agree	166(52.7)	200(62.9)	
Disagree	149(47.3)	118(37.1)	
Should not cook food			<0.01
Agree	118(37.7)	158(50.0)	
Disagree	195(62.3)	158(50.0)	
Menstruation is a secret			< 0.01
Agree	133(42.6)	224(71.6)	
Disagree	179(57.4)	89(28.4)	
Menstruation is shameful			< 0.01
Agree	104(33.1)	188(60.5)	
Disagree	210(66.9)	123(39.5)	
Drying materials outside is shameful			< 0.01
Agree	141(45.0)	204(64.4)	
Disagree	172(55.0)	113(35.6)	
Menstruating girls are dirty			< 0.01
Agree	68(21.6)	161(50.9)	
Disagree	247(78.4)	155(49.1)	
Menstruation is God's punishment			< 0.01
Agree	189(59.6)	255(81.0)	
Disagree	128(40.4)	60(19.0)	
Overall attitude			< 0.01
Negative (0-3 points)	115(38.3)	215(71.0)	
Positive (4-7 points)	185(61.7)	88(29.0)	

4.3.19: Menstrual hygiene management practices of the participants at post-intervention

Fewer participants in the intervention group (13.5%) than the control group (24.9%) changed their menstrual materials in the toilet room when at home ($p < 0.01$). Moreover, 37.7% and 51.4% of the participants in the intervention and control groups, respectively, changed their menstrual materials in the toilet room when at school ($p < 0.01$). A lower proportion of participants in the intervention group (3.2%) than the control group (10.4%) did not wash their hands ($p < 0.01$). Similarly, fewer participants in the intervention group (23.3%) than the control

group (48.4%) washed their genitals with soap ($p < 0.01$). A higher proportion of the participants in the intervention group disposed of menstrual materials in dustbins compared to the control group (69.4 vs. 13.9) ($p < 0.01$). More of the participants in the intervention group (85.0%) than the control group (66.7%) washed their menstrual materials in private (unshared) buckets ($p < 0.01$). Also, 81.1% and 50.5% of participants in the intervention and control groups, respectively, dried their reusable materials in the sun ($p < 0.01$). Exactly 96.4% of participants in the treatment group and 63.7% of those in the control group ironed their reusable materials ($p < 0.01$) (Table 4.20).

Table 4. 21: MHM practices among the study arms at post-intervention

Menstrual hygiene management practices	Intervention n (%)	Control n (%)	p-value
Frequency of changing materials			0.21
One time	6(1.9)	15(4.7)	
Two times	135(42.3)	124(39.1)	
Three times	157(49.2)	160(50.5)	
Four or more times	21(6.6)	18(5.7)	
Changing places at home			<0.01
Toilet/latrine	43(13.5)	79(24.9)	
Bedroom	113(35.4)	87(27.4)	
Bathroom	163(51.1)	151(47.6)	
Changing places at school			<0.01
Toilet /latrine	119(37.7)	162(51.4)	
Urinal	114(36.1)	91(28.9)	
Changing room	83(26.3)	62(19.7)	
Washed hands before changing			< 0.01
Never	10(3.2)	32(10.4)	
Sometimes	71(22.8)	92(29.9)	
Every time	230(74.0)	184(59.7)	
Washed hands after changing			0.05
Never	3(1.0)	12(3.8)	
Sometimes	57(18.1)	62(19.7)	
Every time	255(81)	241(76.5)	
Frequency of washing genitals			0.12
Once per day	10(3.1)	11(3.5)	
Twice per day	186(58.5)	160(50.8)	
Thrice or more per day	122(38.4)	144(45.7)	

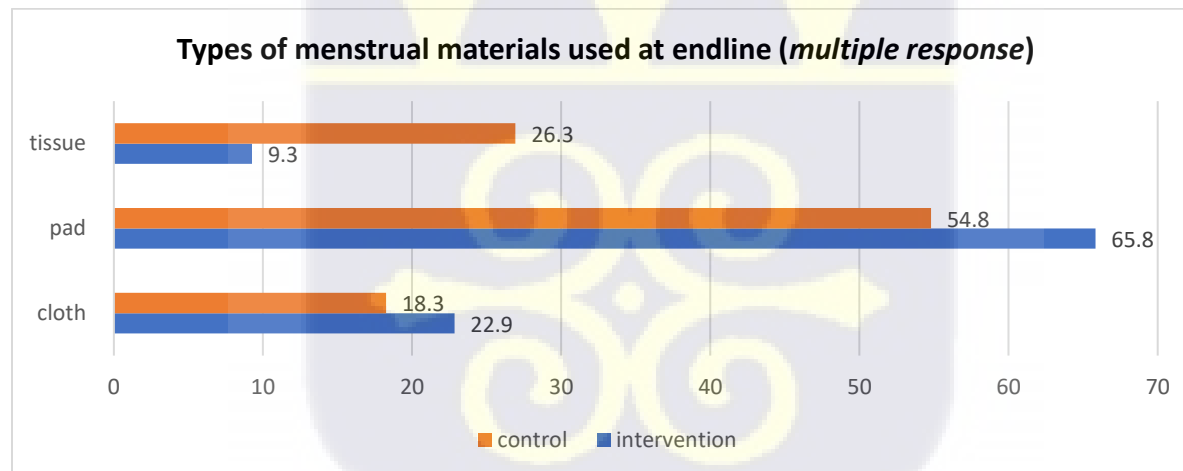
Table 4. 21: MHM practices among the study arms at post-intervention

Washed genitals with soap			< 0.01
Never	207(65.3)	103(32.4)	
Sometimes	36(11.4)	61(19.2)	
Every time	74(23.3)	154(48.4)	
Disposal of materials at home			< 0.01
Toilet	71(22.3)	252(79.5)	
Dustbin	239(74.9)	51(16.1)	
Never disposed	9(2.8)	14(4.4)	
Disposal of material at school			< 0.01
Toilet	78(24.6)	256(80.8)	
Dustbin	220(69.4)	44(13.9)	
Never disposed	19(6.0)	17(5.4)	
Wrapped before disposal			< 0.01
No wrapping	2(0.6)	22(6.9)	
Wrapped in plastic	306(96.5)	256(80.5)	
Wrapped in paper	9(2.8)	40(12.6)	
Stored menstrual materials			< 0.01
No	16(5.1)	41(13.1)	
Yes	300(94.9)	273(86.9)	
Where materials were stored			0.07
In a bag with cloth	233(77.2)	207(73.7)	
Under a bed	58(19.2)	51(18.1)	
Toilet room	11(3.6)	23(8.2)	
Wrapped in			< 0.01
Plastic	276(91.7)	216(76.1)	
Fabric	18(6.0)	51(18.0)	
No wrapping	7(2.3)	17(6.0)	
Same location for urinating at home			< 0.01
Never	173(56.2)	97(31.8)	
Sometimes	101(32.8)	125(41)	
All the time	34(11.0)	83(27.2)	
Same location for urinating at school			< 0.01
Never	191(60.8)	117(37.6)	
Sometimes	85(27.1)	122(39.2)	
All the time	38(12.1)	72(23.2)	
Container for washing reusable cloth			<0.01
Shared bucket	16(15.0)	36(33.3)	
Own bucket	91(85.0)	72(66.7)	
Used soap to wash reusable cloth			0.12
Never	5(4.7)	10(9.3)	
Sometimes	19(17.9)	28(25.9)	

Table 4. 21: MHM practices among the study arms at post-intervention

Every time	82(77.4)	70(64.8)	
Place of drying reusable cloth			< 0.01
Outside hanging	76(68.5)	28(27.2)	
Outside but covered	13(11.7)	42(40.8)	
Inside the room	22(19.8)	33(32)	
Reusable cloth dried in the sun			< 0.01
Never	4(3.6)	22(21.4)	
Sometimes	17(15.3)	29(28.2)	
Every time	90(81.1)	52(50.5)	
Ironed reusable cloth			< 0.01
Never	1(0.9)	6(5.9)	
Sometimes	3(2.7)	31(30.4)	
Every time	108(96.4)	65(63.7)	

At post-intervention, more than half of the participants in both groups used disposable sanitary pads. A considerable proportion used tissue paper and piece of cloth to absorb menstrual blood. (Figure 4.6).

**Figure 4:6 Types of menstrual materials used by participants at post-intervention**

4.3.20: Participants' engagement in school activities at post-intervention

At post-intervention, a higher proportion of the participants in the intervention group (70.5%) reported high engagement in school activities compared to those in the control group (40.1%) (p

< 0.01). More participants in the control group (56.9%) indicated that their concentration was affected compared to those in the intervention group (29.2%) ($p < 0.01$). Also, a lower proportion of the participants in the intervention group than those in the control group had their movement in class affected (40.6% vs. 52.8%, $p < 0.01$), were uncomfortable standing up in class (48.7% vs. 62.3%, $p < 0.01$), missed tests or examinations (13.9 vs. 31%, $p < 0.01$), and missed sport activities during menstruation (31.8% vs. 55.3%, $p < 0.01$) (Table 4.21).

Table 4. 22: Engagement in school activities among study arms at post-intervention

Engagement in school activities	Intervention n (%)	Control n (%)	p-value
Went home before closing time			< 0.01
Yes	68(21.4)	141(44.8)	
No	250(78.6)	174(55.2)	
Missed class tests, exercises or exams			< 0.01
Yes	44(13.9)	97(31)	
No	273(86.1)	216(69)	
Concentration in class affected			< 0.01
Yes	93(29.2)	178(56.9)	
No	225(70.8)	135(43.1)	
Movement in class affected			0.02
Yes	129(40.6)	163(52.8)	
No	189(59.4)	146(47.2)	
Comfortable standing in class			0.01
Yes	154(48.7)	195(62.3)	
No	162(51.3)	118(37.7)	
Missed sport activities			< 0.01
Yes	101(31.8)	173(55.3)	
No	217(68.2)	140(44.7)	
Overall engagement			< 0.01
Low (0-3 points)	93(29.5)	179(59.9)	
High (4-6 points)	222(70.5)	120(40.1)	

4.3.21: School absenteeism at post-intervention

At post-intervention, the prevalence of school absenteeism in the control group (30.9%) was significantly higher than the intervention group (13.6%) ($p < 0.01$) (Figure 4.7).

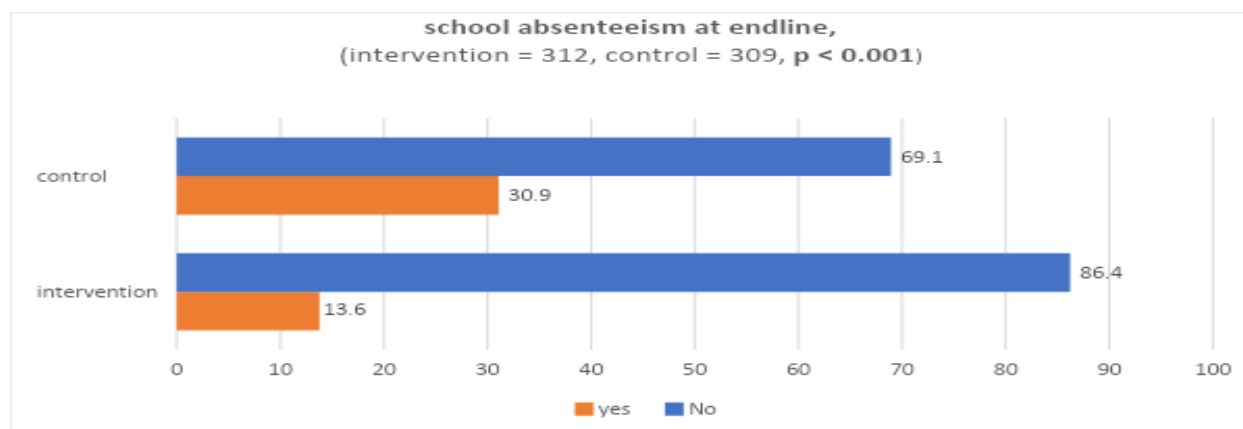


Figure 4:7 School absenteeism during menstruation at post-intervention

4.3.22: Symptoms of urogenital infections at post-intervention

At post-intervention, the symptoms of urogenital infections were lower among the participants in the intervention group (59.4%) compared to those in the control group (70.6%) ($p < 0.01$). Specifically, a lower proportion of the participants in the intervention group than those in the control group reported frequent urination (26.2% vs. 37%, $p < 0.01$) and itching while urinating (23.7% vs. 32%, $p = 0.02$) (Table 4.22).

Table 4. 23: Symptoms of urogenital infections among study arms at post-intervention

Symptoms of urogenital infections	Intervention n (%)	Control n (%)	p-value
Urinate frequently			<0.01
No	234(73.8)	199(63.0)	
Yes	83(26.2)	117(37.0)	
Burning/itching in the genitalia			0.53
No	199(63)	206(65.4)	
Yes	117(37)	109(34.6)	
Abnormal vaginal discharge			0.13
No	226(71.5)	205(65.9)	
Yes	90(28.5)	106(34.1)	
Burning or itching while urinating			0.02
No	242(76.3)	215(68)	
Yes	75(23.7)	101(32)	
Symptoms of UGI status			<0.01
Not infected (0 symptom)	127(40.6)	91(29.4)	
Infected (1-4 symptoms)	186(59.4)	219(70.6)	

4.3.23: Comparing engagement in school activities between the participants in intervention and control groups at post-intervention

The results showed that the interventions were effective in increasing adolescent girls' engagement in school activities during menstruation. In the control group, high engagement in school activities increased marginally from 29.9% at baseline to 40.1% at post-intervention (difference: 10.2%). On the other hand, high engagement in school activities increased substantially from 33.3% at baseline to 70.5% at post-intervention among participants in the intervention group (difference: 37.2%). There were a statistically significant differences between the two groups at post-intervention (Figure 4.8).

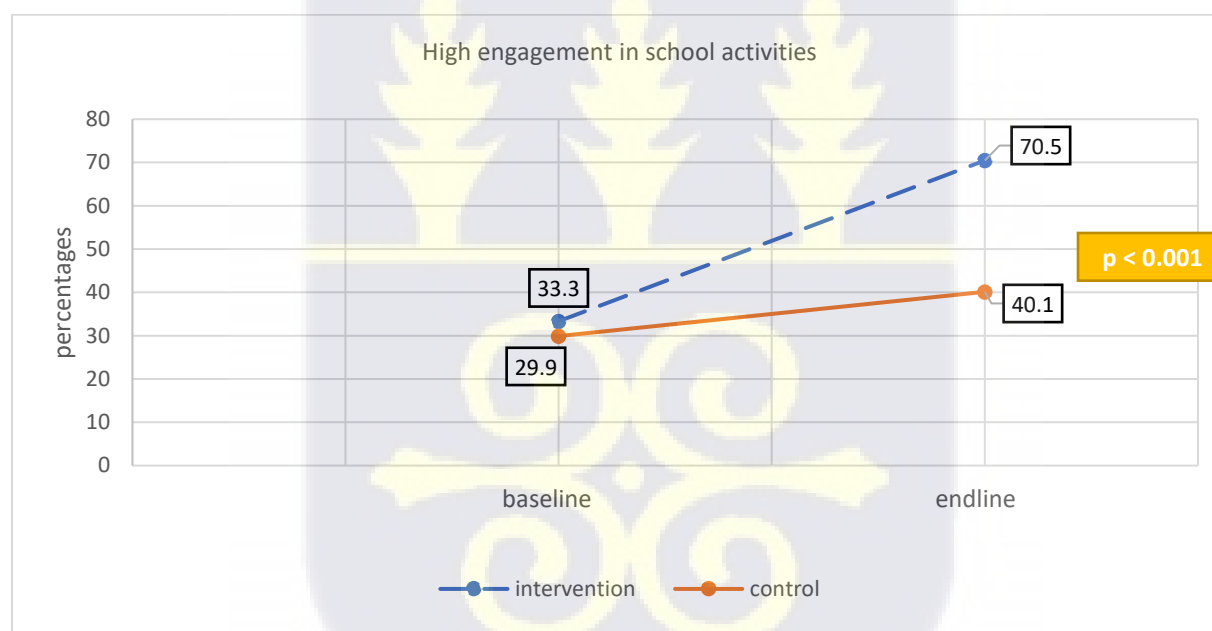


Figure 4:8 Comparing engagement in school activities during menstruation at baseline and post-intervention

4.3.24: Comparing symptoms of urogenital infections between the participants in the intervention and control groups at post-intervention

Figure 4.9 illustrates that the control group's prevalence of symptoms of urogenital infections decreased slightly from 74.6% to 70.6% (a difference of -4%) from baseline to post-intervention. Among the participants in the intervention group, the prevalence of symptoms of UGI decreased from 70.4% at baseline to 59.4% at post-intervention, a decrease of 11.0%. A statistically significant difference was observed between the two groups after the intervention. Therefore, the interventions effectively reduced the symptoms of urogenital infections among the participants (Figure 4.9).

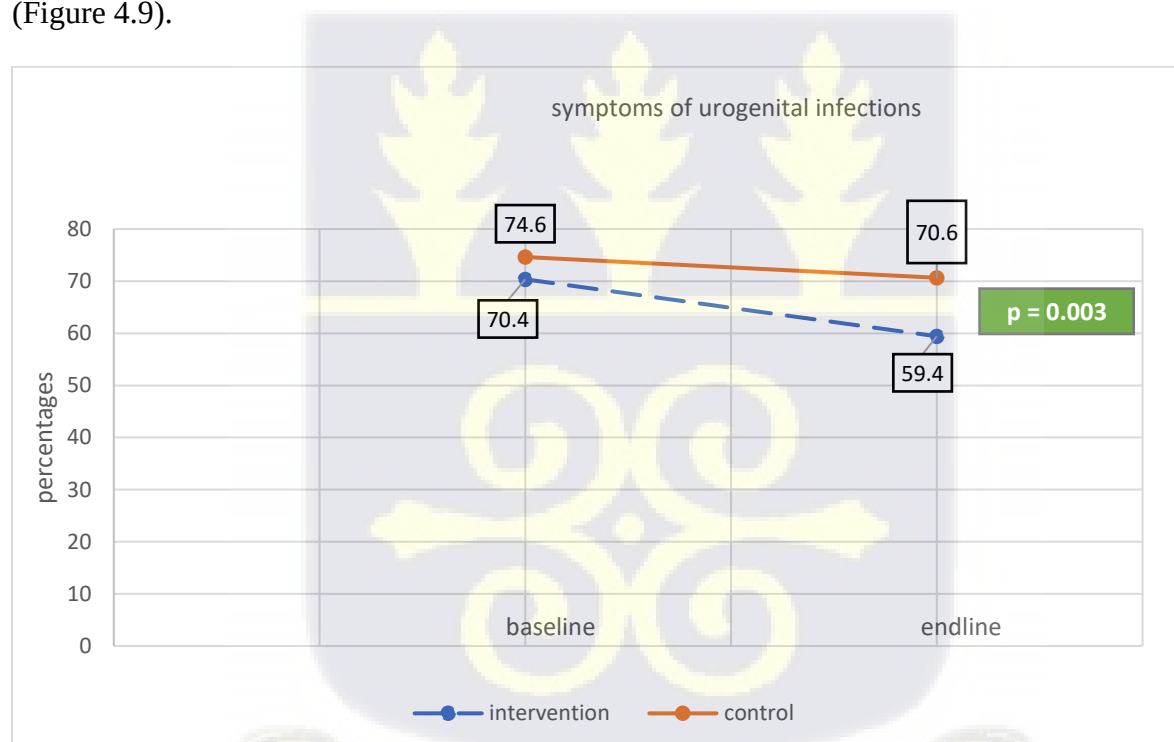


Figure 4:9 Comparing the prevalence of symptoms of urogenital infections at baseline and post-intervention

4.3.25: Comparing school absenteeism between the participants in the intervention and control groups at post-intervention

School absenteeism increased slightly in the control group, from 29.9% at baseline to 30.9% at the post-intervention (difference: 1.0%). However, in the intervention group, school absenteeism decreased significantly from 34.3% at baseline to 13.6% at post-intervention (difference: -17.3%). There was a statistically significant difference between the two groups at post-intervention (Figure 4.10).

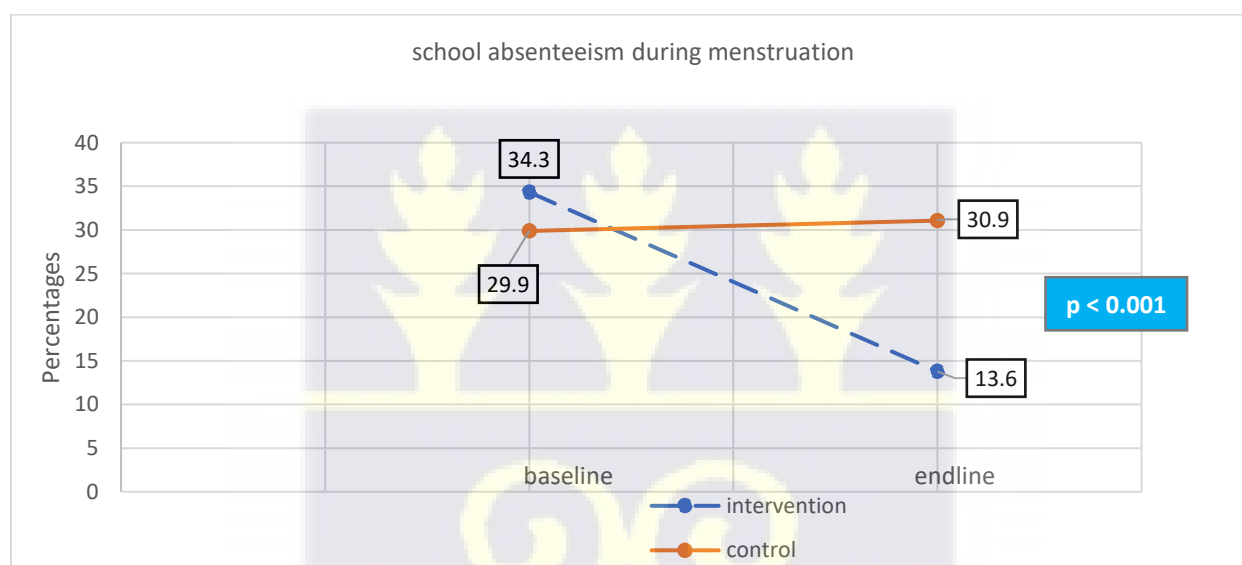


Figure 4.10 Comparing menstruation-related school absenteeism at baseline and post-intervention

4.3.26: Intercept only model

An intercept only model was computed for the three outcomes, including engagement in school activities, symptoms of urogenital infections, and menstruation-related school absenteeism. The intra-cluster correlation coefficient (ICC) for engagement in school activities, symptoms of urogenital infections and menstruation-related school absenteeism were 0.15, 0.02 and 0.09, respectively. This means that 15% of the total variance of engagement in school activities, 2% of

the total variance for symptoms of urogenital infections and 9% of the total variance for school absenteeism were explained by the difference between the schools. There was evidence of substantial clustering for engagement in school activities and school absenteeism ($p < 0.05$). This implies that a multilevel analysis was appropriate compared to a single-level analysis (Table 4.23).

Table 4. 24: Intercept-only model

Model 1	Engagement	Symptoms of UGI	Absenteeism
Intercept (95% CI)	1.23(0.86- 1.79)	1.86(1.52-2.30) **	0.27(0.20-0.37) **
Random effect			
τ_{00} (between)	0.60	0.08	0.32
chi-square	47.35**	2.27	12.61**
ICC (%)	0.15	0.02	0.09
* $p < 0.05$, ** $p < 0.01$			

4.3.27: Effect of interventions on outcome variables after adjusting for clustering

The participants in the intervention group (AOR = 3.67, 95% CI: 2.26–5.96, $p < 0.01$) were three times more likely to highly engage in school activities during menstruation compared to those in the control group, adjusting for clustering. The ICC was 0.04, suggesting that 4.0% of the total variance in engagement in school activities was accounted for by the differences between the schools. It was found that the participants in the intervention group (AOR = 0.58, 95% CI: 0.40 - 0.82, $p < 0.01$) had a lesser likelihood of reporting symptoms of UGI compared to those in the control group. There was no evidence of substantial clustering. The results showed that the participants in the intervention group (AOR = 0.35, 95% CI: 0.22 - 0.55, $p < 0.01$) were less likely to miss school during menstruation compared to those in the control group. The evidence of clustering was not substantial. These findings show that the interventions increased engagement, reduced symptoms of urogenital infections, and decreased menstruation-related school absenteeism (Table 4.24).

Table 4. 25: Effect of interventions on outcomes adjusting for only clustering

Model 2	Engagement	Symptoms of UGI	Absenteeism
Intercept	0.64(0.46 - 0.91) *	2.47(1.90-3.20) **	0.45(0.33 - 0.59) **
Study groups			
Control	1(ref)	1(ref)	1(ref)
Intervention	3.67(2.26 - 5.96) **	0.58(0.40- 0.82) **	0.35(0.22 - 0.55) **
Random effect			
σ^2 (within)	3.29	3.29	3.29
τ^2 (between)	0.16	0.01	0.05
chi-square	6.84**	0.15	0.75
ICC (%)	0.04	0.01	0.01
Model-fit statistics			
AIC	785.9	805.3	638.4

* $p < 0.05$, ** $p < 0.01$ *4.3.28: Effectiveness of the interventions on engagement in school activities during menstruation*

Three binary logistic regression models were computed, including univariable, multivariable, and multilevel analyses. At the univariable level, the participants in the intervention group (COR = 3.58, 95% CI: 2.56-5.00, $p < 0.01$) were three times more likely to highly engage in school activities compared to those in the control group. The participants who highly engaged in school activities at baseline (COR = 2.90, 95% CI: 1.97–4.27) were about three times more likely to engage in school activities at post-intervention. Also, there were statistically significant relationships between ethnicity, cleanliness of toilet rooms, availability of lockable doors in toilet rooms, and engagement in school activities during menstruation. Additionally, the availability of water, dustbins, tissue paper and sanitary pads in school was significantly associated with engagement in school activities during menstruation ($p < 0.05$). Moreover, participants who witnessed period teasing were less likely to engage in school activities during menstruation. There were also statistically significant relationships between menstrual pain, menstrual hygiene practices, attitudes towards menstruation, knowledge about menstrual hygiene and symptoms of urogenital infections (UGI), and engagement in school activities during menstruation ($p < 0.05$).

Covariates that were statistically significant at the univariable level were adjusted in the multivariable analysis. The results showed that three covariates emerged as statistically significant, including access to sanitary pads, symptoms of UGI and engagement in school activities at baseline. The participants in the intervention group (AOR = 5.86, 95% CI: 1.70-20.20) were five times more likely to engage well in school activities compared to those in the control group. Also, the participants with symptoms of UGI (AOR = 0.27, 95% CI: 0.11-0.70) were less likely to engage well in school activities during menstruation compared to their counterparts. The participants who engaged well in school activities at baseline (AOR = 3.79, CI: 1.50-9.53) were about four times more likely to engage well in school activities at post-intervention ($p < 0.05$).

Clustering was adjusted in the multilevel analysis. The result showed that the participants in the intervention group (AOR = 5.80, 95% CI: 1.60-20.93) had increased odds of engaging well in school activities during menstruation. Additionally, the multilevel analysis showed that residual school-level differences, with an ICC of 0.009, explained 0.9% of the variance in engagement in school activities. Further analysis showed that the school-level variance had no statistically significant effect on engagement in school activities, adjusting for covariates ($p > 0.05$). The Akaike Information Criterion (AIC) suggests that the multilevel model (AIC = 213.60) did not fit better than the multivariable model (AIC = 211.60) (Table 4.25).

Table 4. 26: Univariable, multivariable and multilevel analyses of the effect of the intervention on engagement in school activities during menstruation

Model 3 (engagement in school activities)	Univariable COR (95% CI)	Multivariable AOR (95% CI)	Multilevel AOR (95% CI)
Study groups			
Control	1(ref)	1(ref)	1(ref)
Intervention	3.58(2.56-5.00) ***	5.86(1.70-20.20)**	5.80(1.60-20.93)**
Ethnicity			
Kusasi	1(ref)	1(ref)	1(ref)
Bissa	0.58(0.38-0.89) *	0.61(0.19-1.90)	0.61(0.19-1.91)

Table 4. 26: Univariable, multivariable and multilevel analyses of the effect of the intervention on engagement in school activities during menstruation

Moshie	0.52(0.30-0.89) *	0.47(0.11-1.96)	0.46(0.09-2.17)
Others (Fulani, Frafra)	1.15(0.51- 2.58)	0.78(0.17-3.54)	0.79(0.16-3.72)
Toilet rooms has an odour			
No	1(ref)	1(ref)	1(ref)
Yes	0.35(0.25-0.50) ****	0.38(0.13-1.07)	0.37(0.12-1.09)
Changing places have lockable doors			
No	1(ref)	1(ref)	1(ref)
Yes	1.43(1.01 - 2.03) *	1.45(0.51-4.09)	1.46(0.51-4.14)
Toilet rooms have dustbins.			
No	1(ref)	1(ref)	1(ref)
Yes	1.80(1.30-2.49) ****	0.33(0.10-1.07)	0.33(0.09-1.13)
HF is regularly supplied with tissue			
No	1(ref)	1(ref)	1(ref)
Yes	1.74(1.24-2.43) **	1.98(0.72-5.47)	2.02(0.65-6.23)
Sanitary pad for emergency			
No	1(ref)	1(ref)	1(ref)
Yes	2.35(1.69-3.27) ****	0.89(0.29-2.74)	0.89(0.29-2.76)
School has a source of water			
No	1(ref)	1(ref)	1(ref)
Yes	1.64(1.18 - 2.28) **	1.15(0.48-2.76)	1.16(0.47-2.85)
Witnessed period teasing in school			
No	1(ref)	1(ref)	1(ref)
Yes	0.48(0.32-0.70) ****	1.29(0.44-3.80)	1.29(0.43-3.83)
Experience menstrual pains			
No	1(ref)	1(ref)	1(ref)
Yes	0.56(0.39 - 0.81) **	0.61(0.25-1.50)	0.62(0.25-1.50)
Same location for urinating at school			
Never	1(ref)	1(ref)	1(ref)
Sometimes	0.51(0.35-0.73) ****	0.37(0.13-1.05)	0.37(0.12-1.12)
All the time	0.78(0.50-1.22)	0.64(0.21-1.95)	0.63(0.20-2.01)
Place of drying reusable cloth			
Outside hanging	1(ref)	1(ref)	1(ref)
Outside but covered.	0.52(0.26-1.01)	1.62(0.53-4.94)	1.62(0.53-4.96)
Inside the room	0.36(0.18-0.72) **	0.49(0.16-1.50)	0.49(0.16-1.51)
Can ask teacher about period			
No	1(ref)	1(ref)	1(ref)
Yes	1.89(1.27- 2.82) **	0.93(0.31-2.80)	0.94(0.31-2.86)
Taboo to attend school on period			
No	1(ref)	1(ref)	1(ref)
Yes	0.45(0.26 - 0.76) **	0.29(0.06-1.40)	0.28(0.05-1.41)
Able to buy all sanitary products			
No	1(ref)	1(ref)	1(ref)
Yes	2.36(1.68-3.31) ****	0.35(0.13-0.92) *	0.35(0.13-0.92) *
Knowledge			
Poor	1(ref)	1(ref)	1(ref)
Good	2.59(1.84-3.65) ****	0.97(0.35-2.62)	0.96(0.35-2.64)
Attitude			
Negative	1(ref)	1(ref)	1(ref)
Positive	3.04(2.15-4.30) ****	0.97(0.40-2.34)	0.98(0.39-2.43)
Symptoms of urogenital infections			
No	1(ref)	1(ref)	1(ref)
Yes	0.34(0.24-0.49) ****	0.27(0.11-0.70) **	0.27(0.10-0.71) **
Baseline of engagement in school			
Low	1(ref)	1(ref)	1(ref)

Table 4. 26: Univariable, multivariable and multilevel analyses of the effect of the intervention on engagement in school activities during menstruation

High	2.90(1.97-4.27) ***	3.79(1.50-9.53) **	3.92(1.12-13.75) *
Random effect			
σ^2 (within)			3.29
τ_{00} (between)			0.03
chi-square (p-value)			0.01 (0.468)
ICC (%)			0.009 (0.9%)
Model fit statistics			
AIC		211.60	213.60
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$			

4.3.29: Effectiveness of interventions on self-reported symptoms of urogenital infections

Regarding the effectiveness of the interventions on symptoms of urogenital infections, three binary logistic regression models were computed. These include univariable, multivariable, and multilevel logistic regression models. At the univariable level, the results showed that the participants in the intervention group (COR = 0.58, 95% CI: 0.41-0.81) had reduced odds of reporting symptoms of urogenital infections. The availability of sanitary pads in school, access to adequate sanitary pads, good knowledge about menstrual hygiene, and positive attitudes towards menstruation were protective factors against symptoms of UGI ($p < 0.05$). However, lack of access to pocket money and lack of clean toilet rooms in school were risk factors for symptoms of UGI ($p < 0.05$). Additionally, the participants who experienced menstrual pain and heavy menstrual bleeding had increased odds of symptoms of UGI ($p < 0.05$).

In the adjusted analysis, the likelihood of reporting symptoms of UGI did not differ significantly across the intervention and control groups ($p > 0.05$). However, the odds of reporting symptoms of UGI at post-intervention increased among participants who did not have access to pocket money, those without access to clean toilet rooms, those who had menstrual pain, those who wrapped used pads in plastic bags, and those who reported UGI symptoms at baseline ($p < 0.05$).

However, the odds of reporting symptoms of UGI decreased among participants with positive attitudes towards menstruation ($p < 0.05$).

Clustering was adjusted in the multilevel logistic regression model. It was revealed that the participants in the intervention group had lower odds of reporting symptoms of UGI, but this was not statistically significant. On the other hand, the participants without access to clean toilet rooms were more likely to report symptoms of UGI at post-intervention. Similarly, the participants who experienced menstrual pain and those who engaged in poor disposal practices had higher odds of reporting symptoms of UGI. Further, the odds of reporting symptoms of UGI at post-intervention increased among the participants who reported UGI symptoms at baseline. However, the odds decreased among the participants with positive attitudes towards menstruation ($p < 0.05$).

It was also revealed that 3% of the variance in symptoms of UGI was accounted for by residual school-level differences. The intra-cluster correlation was 0.03. The school-level variance had no statistically significant effect on self-reported symptoms of UGI, adjusting for covariates ($p > 0.05$). The Akaike Information Criterion (AIC) showed that the multilevel model (AIC = 631.20) did not fit better than the multivariable model (AIC = 630.90) (Table 4.26).

Table 4. 27: Univariable, multivariable and multilevel analyses of effect of the intervention on self-reported symptoms of urogenital infections

Model 3 (symptoms of urogenital infections)	Univariable COR (95% CI)	Multivariable AOR (95% CI)	Multilevel AOR (95% CI)
Study groups			
Control	1(ref)	1(ref)	1(ref)
Intervention	0.58(0.41-0.81) **	0.91(0.52-1.56)	0.86(0.46-1.62)
Access to pocket money			
Yes	1(ref)	1(ref)	1(ref)
No	1.50(1.03-2.18) *	1.57(1.00-2.48) *	1.55(0.97-2.45)
Toilet room has an odour			
No	1(ref)	1(ref)	1(ref)
Yes	2.30(1.58-3.33)***	1.64(1.04-2.58) *	1.66(1.05-2.63) *

Table 4. 27: Univariable, multivariable and multilevel analyses of effect of the intervention on self-reported symptoms of urogenital infections

Sanitary pad for emergency			
No	1(ref)	1(ref)	1(ref)
Yes	0.71(0.50-0.99) *	1.00(0.60-1.66)	1.08(0.63-1.86)
Experience menstrual pains			
No	1(ref)	1(ref)	1(ref)
Yes	1.96(1.38-2.79)***	1.73(1.13-2.65) *	1.78(1.15-2.76)**
Experience heavy bleeding			
No	1(ref)	1(ref)	1(ref)
Yes	1.65(1.18-2.30) **	1.36(0.90-2.04)	1.39(0.92-2.11)
Wrapped before disposal			
No wrapping	1(ref)	1(ref)	1(ref)
Wrapped in plastic	2.26(1.22-4.20) **	2.60(1.28-5.29)**	2.79(1.34-5.80)**
Wrapped in paper	1.72(0.67-4.46)	1.52(0.47-4.93)	1.61(0.49-5.30)
Same location for urinating at school			
Never	1(ref)	1(ref)	1(ref)
Sometimes	1.58(1.08-2.32) *	1.05(0.66-1.66)	1.05(0.66-1.67)
All the time	0.97(0.62-1.52)	0.71(0.41-1.22)	0.74(0.42-1.30)
Able to buy all sanitary products			
No	1(ref)	1(ref)	1(ref)
Yes	0.51(0.35-0.73)***	0.68(0.42-1.08)	0.67(0.42-1.08)
Knowledge			
Poor	1(ref)	1(ref)	1(ref)
Good	0.66(0.47-0.94) *	0.98(0.61-1.57)	0.96(0.59-1.57)
Attitude			
Negative	1(ref)	1(ref)	1(ref)
Positive	0.53(0.37-0.74)***	0.65(0.43-0.99) *	0.64(0.42-0.98) *
Symptoms of Infections			
No	1(ref)	1(ref)	1(ref)
Yes	2.27(1.58-3.26)***	2.00(1.32-3.05)**	1.99(1.29-3.05)**
Random effect			
σ^2 (within)			3.29
τ^2 (between)			0.10
chi-square (p -value)			1.74 (0.09)
ICC (%)			0.03 (3%)
Model fit statistics			
AIC		630.90	631.20

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Baseline score was excluded because it was not significantly associated with the outcome.

4.3.30: Effectiveness of interventions on school absenteeism during menstruation

Three logistic regression models were computed to assess the effectiveness of the interventions on school absenteeism during menstruation. The three models include univariable, multivariable, and multilevel logistic regression analyses. The univariable analysis revealed that the odds of school absenteeism during menstruation were lower among the participants in the intervention group (COR = 0.35, 95% CI: 0.23-0.52). Moreover, lack of access to pocket money, lack of

access to clean toilet rooms, menstrual pain, perceived taboos about menstruation, symptoms of UGI and period teasing were significantly associated with higher odds of school absenteeism during menstruation ($p < 0.05$). Participants who reported school absenteeism at baseline were two times more likely to report school absenteeism at post-intervention (COR = 2.91, 95% CI: 1.96-4.32). However, the availability of toilet rooms with lockable doors, availability of soap and water in schools, access to enough sanitary pads, good knowledge about menstrual hygiene, and positive attitudes towards menstruation were significantly associated with decreased odds of school absenteeism during menstruation ($p < 0.05$).

Covariates were adjusted in the multivariable analysis. The results showed that the participants in the intervention group (AOR = 0.54, 95% CI: 0.29-0.98) had lower odds of school absenteeism compared to those in the control group. The odds of school absenteeism decreased among the participants who had access to pocket money. However, the participants who witnessed period teasing, those who experienced menstrual pain, and those who believed that attending school during menstruation was taboo were more likely to miss school during menstruation ($p < 0.05$). Moreover, absenteeism at baseline increased the odds of absenteeism at post-intervention ($p < 0.05$).

The findings at the multilevel and multivariable level were similar. There was no substantial evidence of clustering, and the ICC was close to zero. Similar to the above-mentioned findings, the participants in the intervention group had decreased odds of school absenteeism. Risk factors of school absenteeism during menstruation included lack of access to pocket money, witnessing period teasing, experiencing menstrual pain and perceived period taboos. The participants who

reported absenteeism at baseline (AOR = 3.03, 95% CI: 1.88-4.88) were three times more likely to miss school during menstruation at post-intervention. The AIC indicated that the model fit for the multivariable and multilevel models was the same. The findings imply that the interventions were effective in reducing menstruation-related school absenteeism (Table 4.27).

Table 4. 28: Univariable, multivariable and multilevel analyses of effect of the intervention on menstruation-related school absenteeism

Model 3 (school absenteeism)	Univariable COR (95% CI)	Multivariable AOR (95% CI)	Multilevel AOR (95% CI)
Study groups			
Control	1(ref)	1(ref)	1(ref)
Intervention	0.35(0.23-0.53) **	0.54(0.29-0.98) *	0.54(0.29-0.98) *
Access to pocket money			
Yes	1(ref)	1(ref)	1(ref)
No	1.74(1.17-2.59) **	2.00(1.22-3.27) **	2.00(1.22-3.37) **
Toilet room has an odour			
No	1(ref)	1(ref)	1(ref)
Yes	2.23(1.51-3.28) **	1.14(0.69-1.89)	1.14(0.69-1.89)
Changing place has lockable doors			
No	1(ref)	1(ref)	1(ref)
Yes	0.65(0.43-0.97) *	0.89(0.53-1.51)	0.89(0.53-1.51)
HF is regularly supplied with soap			
No	1(ref)	1(ref)	1(ref)
Yes	0.63(0.43-0.94) *	1.33(0.76-2.31)	1.33(0.76-2.31)
School has a source of water			
No	1(ref)	1(ref)	1(ref)
Yes	0.67(0.45-0.98) *	0.77(0.48-1.24)	0.77(0.48-1.24)
Witnessed period teasing in school			
No	1(ref)	1(ref)	1(ref)
Yes	3.01(1.99-4.55) ***	2.17(1.29-3.65) **	2.17(1.29-3.65) **
Experience menstrual pains			
No	1(ref)	1(ref)	1(ref)
Yes	1.55(1.00-2.41) *	1.70(1.00-2.91) *	1.70(1.00-2.91) *
Taboo to attend school on period			
No	1(ref)	1(ref)	1(ref)
Yes	3.19(1.88-5.43) ***	2.38(1.19-4.75) *	2.38(1.19-4.75) *
Able to buy all sanitary products			
No	1(ref)	1(ref)	1(ref)
Yes	0.40(0.276-0.60) ***	0.73(0.44-1.21)	0.73(0.44-1.21)
Knowledge			
Poor	1(ref)	1(ref)	1(ref)
Good	0.45(0.30-0.67) ***	0.83(0.50-1.40)	0.83(0.50-1.40)
Attitude			
Negative	1(ref)	1(ref)	1(ref)
Positive	0.47(0.31-0.71) ***	0.82(0.49-1.36)	0.82(0.49-1.36)
Symptoms of urogenital infections			
No	1(ref)	1(ref)	1(ref)
Yes	2.76(1.73-4.40) ***	1.47(0.85-2.53)	1.47(0.85-2.53)
Baseline of school absenteeism			
No	1(ref)	1(ref)	1(ref)
Yes	2.91(1.96-4.32) ***	3.03(1.88-4.88) **	3.03(1.88-4.88) **

Table 4. 28: Univariable, multivariable and multilevel analyses of effect of the intervention on menstruation-related school absenteeism

Random effect		
σ^2 (within)		3.29
τ_{00} (between)		1.08e-33
chi-square (p-value)		0.00
ICC (%)		3.27e-34
Model fit statistics		
AIC	499.50	499.50
<i>*p < 0.05, **p < 0.01, ***p < 0.001</i>		

4.3.31: Reporting of harm

There was no report of adverse events associated with the interventions. The intervention and control groups did not differ significantly in terms of reporting adverse events or harm. Hence, it can be concluded that the interventions were safe for the study participants since no considerable risk was associated with the interventions.



CHAPTER FIVE

5.0: DISCUSSION

5.1: Introduction

This chapter discusses the findings of the study in relation to existing literature. The chapter begins with a summary of the key findings and highlights the barriers and facilitators to MHM, factors associated with knowledge, attitudes and MHM practices. It also covers the effectiveness of a multi-component menstrual hygiene intervention on menstruation-related school absenteeism, school engagement and symptoms of urogenital infections. The chapter concludes by discussing the limitations and strengths of the study and its contribution to knowledge.

5.2: Summary of key findings

The first objective of the study was to explore barriers and facilitators to optimal menstrual hygiene management among adolescent girls in the Binduri and Pusiga Districts. Personal barriers to optimal MHM include inadequate knowledge and negative attitudes and beliefs about menstruation. At interpersonal level, barriers included inadequate or ambiguous menstrual information from mothers. Inadequate menstrual hygiene facilities in schools, including soap, handwashing, disposal facilities and sanitary pads, made it difficult for girls to adequately manage menstruation. At the societal level, menstruation was stigmatised, and girls were restricted from participating in activities during menstruation. Parents and peer support were facilitators. At the school level, menstrual hygiene lessons were included in various subjects. Some schools had boreholes, toilets and urinal facilities.

The second objective of the study was to assess the effectiveness of the interventions on girls' engagement in school activities during menstruation. The results showed that girls in the intervention group were six times more likely to engage in school activities during menstruation compared to those in the control group. This finding confirms the first hypothesis of the study. The third objective of the study was to evaluate the effectiveness of the interventions on reducing symptoms of urogenital infections. It was found that in the intervention group were less likely to report symptoms of UGI, but this was not statistically significant. This finding points to, but does not confirm, the second hypothesis of the study. The fourth objective of the study was to determine the effectiveness of the interventions on school absenteeism during menstruation. At post-intervention, girls in the intervention group had decreased odds of menstruation-related school absenteeism compared to those in the control group. This suggests that the interventions were effective in reducing school absenteeism during menstruation. This confirms the third hypothesis of the study.

5.3: Barriers to optimal menstrual hygiene management practices

It is important to reiterate that optimal MHM depends on access to and utilisation of menstrual hygiene facilities, including safe menstrual materials to collect the blood, privacy to change the menstrual materials frequently, clean water and soap to wash the body, and safe disposal facilities to discard used menstrual materials. The findings showed that adolescent girls face multiple barriers to optimal MHM, including menstrual disorders, inadequate access to accurate information, sanitary pads, soap, handwashing facilities and disposal facilities. These findings are similar to the findings of existing studies in low- and middle-income countries (Wilbur 2019; Mohammed and Larsen-Reindorf, 2022). The barriers to optimal MHM were categorised into biological, personal, interpersonal, school and community factors.

A major biological-level barrier to optimal MHM was menstrual pain. The baseline results showed that more than half of the girls reported menstrual pain. The prevalence of menstrual pain in this study is higher than the findings of some previous studies in Ghana, Ethiopia and India, (Acheampong et al., 2019; Gebeyehu et al., 2017; Udayar et al., 2022), but lower than the findings of other existing studies in Morocco and Nepal (Lghoul et al., 2020; Sigdel et al., 2023; Ziba et al., 2019). The differences in the prevalence of menstrual pain may be due to the use of a subjective method of measurement (self-reporting). The impact of menstrual pain on optimal MHM cannot be underestimated (Acheampong et al., 2019; Osonuga & Ekor, 2018). Adolescent girls who experience severe pain during menstruation may be unable to maintain optimal personal hygiene, including washing of hands, genitalia and body, as well as, change their menstrual materials frequently. It is therefore crucial to educate adolescent girls about menstrual pain and effective pain management strategies.

Notable among the personal-level barriers to optimal MHM was the inability to buy enough sanitary pads. The baseline findings also revealed that about four in ten participants could not afford enough sanitary pads to manage menstruation. Previous studies reported similar findings among adolescent girls in northern Ghana (Boakye-Yiadom et al., 2018). For example, studies have revealed that adolescent girls lacked regular access to money to buy commercial sanitary pads (Mohammed & Larsen-Reindorf, 2020; Sahiledengle et al., 2022). Adolescents' inability to buy enough sanitary pads was due to the high cost of commercial sanitary products in the study areas. Both teachers and girls who participated in this study expressed concerns about the exorbitant prices of commercial sanitary pads. Evidence shows that the high cost of commercial sanitary products poses a major barrier to accessing safe and adequate menstrual materials

(Hyttel, 2017). A majority of menstruators prefer commercial sanitary pads because they are easy, comfortable and safe to use (Anaba et al. 2022). Therefore, lack of access to adequate sanitary pads may predispose adolescent girls to sub-optimal MHM practices, such as using pieces of old cloth, toilet and tissue paper to collect menstrual blood (Boakye-Yiadom et al., 2018).

Another major personal-level barrier to optimal MHM was inadequate access to information about menstrual hygiene. There is evidence to show that adolescent girls lack access to timely, adequate and accurate information about menstrual hygiene (Chandra-Mouli & Patel, 2017). This is partly because menstruation is shrouded in a culture of silence, secrecy and stigma; hence, teachers and parents are uncomfortable discussing it with adolescents (Chandra-Mouli & Patel, 2017). Some adolescent girls in low-and-middle income countries attain menarche with limited understanding of menstrual hygiene (Chandra-Mouli & Patel, 2017). Inadequate access to menstrual hygiene information may be associated with poor knowledge about menstrual hygiene. The current study revealed that 56.6% of the adolescent girls demonstrated poor knowledge about menstrual hygiene at baseline. Prior studies found that 20-53.6% of Ghanaian girls lacked adequate knowledge about menstrual hygiene (Boakye-Yiadom et al., 2018; Kpodo et al., 2022; Mohammed & Larsen-Reindorf, 2020). The inconsistencies in the findings on knowledge about menstrual hygiene might be due to the use of different measurement scales. Currently, there are no standardised and validated scales for measuring knowledge of menstrual hygiene among adolescents. Several factors may account for adolescents' limited knowledge about menstrual hygiene. Firstly, the current menstrual hygiene curriculum for public junior high schools in Ghana does not contain comprehensive information about menstrual hygiene that meet

the needs of the modern adolescent girl. Secondly, the absence of a female teacher in some of the schools might have affected girls' access to information about menstrual hygiene management. Menstruation is a sensitive topic, and girls may feel uncomfortable or ashamed to discuss it with male teachers. Also, some male teachers are uncomfortable or unprepared to discuss menstruation with adolescent girls (McMahon et al., 2011). There is evidence to show that poor knowledge about menstrual hygiene is associated with unhygienic menstrual management practices (Neupane et al., 2020; Poudel & Gautam, 2020). For instance, a cross-sectional study among adolescent girls in Ethiopia found that girls with poor knowledge about menstruation were 1.5 times more likely to engage in poor menstrual hygiene management practices (Belayneh & Mekuriaw, 2019).

Another major barrier to optimal MHM was poor parent-daughter communication about menstrual hygiene. The girls reported that their mothers gave them inadequate and unclear information about menstruation, while their fathers did not discuss menstruation with them. These findings are consistent with previous studies (Mohammed et al., 2017; Zakaria & Jarin, 2020). For instance, Zakaria and Jarin (2020) reported that mothers in India imposed restrictions on their daughters, such as not attending school, going outside the house, and touching anyone during menstruation. There is also evidence to show that some parents lack the competence to talk to their children about menstruation (Chandra-Mouli & Patel, 2017).

Moreover, mothers socialise girls to comply with menstrual taboos, norms and restrictions (Bennett & Harden, 2014; Costos et al., 2002). In low-and middle-income countries, mothers are adolescents' primary source of information about menstrual hygiene (Coast et al., 2019; Poudel

& Gautam, 2020). Therefore, unclear and inaccurate information from mothers may engender poor menstrual hygiene management practices. For example, a study in Egypt found that less than half of mothers informed their daughters to use disposable sanitary pads and change their pads frequently. Some mothers in Egypt asked their girls to wash their genitalia with soap (Mohammed et al., 2017). Mothers also communicated menstruation in a negative tone and compel their daughters to comply with menstrual taboos and restrictions (Coast et al., 2019; Mohamed et al., 2018). Good mother-daughter communication about menstrual hygiene is associated with optimal menstrual hygiene practices, such as the use of safe sanitary towels (Rana & Jami, 2018). Therefore, improving mother-daughter communication about menstrual hygiene can improve MHM practices among adolescent girls.

Additionally, the formative study and baseline results showed that the schools lacked adequate menstrual hygiene facilities, including soap, handwashing facilities, changing rooms and sanitary products. Moreover, some of the schools had unclean toilet and urinal facilities. These findings support earlier studies that found that basic schools in low-and middle-income countries were not menstrual hygiene-friendly (Hennegan et al., 2016; Rajagopal & Mathur, 2017). For instance, in the study of Mohammed and Larsen-Reindorf (2020), basic schools in the Northern Region of Ghana lacked regular soap supply, adequate disposal, handwashing and clean toilet facilities. Several factors could explain these findings. For instance, financial constraints and a lack of deliberate policies towards promoting menstrual hygiene in schools may explain the above finding. In Ghana, basic education is free for pupils in public schools. Moreover, some teachers indicated that the Ghana Education Service has introduced a new policy where teachers in public schools cannot levy students. This implies that the schools may not have enough funds to provide

or maintain menstrual hygiene and WASH facilities. Prior to this policy, some teachers levied health dues. Thus, the students contributed little money to buy soap, sanitary pads and handwashing facilities.

Finally, adolescent girls faced MHM barriers at the community level. Consistent with the literature, this study found that menstruating girls were stigmatised in society. They were also restricted from using some household items and participating in religious and domestic activities. These findings support previous studies in Egypt and India (Mohamed et al., 2018; Raina & Balodi, 2014; Thakur et al., 2014). For example, a study revealed that menstruating girls were restricted from entering the mosque, cooking local dishes and attending school and work because they were considered unclean (Kapoor & Khari, 2016). In some societies, menstruation is considered taboo and shrouded in a culture of secrecy. These findings could be linked to the beliefs and teachings of certain religious groups. Followers of some religious denominations believe that women are impure or unholy during menstruation. Therefore, they are excluded from participating in religious activities (Sharma et al., 2022). For example, it is a requirement for Muslim women and girls to avoid religious activities during menstruation, including entering the mosque, fasting, and reading the holy Quran (Shah et al., 2019). Additionally, negative beliefs and perceptions about menstruation might have been transferred from older women to adolescent girls. Restrictions, embarrassment and myths associated with menstruation influence poor menstrual hygiene practices (Chandra-Mouli & Patel, 2017). For instance, most of the participants in this study dried their reusable menstrual materials, such as a piece of cloth, indoors or covered them due to fear of stigma and shame. It is recommended that reusable cloth be dried in the sun. The sun is a natural steriliser that helps kill germs (Asumah et al., 2022).

Therefore, drying reusable materials indoors is an unhygienic menstrual practice that is associated with urogenital infections (Torondel et al., 2018). Furthermore, girls who are restricted from sharing buckets may have difficulties maintaining optimal body washing during menstruation. Therefore, it is crucial to focus on de-stigmatizing and normalising menstruation to help improve MHM (Blake et al., 2018; Hennegan, 2017). Normalising menstruation can help create a supportive environment where girls can manage reusable menstrual materials effectively and maintain optimal personal hygiene during menstruation.

5.4: Facilitators of optimal menstrual hygiene management practices

Regarding the facilitators of optimal MHM, two main themes were identified at the interpersonal and school levels. At the interpersonal level, parental support and peer support were highlighted as facilitators of MHM. The adolescents stated their parents bought sanitary pads for them to manage their menstruation. The baseline analysis also showed that eight in ten adolescent girls indicated that their parents supported them with sanitary pads. There is evidence to show that parents are the main benefactors of sanitary pads for adolescent girls (Boakye-Yiadom et al., 2018; Mason et al., 2013). This finding is expected because adolescent girls in school may not be involved in any economic activities. It is therefore the responsibility of parents to meet girls' personal needs, such as sanitary pads. The implications of the findings cannot be underestimated. Adolescent girls who have access to enough sanitary pads are more likely to change their menstrual materials frequently. Increasing access to sanitary pads can also help reduce the risk of using unsafe materials that predispose girls to infections and leakages. Going forward, menstrual hygiene interventions should focus on strengthening parental support for adolescent girls.

With respect to school level facilitators, it was found that the majority of the schools had boreholes, toilet and urinal facilities. Previous studies have shown that basic schools in Ghana have water and toilet facilities (Acheampong et al., 2018; Kumbeni et al., 2020). For instance, Mohammed and Larsen-Reindorf (2020) found that basic schools in the Kumbungu District had toilet facilities (Appiah-Brempong et al., 2018). On the contrary, a similar study in the West Gonja Municipality assessed schools' preparedness for MHM and found that more than half of the schools had no source of water (Asumah et al., 2022). An earlier study also revealed that the majority of basic schools in the Ejisu-Juaben District had no source of water (Appiah-Brempong et al., 2018).

The disparities between the study periods may explain the conflicting results. It seems that studies conducted before the COVID-19 pandemic found that schools lacked adequate water facilities. During the outbreak of the COVID-19 pandemic in Ghana, the government, through the Ghana Education Service and other stakeholders, supplied Veronica buckets to basic schools. It is also possible that water facilities were built in basic schools to help fight the COVID-19 pandemic. Furthermore, the study areas have benefited from the programmes of development partners and non-governmental organisations, including the construction of toilet facilities and boreholes in schools. These findings have implications for MHM. Access to clean water is crucial for optimal MHM. It is expected that girls wash their hands with water and soap before and after changing menstrual materials, as well as wash their genitals with only water. Hand and genital washing can help reduce the risk of infections. In the absence of a menstruation room, adolescent girls changed their menstrual materials in the toilet or urinal rooms. Therefore, the

availability of toilet and urinal rooms in schools can help provide privacy for girls to change menstrual materials frequently to help reduce discomfort and infections.

5.5: Menstrual hygiene management practices among adolescent girls at baseline

This study reported mixed findings regarding menstrual hygiene practices at baseline. A majority of the adolescent girls used disposable sanitary pads. More than half of the girls frequently changed their menstrual materials and practised good handwashing. Previous studies in Ghana have shown that most adolescent girls use disposable sanitary pads to manage menstruation (Nsemo et al., 2020). Also, a study among adolescent girls in the West Gonja Municipality revealed that more than half of the participants used commercial sanitary pads (Asumah et al., 2022). Findings regarding handwashing and changing menstrual products support evidence from LMICs (Mohammed et al., 2020).

However, the findings of this study contradict prior studies among adolescent girls in Ghana. In the study of Mohammed et al. (2020), it was revealed that less than half of adolescent girls in school used disposable sanitary pads (Belay et al., 2020). Boakye-Yiadom et al. (2018) also found that the majority of adolescent girls in the Yendi Municipal used pieces of cloth to manage menstrual blood. Baku et al. (2020) also found poor handwashing practices among adolescent girls in the Volta Region of Ghana.

In this study, a considerable proportion of the adolescent girls combined different menstrual materials, including sanitary pads, pieces of cloth and tissue paper. Additionally, a majority of the adolescent girls washed their genitalia with soap. They also reported unsafe disposal of used menstrual materials. Adolescent girls who used pieces of cloth dried them indoors and did not

sterilise them. These findings corroborate a large menstrual survey in ten low-and middle-income countries (Smith et al., 2020). The authors demonstrated that menstruators combine different types of menstrual materials. In accordance with the present findings, previous studies in Ghana have demonstrated that adolescent girls wash their vagina with soap and water (Boakye-Yiadom et al., 2018; Mohammed et al., 2020). The finding regarding the inappropriate disposal of menstrual materials is also consistent with the literature (Asumah et al., 2022; Mohammed et al., 2020; Nsemo et al., 2020). The literature shows that girls dry their reusable menstrual materials indoors or under shade due to shyness (Asumah et al., 2022).

Several factors may explain the aforementioned findings. For example, more adolescent girls used sanitary pads because their parents supported them with money to buy them. An earlier study in Ghana also showed that adolescent girls prefer disposable sanitary pads because they are safe and comfortable to use (Mohammed & Larsen-Reindorf, 2020). The good handwashing practises among adolescents in this study could be attributed to the availability of water in most of the selected schools. Additionally, the fact that the majority of schools had toilet and urinal facilities may explain the frequent changing of menstrual materials among adolescent girls. These facilities served as changing places for the majority of the participants.

It is possible that the girls combined different menstrual materials because they could not afford enough commercial sanitary pads (Mohammed & Larsen-Reindorf, 2020). Moreover, girls who washed their genitalia with water and soap might lack understanding of the negative health implications. Girls dispose of used menstrual materials in toilet pits out of fear that they can be

used for rituals. Additionally, stigma and the belief that men should not see menstrual materials may explain the drying of reusable cloth indoors (Mohamed et al., 2018).

The findings on access to menstrual materials and MHM practices raise intriguing questions about the affordability of commercial sanitary pads and girls' understanding of menstrual hygiene. Girls who lack access to safe menstrual materials are predisposed to infections, school absenteeism and transactional sex (Vashisht et al., 2018). Girls who wash their vagina with soap are vulnerable to infections (Vashisht et al., 2018). The vagina has ecology with a healthy mucosal environment. Introducing soap into the vagina may change the composition of a healthy vaginal microbiome and increase the risk of infection (Huang et al., 2014). For example, a longitudinal study in Kenya reported that women who washed their vagina with soap were at a higher risk of HIV infection. The risk of developing reproductive tract infections may increase if reusable materials are dried indoors (Torondel et al., 2018). Further, the disposal of menstrual materials in the toilets can cause blockages in sewage systems and the rapid filling of pit latrines (Kaur et al., 2018).

5.6: Factors associated with school absenteeism during menstruation

At baseline, three in ten adolescent girls missed school during their last menstrual cycle. This finding is lower than the prevalence of menstruation-related school absenteeism reported by previous investigations in Ghana (40.4%) (Mohammed et al., 2020), Ethiopia (54.5%) (Tegegne & Sisay, 2014), Bangladesh (41%) (Alam et al., 2022) and India (40%) (Vashisht et al., 2018). On the other hand, the prevalence of school absenteeism in this study is higher than existing studies in The Gambia (27%) (Shah et al., 2022), Nepal (22.1%) (Ranabhat et al., 2019), South Africa (11.3%) (Khamisa et al., 2022) and Indonesia (11.1%) (Davis et al., 2018). These findings

suggest that menstruation still poses a challenge to school attendance among adolescent girls across LMICs.

Consistent with the literature, the present study found a statistically significant association between menstruation-related school absenteeism and menstrual pain, exposure to television, taboo, access to pocket money, availability of sanitary pads, missing religious activities, attitudes towards menstruation and menstrual hygiene practices. For instance, a mixed-methods study in The Gambia found an association between menstrual pain and school absenteeism during menstruation among rural girls (Davis et al., 2018; Khamisa et al., 2022; Shah et al., 2022). Another cross-sectional study in Bangladesh revealed that poor menstrual hygiene practices were associated with school absenteeism (Hasan et al., 2021). In the study of Tegegne and Sisay (2014), lack of access to sanitary pads was linked to school absenteeism during menstruation.

There are several possible explanations for the aforementioned findings. The differences in menstruation-related school absenteeism across LMICs could be attributed to access to menstrual hygiene facilities. Adolescent girls who experience severe menstrual pain might feel uncomfortable attending school. Furthermore, a systematic review showed that access to pocket money was positively associated with good menstrual hygiene management among adolescent girls (Sahiledengle et al., 2022). Therefore, girls who do not have access to pocket money may not have access to sanitary pads. Another possible explanation is that girls who are not exposed to television might lack adequate information about menstrual hygiene management.

These findings have implications for girls' empowerment and public health. For instance, some of the issues emerging from these findings relate specifically to girls' inclusion in education, academic performance and educational attainment. Missing school during menstruation means that adolescent girls will miss some lessons and class activities. These can lead to poor academic performance and decrease their chances of attaining higher education. Frequent school absenteeism may increase the risk of dropping out of school (Tash, 2018). Keeping girls in school is a protective factor against child marriage, unwanted pregnancy and early childbirth (Birchall, 2018; Murphy-Graham et al., 2020). Higher educational attainment among women is a protective factor against low utilisation of maternal and child health services and poor maternal and child health outcomes (Barman et al., 2020; Mensch et al., 2019). Therefore, adolescent girls who are unable to attain higher education due to menstruation-related absenteeism may be at a higher risk of poor maternal and child health in the future. It might as well pose a threat to achieving the Sustainable Development Goals, especially goals related to inclusion in quality education, health and wellbeing, gender equality, hunger, poverty and inequalities. These findings suggest that menstrual hygiene interventions that aim to address menstruation-related school absenteeism are needed.

5.7: Factors associated with symptoms of urogenital infections among adolescent girls

The prevalence of self-reported symptoms of UGI was close to 73%. Four in ten girls reported abnormal vaginal discharge and itching in the genitalia, while three in ten girls reported a burning sensation while urinating. Previous studies have also reported symptoms of urogenital infections among menstruating girls in India and The Gambia (Das et al., 2015; Nabwera et al., 2021). For instance, a study in an Indian urban slum found that more than half of adolescent girls reported genitourinary tract morbidities (Pal et al., 2017). Vaginal discharge was reported among

19% of adolescent girls in the study of (Juyal et al., 2014). A similar study found that 10%, 15.6%, and 32.6% of menstruating girls reported pain during urination, itching in the genitalia, and vaginal discharge, respectively (Singh & Kushwaha, 2022). In The Gambia, 47% of adolescent girls had at least one symptom of reproductive tract infections. The researcher observed that exactly 45% had itching in the genitalia, 22% had abnormal vaginal discharge, and 23% reported burning sensations during urination (Nabwera et al., 2021). Another study among adolescent girls in Uganda found a high prevalence of vaginal discharge and itching (Hennegan et al., 2016). These findings provide tentative evidence that urogenital infections might be common among menstruating adolescents in LMICs.

Consistent with the literature, this study found a statistically significant relationship between symptoms of UGI and menstrual hygiene practices, menstrual pain and heavy bleeding, and the unavailability of WASH facilities in schools (Singh et al., 2011). Again, a cross-sectional survey in India showed a statistically significant relationship between unhygienic menstrual practices and symptoms of reproductive tract infections (Juyal et al., 2014). Another study demonstrated that menstruators who used reusable materials and practised poor personal hygiene were more likely to report symptoms of infection (Torondel et al., 2018).

Regarding the correlates of symptoms of urogenital infections, it is possible that girls who do not wash their hands before changing menstrual materials may introduce bacteria into their reproductive or urinary tracts. Also, adolescent girls who wear menstrual materials for a longer period are susceptible to infections because damp or moist menstrual materials create a conducive environment for fungi and bacteria to thrive. It was observed in this study that a

majority of adolescent girls washed their genitals with soap. The chemical in soap may change the makeup of the vaginal microbiome and increase the risk of UGI (Fashemi et al., 2013). Additionally, adolescents who lack access to safe menstrual materials may resort to the use of unsafe materials such as old cloth and tissue papers. These unsafe materials may hold bacteria and fungi and could lead to infections in the urinary and reproductive tracts (Ademas et al., 2020).

The public health implications of these findings are evident. Untreated infections in the reproductive or urinary tracts have health implications that can be life-threatening. For instance, infections in the reproductive tract increase the risk of prenatal infection, toxic shock syndrome, ectopic pregnancy and low birth weight (Hema Priya et al., 2017). Infections are associated with school absenteeism among adolescent girls. Further, girls with infections might be unable to concentrate in class due to the discomfort and pain. These could have consequences for their academic performance, health and wellbeing.

5.8: Factors associated with engagement in school activities during menstruation

Another important finding at baseline was that the majority of the participants reported low engagement in school activities during menstruation. More than half of the participants missed school hours, had their concentration and movement in class affected, and missed sports activities due to menstruation. Four in ten missed class tests or were not comfortable standing up in the classroom during menstruation. These findings confirm previous investigations in low- and middle-income countries (Mohamed et al., 2018; Vaughn, 2013). For instance, a qualitative study in Ghana found that menstruation affected girl participation in daily activities, physical activities and concentration (Dolan et al., 2014). An investigation in Uganda also found that

64.7% of menstruating girls avoided standing up to answer a question in the classroom, and 51% found it difficult to concentrate in the classroom (Hennegan et al., 2016). These findings imply that menstruation poses a threat to girls' engagement in school activities.

There was a statistically significant association between engagement in school activities and exposure to television, menstrual pain, heavy bleeding, symptoms of UGI, access to sanitary pads, availability of clean toilet rooms, knowledge and attitudes towards menstruation. Several reasons may explain girls' low engagement in school activities during menstruation. For instance, there is evidence to show that fear of staining school uniforms, distress and menstrual pain are associated with poor concentration in the classroom (Armour et al., 2020; Vashisht et al., 2018). Worries about the absence of clean changing places in school may be linked to insecurity and disengagement in class activities (Hennegan et al., 2016).

It has been revealed that adolescent girls who lack access to adequate sanitary pads and menstrual hygiene facilities may be unable to manage menstruation confidently. This can lead to fear and difficulties in concentrating in the classroom (Vaughn, 2013). Girls are also uncomfortable standing up in class to answer questions or avoid physical activities due to the fear of period teasing (Crichton et al., 2013). Poor concentration in class and fear of standing up to answer questions might be due to worries about stains or concern over odours (Dutta et al., 2016). According to Mohamed et al. (2018), low participation in school activities during menstruation is due to a lack of access to safe menstrual materials, a lack of functional WASH facilities in schools, and fear of staining uniforms.

The results of this study suggest that menstruation is a risk factor for low engagement in school activities among menstruating girls. These have consequences for girls' wellbeing and academic performance. Poor concentration in the classroom can lead to poor academic performance and reduce girls' chances of attaining higher education and future economic opportunities. Additionally, the fear of standing up or walking in class implies that adolescent girls may not change their menstrual materials as frequently as expected when at school. Prolonged use of the same materials could predispose girls to infections, discomfort, and the staining of their uniforms due to an overflow of menstrual blood. Girls who stain their uniforms are susceptible to period teasing, ridicule and embarrassment. Finally, the fear of teasing and anxiety may affect the psychosocial wellbeing of adolescent girls. In summary, barriers and facilitators at the biological, personal, school and societal levels influence MHM practices, school absenteeism, engagement in school activities and symptoms of urogenital infections among adolescent girls. Therefore, menstrual hygiene interventions that focus on addressing multiple barriers are more likely to be effective. Hence, there is a need for menstrual hygiene interventions that combine both software and hardware interventions.

5.9: Effectiveness of the menstrual hygiene interventions on girls' knowledge about menstrual hygiene

At baseline, less than half of the participants demonstrated good knowledge of menstrual hygiene. A statistically significant difference was found between the intervention group and control group at post-intervention. This finding is consistent with previous studies in Iran, Indonesia and India, (Darabi & Yaseri, 2022; Nastiti et al., 2023; Ramaiya et al., 2019). For instance, studies in Bangladesh, Ethiopia, and China found that menstrual hygiene education

interventions were effective in increasing adolescents' knowledge about menstruation (Blake et al., 2018; Haque et al., 2014; Su & Lindell, 2016). The observed increase in knowledge suggests that the information materials and training in this study were comprehensive and provided age-appropriate menstrual hygiene information.

5.10: Effectiveness of the menstrual hygiene interventions on attitude towards menstruation

There was a statistically significant difference between the intervention and control groups in terms of attitude towards menstruation. For example, more girls in the control group reported misperceptions related to menstruation. Some previous studies have reported that menstrual hygiene interventions are effective in improving attitudes, beliefs and perceptions about menstruation (El-Lassy & Madian, 2013; Mehrabi et al., 2016; Nastiti et al., 2023). For instance, a recent mixed-methods study in Zimbabwe reported that young women felt more confident about menstruation after receiving education and sanitary products. Moreover, girls were confident of breaking socio-cultural norms that portray menstruation as shameful and secretive (Tembo et al., 2023).

The positive results reported in this study and other studies suggest that menstrual hygiene education has the potential to change negative beliefs, perceptions and attitudes towards menstruation (Fetohy, 2007). An improvement in positive beliefs and attitudes towards menstruation has several public health advantages. For instance, a positive attitude towards menstruation can result in optimal menstrual hygiene practices, school attendance and participation in social and economic activities (Afsari et al., 2017). Positive menstrual attitudes can also help reduce discrimination and abusive behaviours against menstruating girls (Aluko et

al., 2020). Furthermore, positive beliefs about menstruation may contribute to high self-esteem and increase the self-confidence of adolescent girls during menstruation (Anee et al., 2020).

5.11: Effectiveness of the menstrual hygiene intervention on MHM practices

The interventions were effective in increasing MHM practices among adolescent girls. At post-intervention, a few girls in the intervention group were involved in poor MHM practices. These findings are similar to the findings of some previous studies (Agbede & Ekeanyanwu, 2021; Neelkanth et al., 2017). For instance, a study by Haque et al. (2014) in Bangladesh found an improvement in the use of sanitary pads, disposal practices, drying of reusable materials, and cleaning of the genitalia after a six-month educational intervention. Another study in India revealed a significant improvement in genital cleaning, handwashing and drying practices at post-test (Santhanakrishnan & Athipathy, 2018). The observed increase in menstrual hygiene practices in this study could be explained by the dosage and high compliance with the interventions. Providing subsidised sanitary pads means that more girls were able to afford enough of them. Hence, access to safe menstrual materials increased among girls in the intervention group. Additionally, the improvement in handwashing and disposal practices could be attributed to the distribution of Veronica buckets, soap and dustbins, which increased access to WASH facilities in schools. Prior studies have established a significant relationship between the availability of WASH facilities in schools and good MHM practices (Acheampong et al., 2018; Chinyama et al., 2019). These results have implications for reducing infections in the urinary and reproductive tracts among girls. There is a growing public concern about Ghanaian adolescent girls exchanging sex for money to buy sanitary pads (Tahiru, 2023). Therefore, subsidising the price of sanitary pads may help address the issue of transactional sex among young women (Phillips-Howard et al., 2016). Girls who exchange sex for money to buy sanitary

pads are susceptible to sexually transmitted diseases, reproductive tract infections, unplanned pregnancy, sexual abuse, school dropout, early childbirth and child marriage (Austrian et al., 2019; Kilburn et al., 2018; Ranganathan et al., 2016). Besides, adolescents who resort to using tissue paper and old pieces of cloth, as well as, those who practise poor personal hygiene, are predisposed to reproductive tract infections. Moreover, tissue paper might be unable to absorb all the menstrual blood, which may lead to leakages and period teasing. Again, girls who use makeshift menstrual materials may have poor concentration, less engagement and low confidence in the classroom due to fear of soiling their uniforms. These observations provide some initial evidence that providing subsidised sanitary pads, menstrual hygiene education, and WASH facilities can help improve menstrual hygiene management among girls in school.

5.12: Effectiveness of the menstrual hygiene interventions on school absenteeism during menstruation

The CRT showed a significant reduction in menstruation-related school absenteeism. Previous studies in Kenya found similar evidence regarding menstrual hygiene interventions and school absenteeism (Mason et al., 2015; Mucherah & Thomas, 2017). For instance, the first intervention in an African setting showed that combining puberty education with free sanitary pads or puberty education alone increased school attendance at three and five months post-intervention, respectively (Montgomery et al., 2012). In Bangladesh, providing menstrual hygiene kits and puberty education to teenage girls for six months increased school attendance (Alam et al., 2022). In the study of Benshaul-Tolonen et al. (2021), providing sanitary pads resulted in decreased school absenteeism among adolescent girls in Kenya. Furthermore, there is a positive

relationship between access to menstrual information and reduced school absenteeism (Vashisht et al., 2018).

Plausible explanations are that interventions increased access to safe menstrual materials among girls. Also, access to WASH facilities improved because Veronica buckets, soap, tissue papers and dustbins were provided. Additionally, an improvement in knowledge about menstrual hygiene was observed at the end of the trial. Lastly, the sensitization activities against period teasing in schools could have helped reduce the fear of period teasing among the participants. Promoting school attendance among adolescent girls has several educational and public health advantages. For example, increasing school attendance means that no girl will miss classes due to menstruation. So, girls would be able to attain good grades and pursue higher education, which would increase their chances of gaining better economic opportunities in the future. Higher educational status among women is an enabling factor for the uptake of public health services, including family planning services (Damtie et al., 2021) and maternal and child health services (Agunwa et al., 2017). Further, highly educated women may obtain better employment opportunities, that can help reduce issues of hunger, poverty, and food insecurity (Alpízar et al., 2020). Empowering girls through education can help reduce gender inequalities, discriminations and violence against women and girls (Sanz-Barbero et al., 2019).

5.13: Effectiveness of the menstrual hygiene interventions on symptoms of UGI

The current study demonstrated that the interventions were ineffective in reducing self-reported symptoms of urogenital infection among adolescent girls. This is the first study in Ghana to investigate menstrual hygiene interventions and symptoms of urogenital infection. The literature contains conflicting evidence about menstrual hygiene interventions and infections. For example,

a study conducted among adolescent girls in rural India found that providing menstrual materials did not significantly reduce self-reported symptoms of infection (Shah et al., 2013). Another study in Egypt showed that providing reproductive health education was ineffective in reducing symptoms of reproductive tract infections among adolescent girls (Mohamed, 2018).

This finding broadly contradicts the work of other studies on menstrual hygiene interventions and infections. For example, Phillips-Howard et al. (2016) conducted a three-arm randomised controlled trial in Kenya. The author found that distributing menstrual cups to adolescent girls decreased their risk of bacterial vaginosis. In India, a non-randomized trial showed that weekly menstrual hygiene lectures and interactive classes significantly reduced genital and urinary tract infections among primary school girls (Pal et al., 2017). Similarly, a prospective cohort study in Rwanda revealed that providing sanitary pads resulted in reduced symptoms of vulvovaginal infections after six months (Janoowalla et al., 2020). The disparities in the findings can be attributed to differences in measurement methods. This study employed a self-reporting method of assessment, which may differ from using clinical assessment.

Urogenital infection poses a public health threat and can affect health, wellbeing and participation in socio-economic activities. This study revealed that poor school engagement during menstruation was common among girls reporting symptoms of urogenital infections. Girls with symptoms of infections may experience ill health. Hence, they may not attend school, or they may miss school to seek treatment at a health facility. When infections in the reproductive and urinary tract are not treated, they can have deleterious health consequences, including ectopic pregnancy, prenatal infection, and low birth weight (Hema Priya et al., 2017).

5.14: Effectiveness of the menstrual hygiene interventions on engagement in school activities during menstruation

At post-intervention, girls in the intervention group were significantly more likely to engage effectively in school activities during menstruation compared to those in the control group. These findings are similar to the existing body of knowledge. For example, a study by Dolan et al. (2014) in Ghana demonstrated that providing free sanitary pads with education was effective in addressing issues of self-confidence, insecurity and concentration in the classroom during menstruation. A recent study in Bangladesh showed that providing menstrual hygiene kits, puberty education and improving sanitation facilities in schools led to an increase in girls' concentration and participation in class activities during menstruation (Alam et al., 2022). The increase in school engagement can be attributed to various factors. For instance, the subsidy on sanitary pads significantly improved access to safe absorbents, thereby reducing the fear of period soiling and the dislodging of menstrual material. Moreover, the menstrual hygiene interventions increased adolescents' knowledge and menstrual hygiene practices. These might have led to an improvement in self-confidence and engagement in school activities. The public health implications are apparent. An increase in girls' engagement in class activities can lead to better academic performance. Also, a positive self-image could be achieved when adolescent girls feel confident and succeed in their academics. The long-term implications of improved academic performance include higher income and better economic opportunities. Improved socio-economic status is a protective factor against poor physical and mental health (Williams et al., 2016). Adolescent girls who engage well in class activities can develop skills such as critical thinking, effective communication and problem solving. These skills may foster their academic

progression and future success. Moreover, improving academic performance among adolescent girls can help bridge the gender inequality gap.

In summary, increasing school attendance and engagement through menstrual hygiene interventions are crucial for achieving the Sustainable Development Goals. Increasing access to menstrual hygiene facilities is directly linked to addressing health, sanitation and water-related problems. Also, reducing school absenteeism and disengagement among girls is closely linked to ensuring inclusive and equitable quality education. Finally, higher educational status among girls and women is a major protective factor against poverty, hunger, gender inequality, indecent work and income inequality.

5.15: Strengths of the study

The study has several strengths:

1. The design of the multi-component menstrual hygiene intervention was based on the findings of the formative study. The researcher collected data on the population and setting for a comprehensive understanding of the problem. The findings of the formative study helped in the design of tailored interventions.
2. This study combined both quantitative and qualitative research approaches to find answers to the research questions. A major strength of mixed-methods studies is that the researcher can obtain a comprehensive understanding of the research problem by complementing quantitative and qualitative findings.
3. The risk of contamination was low in this study because the schools were randomly assigned instead of individual participants.

4. The trial was implemented and evaluated in a real-world setting with a large sample size. In addition, the study had a low attrition rate and appropriate statistical analyses were employed. These factors lead to greater internal and external validity.

5.16: Limitations of the study

Although the study has several strengths, it is not devoid of limitations.

1. The study cannot determine the contribution of different aspects of the interventions. It should be explored in future studies.
2. In this study, it was difficult to blind the participants and the research team because of the nature of the interventions.
3. The non-involvement of community members is another limitation of this study.
4. The findings of this study should be interpreted with caution because of missing data.
5. It would have been appropriate to ask about the types of wrappers used at home and school, respectively, because the intervention was based in schools.
6. Also, it would have been appropriate to use proportional allocation in the study groups.

5.17: Field challenges

The researcher encountered challenges during the piloting, data collection and implementation phases of the study. Initially, the researcher wanted to provide adolescent girls with free menstrual cups. The menstrual cup is a cost-effective and environmentally friendly alternative to sanitary pads. It has been piloted among adolescent girls in Kenya and Uganda to assess its acceptability. The goal was to determine its feasibility among adolescent girls in Ghana. According to the 2022 Ghana Demographic and Health Survey report, some women in Ghana use menstrual cups to manage menstruation. However, during the piloting of the intervention in a

different district, the researcher observed low acceptability and intention to use the menstrual cup. Adolescent girls expressed concerns about the size and texture of the menstrual cup. They were also unwilling to insert the menstrual cup into their vagina. Consequently, the protocol was revised. The menstrual cups were replaced with subsidised sanitary pads. The Institutional Review Board approved the amended protocol. Additionally, public school teachers embarked on a strike action that delayed the study for two weeks.

5.18: Contribution to knowledge

The findings of this study make a relevant contribution to the literature on menstrual hygiene and health. It also adds to the limited evidence on the effectiveness of menstrual hygiene interventions in Africa. The findings can be useful to school managers, policymakers and the scientific community.

1. This study is among the few studies that have comprehensively explored barriers and facilitators to optimal MHM among adolescent girls in school.
2. To the best of the researcher's knowledge, this is the first cluster randomised trial in Ghana to investigate the effectiveness of menstrual hygiene interventions on school attendance, school engagement and symptoms of urogenital infection.
3. Previous menstrual hygiene interventions have focused on providing free menstrual materials. This is the first study in Ghana to investigate the effectiveness of providing subsidised menstrual materials to adolescent girls in school.

CHAPTER SIX

6.0: CONCLUSIONS AND RECOMMENDATIONS

6.1: Introduction

This chapter of the study draws meaningful conclusions that can be useful to various stakeholders. In addition, it provides a set of recommendations that are intended to inform policy, improve practice, and guide future research in this relevant field.

6.2: Conclusions

The study has demonstrated that adolescent girls in the Binduri and Pusiga Districts encountered multiple barriers to optimal menstrual hygiene management. The barriers are multifaceted: biological, personal, interpersonal, school-related, and societal. Adolescent girls experienced menstrual pain and lacked adequate knowledge and positive attitudes towards menstruation. The schools lacked adequate menstrual hygiene and WASH facilities. These barriers affected adolescent girls' menstrual hygiene management, engagement in school activities, and school attendance during menstruation.

At baseline, a majority of adolescent girls lacked adequate knowledge and positive attitudes towards menstruation. Moreover, the prevalence of symptoms of urogenital infection was high. A majority of the participants did not engage well in school activities during menstruation, and one in three adolescent girls missed school during menstruation.

Providing subsidised sanitary pads, menstrual hygiene education, sensitization, soap, tissue paper, handwashing and disposal facilities in schools was effective in reducing menstruation-

related school absenteeism and increasing engagement in school activities during menstruation. However, self-reported symptoms of urogenital infections among girls in junior high school was not affected by this intervention.

These findings have several public health implications. Stakeholders who are interested in promoting menstrual hygiene and health among adolescent girls can leverage these findings. Additionally, these findings can be instrumental to stakeholders who are interested in promoting girl child education and the reproductive health and rights of girls. This study has highlighted the deficiencies in menstrual hygiene management and gaps in the current menstrual hygiene curriculum. Therefore, stakeholders can leverage these findings to develop a new menstrual hygiene curriculum that is relevant to contemporary adolescents.

Above all, stakeholders can integrate the interventions into existing menstrual hygiene programmes. This can help improve menstrual hygiene practices among adolescent girls. If implemented effectively, the interventions could contribute to promoting the overall health and well-being of adolescent girls. An improvement in school engagement and school attendance can lead to better academic performance among adolescent girls. It can increase their chance of attaining higher education and associated benefits. Investing in menstrual hygiene management among adolescent girls can help Ghana achieve some of the United Nations Sustainable Development Goals.

6.3: Recommendations

The following recommendations are made based on the findings of the study.

6.3.1: Policy

1. The Ghana Education Service, through the National Council for Curriculum Assessment, should collaborate with the Ghana Health Service to review and update the current menstrual hygiene curriculum for junior high schools. The revised curriculum should be more comprehensive and include pertinent aspects of menstrual hygiene and health, including menstrual disorders, the menstrual cycle and strategies for managing menstrual pains. This will help address adolescents' knowledge gaps regarding menstrual health.
2. The Ministry of Finance, through the Ghana Revenue Authority, should consider removing taxes on sanitary products. They should also regulate the pricing of commercial sanitary products to help address period poverty. This may help increase access to safe menstrual materials and improve health and educational outcomes among adolescent girls.

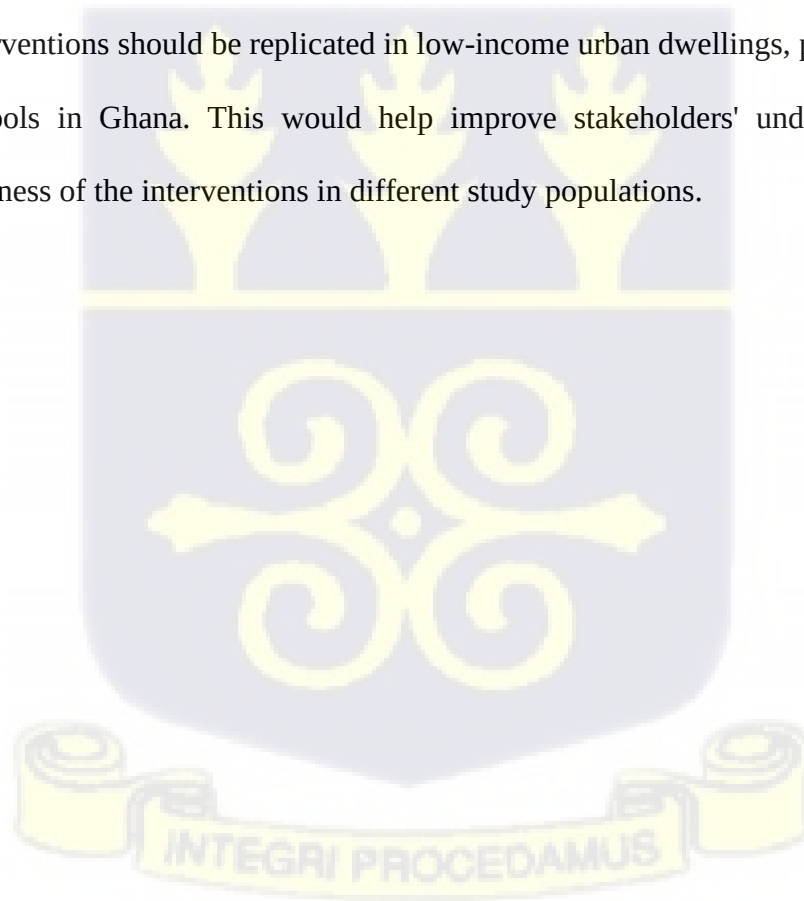
6.3.2: Practice

1. The School Health Education Programme Unit of the Ghana Education Service and the Metropolitan, Municipal and District Assemblies should provide public junior high schools with adequate MHM facilities, including soap, handwashing and disposal facilities, as well as sanitary pads for emergencies.
2. The School Health Education Programme Unit should also intensify efforts towards inculcating good menstrual hygiene management practices and promoting peer support among adolescent girls.
3. In the meantime, the Ghana Education Service should ensure that improvised changing places, such as toilets and urinals, are fitted with lockable doors and always kept clean.

4. The Ghana Education Service and Metropolitan, Municipal and District Assemblies should construct menstruation rooms in junior high schools as well as incorporate them into the design of school buildings. These measures may help address the issues of poor menstrual hygiene management practices, school absenteeism and poor engagement in school activities during menstruation.

6.3.3: Future research

1. By design, this study cannot determine the contribution of the various aspects of the interventions. Testing of the various components should be explored in future studies.
2. The interventions should be replicated in low-income urban dwellings, private and single-sex schools in Ghana. This would help improve stakeholders' understanding of the effectiveness of the interventions in different study populations.



References

- Acheampong, K., Baffour-Awuah, D., Ganu, D., Appiah, S., Pan, X., Kaminga, A., & Liu, A. (2019). Prevalence and Predictors of Dysmenorrhea, Its Effect, and Coping Mechanisms among Adolescents in Shai Osudoku District, Ghana. *Obstetrics and Gynecology International*, 2019, 1-7, 5834159
- Acheampong, P., Akodwaa-Boadi, K., Appiah-Effah, E., & Nyarko, K. B. (2018). *WASH infrastructure and menstrual hygiene management in basic schools: a study in Kumasi, Ghana*. [Conference session]. 41st WEDC International Conference, Egerton University, Nakuru, Kenya
- Achmad, L. N., Sirait, B. I., Semen, G. M. (2021). The relationship between stress levels and menstrual cycle regularity in students of the Faculty of Medicine, Universitas Kristen Indonesia, class of 2017. *International Journal of Medical and Health Research*, 7(8), 74-79.
- Adadevoh, S., Agble, T., Hobbs, C., Elkins, T. E. (1989). Menarcheal age in Ghanaian school girls. *International Journal of Gynecology and Obstetrics*, 30(1), 63-68.
- Addo-Lartey, A. A., Ogum Alangea, D., Sikweyiya, Y., Chirwa, E. D., Coker-Appiah, D., Jewkes, R., & Adanu, R. M. (2019). Rural response system to prevent violence against women: methodology for a community randomised controlled trial in the central region of Ghana. *Global Health Action*, 12(1), 1612604.
- Ademas, A., Adane, M., Sisay, T., Kloos, H., Eneyew, B., Keleb, A., Lingerew, M., Derso, A., & Alemu, K. (2020). Does menstrual hygiene management and water, sanitation, and hygiene predict reproductive tract infections among reproductive women in urban areas in Ethiopia? *PloS one*, 15(8), e0237696.
- Afsari, A., Mirghafourvand, M., Valizadeh, S., Abbasnezhadeh, M., Galeshi, M., & Fatahi, S. (2017). The effects of educating mothers and girls on the girls' attitudes toward puberty health: a randomized controlled trial. *International Journal of Adolescent Medicine and Health*, 29(2), 20150043.
- Agbede, C. O., & Ekeanyanwu, U. C. (2021). An outcome of educational intervention on the menstrual hygiene practices among school girls in Ogun State, Nigeria: a quasi-experimental study. *Pan African Medical Journal*, 40(1), 10.11604/pamj.2021.40.214.30601
- Agunwa, C. C., Obi, I. E., Ndu, A. C., Omotowo, I. B., Idoko, C. A., Umeobieri, A. K., & Aniwada, E. C. (2017). Determinants of patterns of maternal and child health service utilization in a rural community in south eastern Nigeria. *BMC Health Services Research*, 17(1), 1-8.
- Ainul, S., Noor, F. R., Hossain, M. I., Ehsan, I., Manzur, M., Rob, U., & Amin, S. (2022). *Keeping girls in schools to reduce child marriage in rural Bangladesh: Endline assessment*. Dhaka: Population Council.
- Alam, M.-U., Luby, S. P., Halder, A. K., Islam, K., Opel, A., Shoab, A. K., Ghosh, P. K., Rahman, M., Mahon, T., & Unicomb, L. (2017). Menstrual hygiene management among Bangladeshi adolescent schoolgirls and risk factors affecting school absence: results from a cross-sectional survey. *BMJ open*, 7(7), e015508.

- Alam, M.-U., Sultana, F., Hunter, E. C., Winch, P. J., Unicomb, L., Sarker, S., Mahfuz, M. T., Al-Masud, A., Rahman, M., & Luby, S. P. (2022). Evaluation of a menstrual hygiene intervention in urban and rural schools in Bangladesh: a pilot study. *BMC Public Health*, 22(1), 1-16.
- Alpízar, F., Saborío-Rodríguez, M., Martínez-Rodríguez, M. R., Viguera, B., Vignola, R., Capitán, T., & Harvey, C. A. (2020). Determinants of food insecurity among smallholder farmer households in Central America: recurrent versus extreme weather-driven events. *Regional Environmental Change*, 20, 1-16.
- Aluko, O. O., Udechukwu, J. N., Loto, O. A., Orisawayi, A. O., Ojogba, G. O., & Arowosafe, P. O. (2020). *Attitude towards menstruation by female in-school adolescents: A comparative cross-sectional study in southwest Nigeria*. Research Square. <https://doi.org/10.21203/rs.3.rs-42447/v1>
- Ameade, E. P. K., & Garti, H. A. (2016). Age at menarche and factors that influence it: a study among female university students in Tamale, Northern Ghana. *PloSone*, 11(5), e0155310.
- An, R. J. (2013). Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. *Public Health Nutrition*, 16(7), 1215-1228.
- Anaba, E. A., Udofia, E. A., Manu, A., Daniels, A. A., & Aryeetey, R. (2022). Use of reusable menstrual management materials and associated factors among women of reproductive age in Ghana: analysis of the 2017/18 Multiple Indicator Cluster Survey. *BMC women's health*, 22(1), 1-10.
- Anand, E., Singh, J., Unisa, S. (2015). Menstrual hygiene practices and its association with reproductive tract infections and abnormal vaginal discharge among women in India. *Sexual and Reproductive Healthcare*, 6(4), 249-254.
- Anbesu, E. W., & Asgedom, D. K. (2023). Menstrual hygiene practice and associated factors among adolescent girls in sub-Saharan Africa: a systematic review and meta-analysis. *BMC Public Health*, 23(1), 1-14.
- Anee, U. S., Islam, A., Wahid, F., & Ahmed, K. (2020). Knowledge, Attitude and Practice on Female Hygiene Management among Madrasa Girls in Dhaka, Bangladesh. *Asian Journal of Multidisciplinary Studies*, 3(1), 110-116.
- Aninanya, G. A., Debpuur, C. Y., Awine, T., Williams, J. E., Hodgson, A., & Howard, N. (2015). Effects of an adolescent sexual and reproductive health intervention on health service usage by young people in northern Ghana: a community-randomised trial. *PloSone*, 10(4), e0125267.
- Appiah-Brempong, E., Harris, M. J., Newton, S., & Gulis, G. (2018). Examining school-based hygiene facilities: a quantitative assessment in a Ghanaian municipality. *BMC Public Health*, 18, 1-8.
- Armour, M., Ferfolja, T., Curry, C., Hyman, M. S., Parry, K., Chalmers, K. J., Smith, C. A., MacMillan, F., Holmes, K. J. (2020). The prevalence and educational impact of pelvic and menstrual pain in Australia: a national online survey of 4202 young women aged 13-25 years. *Journal of Pediatric and Adolescent Gynecology*, 33(5), 511-518.

- Armour, M., Smith, C. A., Steel, K. A., & Macmillan, F. (2019). The effectiveness of self-care and lifestyle interventions in primary dysmenorrhea: a systematic review and meta-analysis. *BMC complementary and alternative medicine*, 19(1), 22-38.
- Arora, A., Mittal, A., Pathania, D., Singh, J., Mehta, C., & Bungler, R. (2013). Impact of health education on knowledge and practices about menstruation among adolescent school girls of rural part of district Ambala, Haryana. *Indian Journal of Community Health*, 25(4), 492-497.
- Aryeetey, R., Ashinyo, A., & Adjuik, M. (2011). Age of Menarche among basic level school girls in Madina, Accra. *African journal of reproductive health*, 15(3), 113-121.
- Asumah, M. N., Abubakari, A., & Aninanya, G. A. (2022). Determinants of Menstrual Hygiene Management Practices among Schoolgirls: A Cross-Sectional Study in the Savannah Region of Ghana. *Infectious diseases in obstetrics and gynecology*, 2022, <https://doi.org/10.1155/2022/7007117>
- Asumah, M. N., Abubakari, A., Aninanya, G. A., & Salisu, W. J. (2022). Perceived factors influencing menstrual hygiene management among adolescent girls: a qualitative study in the West Gonja Municipality of the Savannah Region, Ghana. *The Pan African Medical Journal*, 41(146), 10.11604/pamj.2022.41.146.33492
- Asumah, M. N., Abubakari, A., & Gariba, A. (2022). Schools preparedness for menstrual hygiene management: a descriptive cross-sectional study in the West Gonja Municipality, Savannah Region of Ghana. *BMJ open*, 12(4), e056526.
- Austrian, K., Kangwana, B., Muthengi, E., & Soler-Hampejsek, E. (2021). Effects of sanitary pad distribution and reproductive health education on upper primary school attendance and reproductive health knowledge and attitudes in Kenya: a cluster randomized controlled trial. *Reproductive health*, 18(1), 1-13.
- Austrian, K., Soler-Hampejsek, E., Duby, Z., & Hewett, P. C. (2019). “When he asks for sex, you will never refuse”: Transactional sex and adolescent pregnancy in Zambia. *Studies in Family Planning*, 50(3), 243-256.
- Aziato, L., Dedey, F., & Clegg-Lampsey, J. N. A. (2014). The experience of dysmenorrhoea among Ghanaian senior high and university students: pain characteristics and effects. *Reproductive health*, 11(1), 58.
- Aziato, L., Dedey, F., & Clegg-Lampsey, J. N. A. (2015). Dysmenorrhea management and coping among students in Ghana: A qualitative exploration. *Journal of pediatric and adolescent gynecology*, 28(3), 163-169.
- Baku, E. A., Adrakpanya, V., Konlan, K. D., & Adatar, P. (2020). Menstrual hygiene management among girls at a peri-urban senior high school in the Volta Region, Ghana. *African Journal of Midwifery and Women's Health*, 14(1), 1-12.
- Barman, B., Saha, J., & Chouhan, P. (2020). Impact of education on the utilization of maternal health care services: An investigation from National Family Health Survey (2015–16) in India. *Children and Youth Services Review*, 108, 104642.

- Belay, S., Kuhlmann, A. K. S., & Wall, L. L. (2020). Girls' attendance at school after a menstrual hygiene intervention in northern Ethiopia. *International Journal of Gynecology Obstetrics* 149(3), 287-291.
- Belayneh, Z., & Mekuriaw, B. (2019). Knowledge and menstrual hygiene practice among adolescent school girls in southern Ethiopia: a cross-sectional study. *BMC Public Health*, 19, 1-8.
- Bennett, C., & Harden, J. (2014). An exploration of mothers' attitudes towards their daughters' menarche. *Sex Education*, 14(4), 457-470.
- Benshaul-Tolonen, A., Aguilar-Gomez, S., Heller Batzer, N., Cai, R., & Nyanza, E. C. (2020). Period teasing, stigma and knowledge: A survey of adolescent boys and girls in Northern Tanzania. *PloS one*, 15(10), e0239914.
- Benshaul-Tolonen, A., Zulaika, G., Nyothach, E., Odour, C., Mason, L., Obor, D., Alexander, K. T., Laserson, K. F., & Phillips-Howard, P. A. (2021). *Sanitary products, absenteeism and psychosocial well-being: Evidence from a three-arm cluster randomized controlled feasibility study in Western Kenya*. Columbia, SIPA, Center for Development Economics and Policy.
- Bhusal, C. K. (2020). Practice of menstrual hygiene and associated factors among adolescent school girls in Dang district, Nepal. *Advances in preventive medicine*, 2020, <https://doi.org/10.1155/2020/1292070>
- Bhusal, C. K., Bhattarai, S., Kafle, R., Shrestha, R., Chhetri, P., & Adhikari, K. (2020). Level and Associated Factors of Knowledge regarding Menstrual Hygiene among School-Going Adolescent Girls in Dang District, Nepal. *Advances in preventive medicine*, 2020, <https://doi.org/10.1155/2020/8872119>
- Birchall, J. (2018). *Early marriage, pregnancy and girl child school dropout*. K4D Helpdesk Report. Brighton, UK: Institute of Development Studies.
- Blake, S., Boone, M., Yenew Kassa, A., & Sommer, M. (2018). Teaching girls about puberty and menstrual hygiene management in rural Ethiopia: Findings from a pilot evaluation. *Journal of Adolescent Research*, 33(5), 623-646.
- Boakye-Yiadom, A., Aladago, D. A., Beweleyir, J., Mohammed, H. B., Salifu, M. F., & Asaarik, M. (2018). Assessing the Knowledge, Attitude and Practice of Menstrual Hygiene Management Among Junior High Schools Adolescent Females in the Yendi Municipality in the Northern Region of Ghana. *European Scientific Journal*, 14(36), 467-487.
- Braun, V., & Clarke, V. (2014). What can “thematic analysis” offer health and wellbeing researchers? *International journal of qualitative studies on health and well-being*, 9. <https://doi.org/10.3402/qhw.v9.26152>
- Bryn, W. (2020). *Taxes and duties for sanitary products in Africa*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/891903/Query-50-Ethiopia-taxation-sanitary-products.pdf
- Butcher, N. J., Monsour, A., Mew, E. J., Chan, A.-W., Moher, D., Mayo-Wilson, E., Terwee, C. B., Chee-A-Tow, A., Baba, A., & Gavin, F. J. J. (2022). Guidelines for reporting

outcomes in trial reports: the CONSORT-Outcomes 2022 extension. 328(22), 2252-2264.

- Caruso, B., Clasen, T., Hadley, C., Yount, K., Haardorfer, R., & Rout, M. (2017). Understanding and defining sanitation insecurity: women's gendered experiences of urination, defecation and menstruation in rural Odisha, India. *BMJ Global Health*, 2 (4): e000414.
- Chandra-Mouli, V., & Patel, S. V. (2017). Mapping the knowledge and understanding of menarche, menstrual hygiene and menstrual health among adolescent girls in low-and middle-income countries. *Reproductive health*, 14(1), 30. 10.1186/s12978-017-0293-6
- Chinyama, J., Chipungu, J., Rudd, C., Mwale, M., Verstraete, L., Sikamo, C., Mutale, W., Chilengi, R., & Sharma, A. (2019). Menstrual hygiene management in rural schools of Zambia: a descriptive study of knowledge, experiences and challenges faced by schoolgirls. *BMC Public Health*, 19, 1-10.
- Coast, E., Lattof, S. R., & Strong, J. (2019). Puberty and menstruation knowledge among young adolescents in low-and middle-income countries: a scoping review. *International journal of public health*, 64(2), 293-304.
- Costos, D., Ackerman, R., & Paradis, L. (2002). Recollections of menarche: Communication between mothers and daughters regarding menstruation. *Sex roles*, 46(1-2), 49-59.
- Creswell, J. W. (2009). *Research design: Qualitative, quantitative, and mixed methods approaches* (V. Knight, Ed. 3rd Edition ed., Vol.). SAGE Publications, Inc.
- Creswell, J. W., Hanson, W. E., Clark Plano, V. L., & Morales, A. (2007). Qualitative research designs: Selection and implementation. *The counseling psychologist*, 35(2), 236-264.
- Crichton, J., Okal, J., Kabiru, C. W., & Zulu, E. M. (2013). Emotional and psychosocial aspects of menstrual poverty in resource-poor settings: a qualitative study of the experiences of adolescent girls in an informal settlement in Nairobi. *Health care for women international*, 34(10), 891-916.
- Damtie, Y., Kefale, B., Yalew, M., Arefaynie, M., & Adane, B. (2021). Short birth spacing and its association with maternal educational status, contraceptive use, and duration of breastfeeding in Ethiopia. A systematic review and meta-analysis. *PloSone*, 16(2), e0246348.
- Darabi, F., & Yaseri, M. (2022). Intervention to Improve Menstrual Health Among Adolescent Girls Based on the Theory of Planned Behavior in Iran: A Cluster-randomized Controlled Trial. *Journal of Preventive Medicine and Public Health*, 55(6), 595-603.
- Das, P., Baker, K. K., Dutta, A., Swain, T., Sahoo, S., Das, B. S., Panda, B., Nayak, A., Bara, M., & Bilung, B. (2015). Menstrual hygiene practices, WASH access and the risk of urogenital infection in women from Odisha, India. *PloS one*, 10(6), e0130777.
- Davis, J., Macintyre, A., Odagiri, M., Suriastini, W., Cordova, A., Huggett, C., Agius, P. A., Budiyan, A. E., Quillet, C., & Cronin, A. A. (2018). Menstrual hygiene management and school absenteeism among adolescent students in Indonesia: evidence from a cross-sectional school-based survey. *Tropical Medicine & International Health*, 23(12), 1350-1363.

- Diamond-Smith, N., Onyango, G. O., Wawire, S., & Ayodo, G. (2020). Knowledge of menstruation and fertility among adults in rural Western Kenya: Gaps and opportunities for support. *PloS one*, 15(3), e0229871.
- Djalalinia, S., Tehrani, F. R., Afzali, H. M., Hejazi, F., & Peykari, N. (2012). Parents or school health trainers, which of them is appropriate for menstrual health education? *International journal of preventive medicine*, 3(9), 622-627.
- Dolan, C. S., Ryus, C. R., Dopson, S., Montgomery, P., & Scott, L. (2014). A blind spot in girls' education: menarche and its webs of exclusion in Ghana. *Journal of International Development*, 26(5), 643-657.
- Dorgbetor, G. (2015). Mainstreaming MHM in schools through the play-based approach: lessons learned from Ghana. *Waterlines*, 41-50.
- Dündar, T., & Özsoy, S. (2020). Menstrual hygiene management among visually impaired women. *British Journal of Visual Impairment*, 38(3), 347-362.
- Dutta, D., Badloe, C., Lee, H., & House, S. (2016). Supporting the Rights of Girls and Women through Menstrual Hygiene Management (MHM) in the East Asia and Pacific Region: Realities, Progress and Opportunities. *Bangkok, Thailand: UNICEF East Asia and Pacific Regional Office (EAPRO)*.
- Ekong, I. (2015). Effect of health education on menstrual hygiene and health-seeking behaviour among rural and urban adolescents. *International Journal of Current Research and Review*, 7(14), 27-34.
- El-Lassy, R. B., & Madian, A. (2013). Impact of health educational program on menstrual beliefs and practices of adolescent Egyptian girls at secondary technical nursing school. *Life Science Journal*, 10(2), 1-5.
- El Meselhy, H. M., Salama, A. A., & El Mawardy, S. R. (2020). Menstrual hygiene among secondary school students. *Menoufia Medical Journal*, 33(1), 24.
- Elledge, M. F., Muralidharan, A., Parker, A., Ravndal, K. T., Siddiqui, M., Toolaram, A. P., & Woodward, K. P. (2018). Menstrual hygiene management and waste disposal in low and middle income Countries—A review of the literature. *International journal of environmental research and public health*, 15(11), 2562-2582.
- Emmanuel, B., & Yawson, A. E. (2019). Menstrual Hygiene Management and resources for Adolescent girls in an urban setting in Accra, Ghana. *Ghana Medical Journal* 8(1), 17-22.
- Farotimi, A. A., Esike, J., Nwozichi, C. U., Ojediran, T. D., & Ojewole, F. O. (2015). Knowledge, attitude, and healthcare-seeking behavior towards dysmenorrhea among female students of a private university in Ogun State, Nigeria. *Journal of basic and clinical reproductive sciences*, 4(1), 33-38.
- Fashemi, B., Delaney, M. L., Onderdonk, A. B., & Fichorova, R. N. (2013). Effects of feminine hygiene products on the vaginal mucosal biome. *Microbial ecology in health and disease*, 24(1), 19703.
- Fehintola, F. O., Fehintola, A. O., Aremu, A. O., Idowu, A., Ogunlaja, O. A., & Ogunlaja, I. P. (2017). Assessment of knowledge, attitude and practice about menstruation and

- menstrual hygiene among secondary high school girls in Ogbomoso, Oyo state, Nigeria. *International Journal of Reproduction, Contraception, Obstetrics and Gynecology*, 6(5), 1726-1732.
- Fetohy, E. M. (2007). Impact of a health education program for secondary school Saudi girls about menstruation at Riyadh city. *Journal Egypt Public Health Association*, 82(1-2), 105-126.
- Freeman, M. C., Greene, L. E., Dreibelbis, R., Saboori, S., Muga, R., Brumback, B., Rheingans, R. (2012). Assessing the impact of a school-based water treatment, hygiene and sanitation programme on pupil absence in Nyanza Province, Kenya: a cluster-randomized trial. *Tropical Medicine and International Health*, 17(3), 380-391.
- Gade, A., & Hytti, L. (2017). Menstrual Health in Rhino Camp Refugee Settlement, West Nile, Uganda: Pilot Project Intervention Report. *Kampala, Uganda: WoMena and ZOA*.
- Garikipati, S., & Boudot, C. (2017). To pad or not to pad: towards better sanitary care for women in Indian slums. *Journal of International Development*, 29(1), 32-51.
- Gebeyehu, M. B., Mekuria, A. B., Tefera, Y. G., Andarge, D. A., Debay, Y. B., Bejiga, G. S., & Gebresillassie, B. M. (2017). Prevalence, impact, and management practice of dysmenorrhea among University of Gondar Students, Northwestern Ethiopia: a cross-sectional study. *International Journal of Reproductive Medicine*, 2017. <https://doi.org/10.1155/2017/3208276>
- Ghana Education Service. (2014). *Ghana Education Service - WASH in Schools National Implementation-Model*. <https://www.washghana.net/sites/default/files/Ghana%2BEducation%2BService%2BWA%2B%2Bin%2BSchools%2BNational%2BImplementation%2BModel.pdf>
- Ghana Health Service. (2016). *Adolescent Health Service Policy and Strategy (2016-2020)*. <https://www.afro.who.int/sites/default/files/2017-10/ADOLESCENT%20HEALTH%20SERVICE%20POLICY%20%20AND%20STRAT%20EGY.pdf>
- Ghana Statistical Service. (2021). *Ghana 2021 Population and Housing Census. General report, volume 3A. Population of regions and districts* https://statsghana.gov.gh/gssmain/fileUpload/pressrelease/2021%20PHC%20General%20Report%20Vol%203A_Population%20of%20Regions%20and%20Districts_181121.pdf
- Ghana Statistical Service. (2014a). *2010 Population and Housing Census. District Analytical Report. Binduri District*
- Ghana Statistical Service. (2014b). *2010 Population and Housing Census. District Analytical Report. Pusiga District*
- Ghana Statistical Service. (2018). *Multiple Indicator Cluster Survey (MICS2017/18) Survey Findings Report*.
- Gittelsohn, J., Steckler, A., Johnson, C. C., Pratt, C., Grieser, M., Pickrel, J., Stone, E. J., Conway, T., Coombs, D., Staten, L. K. (2006). Formative research in school and community-based health programs and studies: "State of the art" and the TAAG approach. *Health Education and Behaviour*, 33(1), 25-39.

- Glanz, K., Rimer, B. K., & Viswanath, K. (2015). *Health behavior: Theory, research, and practice*. John Wiley & Sons.
- Golden, S. D., & Earp, J. A. L. (2012). Social ecological approaches to individuals and their contexts: twenty years of health education & behavior health promotion interventions. *Health education & behavior*, 39(3), 364-372.
- Guetterman, T. (2015). Descriptions of sampling practices within five approaches to qualitative research in education and the health sciences. *Educational Psychology Papers and Publications*. 16(2),263.
- Gumanga, S., & Kwame-Aryee, R. (2012). Menstrual characteristics in some adolescent girls in Accra, Ghana. *Ghana medical journal*, 46(1).
- Haque, S. E., Rahman, M., Itsuko, K., Mutahara, M., & Sakisaka, K. (2014). The effect of a school-based educational intervention on menstrual health: an intervention study among adolescent girls in Bangladesh. *BMJ open*, 4(7), e004607.
- Hasan, M., Hassan, M. N., Mita, M. H., Zahara, F. T., & Hasib, M. (2021). Menstrual hygiene practices and school absenteeism among adolescent girls in Bangladesh: a cross-sectional study. *Population Medicine*, 3(March), 1-8.
- Hayes, R. J., & Moulton, L. H. (2017). *Cluster randomised trials*. CRC press.
- Heidi, B. (2020). *Menstrual Cups*. Trailsister,net. <https://trailsisters.net/2020/03/03/menstrual-cups/>
- Hema Priya, S., Nandi, P., Seetharaman, N., Ramya, M., Nishanthini, N., & Lokeshmaran, A. (2017). A study of menstrual hygiene and related personal hygiene practices among adolescent girls in rural Puducherry. *International Journal of Community Medicine and Public Health*, 4, 2348-2355.
- Hennegan, J. (2017). Menstrual hygiene management and human rights: the case for an evidence-based approach. *Women's Reproductive Health*, 4(3), 212-231.
- Hennegan, J., Dolan, C., Steinfield, L., & Montgomery, P. (2017). A qualitative understanding of the effects of reusable sanitary pads and puberty education: implications for future research and practice. *Reproductive health*, 14(1), 78-90.
- Hennegan, J., Dolan, C., Wu, M., Scott, L., & Montgomery, P. (2016). Measuring the prevalence and impact of poor menstrual hygiene management: a quantitative survey of schoolgirls in rural Uganda. *BMJ open*, 6(12), e012596
- Hennegan, J., Kibira, S. P., Exum, N. G., Schwab, K. J., Makumbi, F. E., & Bukenya, J. (2020). 'I do what a woman should do': a grounded theory study of women's menstrual experiences at work in Mukono District, Uganda. *BMJ global health*, 5(11), e003433.
- Hennegan, J., & Montgomery, P. (2016). Do menstrual hygiene management interventions improve education and psychosocial outcomes for women and girls in low and middle income countries? A systematic review. *PloS one*, 11(2), doi.org/10.1371/journal.pone.0146985

- Hennegan, J., Nansubuga, A., Akullo, A., Smith, C., & Schwab, K. J. (2020). The Menstrual Practices Questionnaire (MPQ): development, elaboration, and implications for future research. *Global health action*, 13(1), 1829402.
- Hennegan, J., OlaOlorun, F. M., Oumarou, S., Alzouma, S., Guiella, G., Omoluabi, E., Schwab, K. J. (2021). School and work absenteeism due to menstruation in three West African countries: findings from PMA2020 surveys. *Sexual and Reproductive Health Matters*, 29(1), 409-424.
- Hennegan, J., Shannon, A. K., Rubli, J., Schwab, K. J., & Melendez-Torres, G. (2019). Women's and girls' experiences of menstruation in low-and middle-income countries: A systematic review and qualitative metasynthesis. *PLoS medicine*, 16(5), e1002803.
- Hennegan, J., Tsui, A. O., & Sommer, M. (2019). Missed Opportunities: Menstruation Matters for Family Planning. *International perspectives on sexual and reproductive health*, 45, 55-59.
- Huang, B., Fettweis, J. M., Brooks, J. P., Jefferson, K. K., & Buck, G. A. (2014). The changing landscape of the vaginal microbiome. *Clinics in laboratory medicine*, 34(4), 747-761.
- Hyttel, M. (2017). Drivers and challenges to use of menstrual cups among schoolgirls in rural Uganda: a qualitative study. *Waterlines*, 36(2), 109-124.
- Iacovides, S., Avidon, I., & Baker, F. (2015). Does pain vary across the menstrual cycle? A review. *European Journal of Pain*, 19(10), 1389-1405.
- Ibitoye, M., Choi, C., Tai, H., Lee, G., & Sommer, M. (2017). Early menarche: A systematic review of its effect on sexual and reproductive health in low-and middle-income countries. *PloS one*, 12(6), e0178884.
- Iddrisu, H. (2020). You Can't Tax Menstruation — Group To Petition Gov't Over Tax On Sanitary Pad. *Modern Ghana*. <https://www.modernghana.com/news/989253/you-cant-tax-menstruation-group-to-petition.html>
- Janoowalla, H., Keppler, H., Asanti, D., Xie, X., Negassa, A., Benfield, N., Rulisa, S., & Nathan, L. M. (2020). The impact of menstrual hygiene management on adolescent health: The effect of Go! pads on rate of urinary tract infection in adolescent females in Kibogora, Rwanda. *International Journal of Gynecology & Obstetrics*, 148(1), 87-95.
- Johnson, R. B., & Christensen, L. (2019). *Educational research: Quantitative, qualitative, and mixed approaches*. Sage publications.
- Juyal, R., Kandpal, S., & Semwal, J. (2014). Menstrual hygiene and reproductive morbidity in adolescent girls in Dehradun, India. *Bangladesh Journal of Medical Science*, 13(2), 170-174.
- Kambala, C., Chinangwa, A., Chipeta, E., Torondel, B., & Morse, T. (2020). Acceptability of menstrual products interventions for menstrual hygiene management among women and girls in Malawi. *Reproductive health*, 17(1), 1-12.
- Kansiime, C., Hytti, L., Nalugya, R., Nakuya, K., Namirembe, P., Nakalema, S., Neema, S., Tanton, C., Alezuyo, C., & Musoke, S. N. (2020). Menstrual health intervention and school attendance in Uganda (MENISCUS-2): a pilot intervention study. *BMJ open*, 10(2), e031182.

- Kapoor, A., & Khari, S. (2016). Knowledge, attitude and Socio-cultural beliefs of adolescent girls Towards menstruation. *Journal of Nepal Paediatric Society*, 36(1), 42-49.
- Kaur, R., Kaur, K., & Kaur, R. (2018). Menstrual hygiene, management, and waste disposal: Practices and challenges faced by girls/women of developing countries. *Journal of environmental and public health*, 2018. <https://doi.org/10.1155/2018/1730964>
- Khamisa, N., Nanji, N., Tshuma, N., & Kagura, J. (2022). The relationship between menstrual hygiene management, practices, and school absenteeism among adolescent girls in Johannesburg, South Africa. *South African Journal of Child Health*, 16(1), 7-12.
- Khodakarami, B., Refaei, M., Faradmal, J., & Uraki, H. (2020). Evaluation of school-based educational intervention to improve knowledge and attitude of adolescent girls about puberty health. *Current Women's Health Reviews*, 16(4), 341-347.
- Kilanowski, J. F. (2017). Breadth of the socio-ecological model. *Journal of Agromedicine*, 22(4), 295-297.
- Kilburn, K., Ranganathan, M., Stoner, M. C., Hughes, J. P., MacPhail, C., Agyei, Y., Gómez-Olivé, F. X., Kahn, K., & Pettifor, A. (2018). Transactional sex and incident HIV infection in a cohort of young women from rural South Africa. *AIDS*, 32(12), 1669-1677.
- Kimwaga, R., Mayo, A. W., & Guya, E. (2014). Menstrual hygiene management in secondary schools in Tanzania. *International Journal of Science and Technology*, 3(1), 27-40
- Kpodo, L., Aberese-Ako, M., Axame, W. K., Adjuik, M., & Gyapong, M. (2022). Socio-cultural factors associated with knowledge, attitudes and menstrual hygiene practices among Junior High School adolescent girls in the Kpando district of Ghana: A mixed method study. *PloS one*, 17(10), e0275583.
- Kumbeni, M. T., Otupiri, E., & Ziba, F. A. (2020). Menstrual hygiene among adolescent girls in junior high schools in rural northern Ghana. *The Pan African Medical Journal*, 37(190), 10.11604/pamj.2020.37.190.19015
- Lghoul, S., Loukid, M., & Hilali, M. K. (2020). Prevalence and predictors of dysmenorrhea among a population of adolescent's schoolgirls (Morocco). *Saudi Journal of Biological Sciences*, 27(7), 1737-1742.
- Long, J., Caruso, B. A., Lopez, D., Vancraeynest, K., Sahin, M., Andes, K. L., & Freeman, M. C. (2013). *WASH in schools: Empowers girls' education in rural Cochabamba, Bolivia: An assessment of menstrual hygiene management in schools*. United Nations Children's Fund.
- Loughnan, L., Mahon, T., Goddard, S., Bain, R., & Sommer, M. (2020). Monitoring Menstrual Health in the Sustainable Development Goals. In *The Palgrave Handbook of Critical Menstruation Studies* (pp. 577-592). Palgrave Macmillan, Singapore.
- MacLean, K., Hearle, C., & Ruwanpura, K. N. (2020). Stigma of staining? Negotiating menstrual taboos amongst young women in Kenya. *Women's Studies International Forum*, 78, 102290
- Mason, L., Laserson, K. F., Oruko, K., Nyothach, E., Alexander, K. T., Odhiambo, F. O., Eleveld, A., ISIYE, E., Ngere, I., & Omoto, J. (2015). Adolescent schoolgirls'

- experiences of menstrual cups and pads in rural western Kenya: a qualitative study. *Waterlines*, 15-30.
- Mason, L., Nyothach, E., Alexander, K., Odhiambo, F. O., Eleveld, A., Vulule, J., Rheingans, R., Laserson, K. F., Mohammed, A., & Phillips-Howard, P. A. (2013). 'We keep it secret so no one should know'—A qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural Western Kenya. *PloS one*, 8(11), e79132.
- Mason, L., Zulaika, G., van Eijk, A. M., Fwaya, E., Obor, D., Phillips-Howard, P., & Nyothach, E. (2022). 'You don't have to sleep with a man to get how to survive': Girl's perceptions of an intervention study aimed at improving sexual and reproductive health and schooling outcomes. *Plos Global Public Health*, 2(10), e0000987.
- Maulingin-Gumbaketi, E., Larkins, S., Whittaker, M., Rembeck, G., Gunnarsson, R., & Redman-MacLaren, M. (2022). Socio-cultural implications for women's menstrual health in the Pacific Island Countries and Territories (PICTs): a scoping review. *Reproductive Health*, 19(1), 1-20.
- McCammon, E., Bansal, S., Hebert, L. E., Yan, S., Menendez, A., & Gilliam, M. (2020). Exploring young women's menstruation-related challenges in Uttar Pradesh, India, using the socio-ecological framework. *Sexual and Reproductive Health Matters*, 28(1), 1749342.
- McMahon, S. A., Winch, P. J., Caruso, B. A., Obure, A. F., Ogutu, E. A., Ochari, I. A., Rheingans, R. D. (2011). 'The girl with her period is the one to hang her head' Reflections on menstrual management among schoolgirls in rural Kenya. *BMC International Health and Human Rights*, 11, 1-10.
- Mehrabi, S., Etemadi, A., Borjali, A., & Sadipoor, E. (2016). The effect of puberty education on knowledge, attitude and function of girl's students. *Journal of Patient Safety & Quality Improvement*, 4(3), 405-409.
- Mensch, B. S., Chuang, E. K., Melnikas, A. J., & Psaki, S. R. (2019). Evidence for causal links between education and maternal and child health: systematic review. *Tropical Medicine & International Health*, 24(5), 504-522.
- Midilli, T. S., Yasar, E., & Baysal, E. (2015). Dysmenorrhea characteristics of female students of health school and affecting factors and their knowledge and use of complementary and alternative medicine methods. *Holistic Nursing Practice*, 29(4), 194-204.
- Mohamed, H. A. H. (2018). Effect of health education program on menstrual practices among secondary school girls. *Port Said Scientific Journal of Nursing*, 5(1), 27-52.
- Mohamed, Y., Durrant, K., Huggett, C., Davis, J., Macintyre, A., Menu, S., Wilson, J. N., Ramosaea, M., Sami, M., & Barrington, D. J. (2018). A qualitative exploration of menstruation-related restrictive practices in Fiji, Solomon Islands and Papua New Guinea. *PloS one*, 13(12), e0208224.
- Mohammed, Hassan, L. E.-W. E.-A., & Mahdy, S. F. (2017). Mothers and their Adolescent Daughters Communication Regarding Pubertal Changes at Tanta City. *Journal of Nursing and Health Science*, 6(14), 10.9790/1959-0604020108

- Mohammed, S., & Larsen-Reindorf, R. E. (2020). Menstrual knowledge, sociocultural restrictions, and barriers to menstrual hygiene management in Ghana: Evidence from a multi-method survey among adolescent schoolgirls and schoolboys. *PloS one*, 15(10), e0241106.
- Mohammed, S., Larsen-Reindorf, R. E., & Awal, I. (2020). Menstrual Hygiene Management and School Absenteeism among Adolescents in Ghana: Results from a School-Based Cross-Sectional Study in a Rural Community. *International Journal of Reproductive Medicine*, 2020. <https://doi.org/10.1155/2020/6872491>
- Montgomery, P., Hennegan, J., Dolan, C., Wu, M., Steinfield, L., & Scott, L. (2016). Menstruation and the cycle of poverty: a cluster quasi-randomised control trial of sanitary pad and puberty education provision in Uganda. *PloS one*, 11(12), e0166122.
- Montgomery, P., Ryus, C. R., Dolan, C. S., Dopson, S., & Scott, L. M. (2012). Sanitary pad interventions for girls' education in Ghana: a pilot study. *PloS one*, 7(10), e48274
- Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of mixed methods research*, 1(1), 48-76.
- Mucherah, W., & Thomas, K. (2017). Reducing barriers to primary school education for girls in rural Kenya: reusable pads' intervention. *International journal of adolescent medicine and health*, 31(3), 20170005.
- Murphy-Graham, E., Cohen, A. K., & Pacheco-Montoya, D. (2020). School Dropout, Child Marriage, and Early Pregnancy among Adolescent Girls in Rural Honduras. *Comparative Education Review*, 64(4), 703-724.
- Nabwera, H. M., Shah, V., Neville, R., Sosseh, F., Saidykhan, M., Faal, F., Sonko, B., Keita, O., Schmidt, W.-P., & Torondel, B. (2021). Menstrual hygiene management practices and associated health outcomes among school-going adolescents in rural Gambia. *PloS one*, 16(2), e0247554.
- Nastiti, A. A., Triharini, M., Pratiwi, A. H., & Gouda, K. (2023). Educational intervention to improve menstrual hygiene management in adolescent girls in Kalimantan, Indonesia. *The Journal of the Pakistan Medical Association*, 73(2), S13-S17.
- Neelkanth, N., Singh, D., & Bhatia, P. (2017). A study to assess the knowledge regarding practices of menstrual hygiene and RTI among high and higher secondary school girls: An educational interventional study. *International Journal of Community Medicine and Public Health*, 4, 4520-4526.
- Neupane, M. S., Sharma, K., Bista, A. P., Subedi, S., & Lamichhane, S. (2020). Knowledge on menstruation and menstrual hygiene practices among adolescent girls of selected schools, Chitwan. *Journal of Chitwan Medical College*, 10(1), 69-73.
- Nia, F., Ilahi, F., Dwiyan, J. P., & Rita, R. S. (2019). Risk Factors of Early Menarche Among Adolescent Girls. In *Enhancing Capacity of Healthcare Scholars and professionals in Responding to the Global Health Issues* (pp. 94-100). Sciendo.

- Nsemo, A. D., Ojong, I. N., Agambire, R., Adu, R., & Dankwah, M. (2020). Menstrual Hygiene Practices Among Adolescent Girls in Junior High Schools in Selected Communities of Ashanti Region, Ghana. *Global Journal of Health Science*, 12(8), 1-38.
- Osborne, A. (2020). Assessment of Perceptions and Practices on Menstruation among Adolescent Girls in Five Schools in bo district, Sierra Leone. *Journal of Clinical Case Studies Reviews & Reports. SRC/JCCSR-157*, 3.
- Osonuga, A., & Ekor, M. (2018). The impact of dysmenorrhea on activities of Ghanaian undergraduate students. *Tropical Journal of Obstetrics and Gynaecology*, 35(3), 276-280.
- Osonuga, A., & Ekor, M. (2019). Risk factors for dysmenorrhea among Ghanaian undergraduate students. *African Health Sciences*, 19(4), 2993-3000.
- Osonuga, A., & Ekor, M. N. (2018). The menstrual characteristics of undergraduate students in a Ghanaian Public University. *Jos Journal of Medicine*, 12(1), 57-63.
- Oster, E., & Thornton, R. (2011). Menstruation, sanitary products, and school attendance: evidence from a randomized evaluation. *American Economic Journal: Applied Economics*, 3(1), 91-100.
- Pal, J., Ahmad, S., & Siva, A. (2017). Impact of health education regarding menstrual hygiene on genitourinary tract morbidities: an intervention study among adolescent girl students in an urban slum. *International Journal of Research in Medical Sciences*, 5(11), 4937-4941.
- Phillips-Howard, P. A., Nyothach, E., ter Kuile, F. O., Omoto, J., Wang, D., Zeh, C., Onyango, C., Mason, L., Alexander, K. T., & Odhiambo, F. O. (2016). Menstrual cups and sanitary pads to reduce school attrition, and sexually transmitted and reproductive tract infections: a cluster randomised controlled feasibility study in rural western Kenya. *BMJ open*, 6(11). e013229.
- Phillips-Howard, P. A., Otieno, G., Burmen, B., Otieno, F., Odongo, F., Odour, C., Nyothach, E., Amek, N., Zielinski-Gutierrez, E., & Odhiambo, F. (2015). Menstrual needs and associations with sexual and reproductive risks in rural Kenyan females: a cross-sectional behavioral survey linked with HIV prevalence. *Journal of women's health*, 24(10), 801-811.
- Poudel, S., & Gautam, D. (2020). Knowledge and Practices on Menstrual Hygiene Management Among Adolescent Girls of Kaski District, Nepal. *International Journal of Social Sciences and Management*, 7(3), 169-175.
- Raina, D., & Balodi, G. (2014). Menstrual hygiene: knowledge, practise and restrictions amongst girls of Dehradun, Uttarakhand, India. *Global Journal of Interdisciplinary Social Sciences*, 3(4), 156-162.
- Rajagopal, S., & Mathur, K. (2017). 'Breaking the silence around menstruation': experiences of adolescent girls in an urban setting in India. *Gender & Development*, 25(2), 303-317.
- Ramaiya, A., Malhotra, A., Cronin, C., Stevens, S., Kostizak, K., Sharma, A., Nagar, S., & Sood, S. (2019). How does a social and behavioral change communication intervention predict menstrual health and hygiene management: a cross-sectional study. *BMC Public Health*, 19(1), 1039.

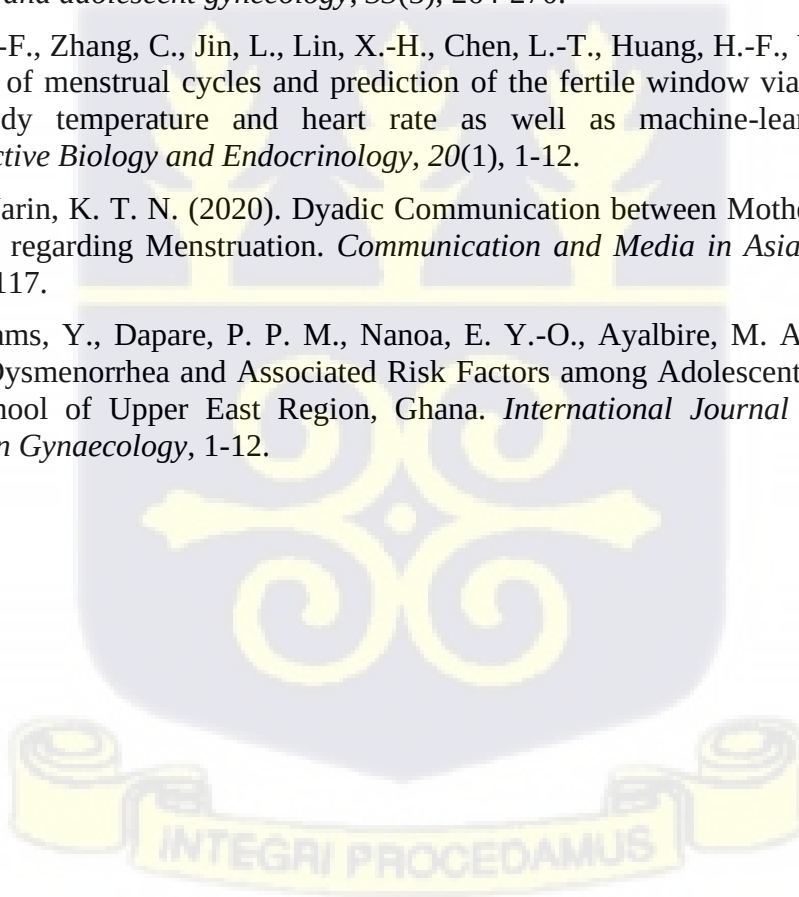
- Ramathuba, D. U. (2015). Menstrual knowledge and practices of female adolescents in Vhembe district, Limpopo Province, South Africa. *curationis*, 38(1), 1-6.
- Rana, G., & Jami, H. (2018). Knowledge/awareness and practices related to menstruation among female students: Role of mother-daughter relationship. *Pakistan Journal of Psychological Research*, 33(2), 313-334.
- Ranabhat, D., Nepal, S., & Regmi, B. (2019). Menstrual hygiene practice and school absenteeism among rural adolescent girls of Kalikot district. *Nepal Medical College Journal*, 21(4), 258-264.
- Ranganathan, M., Heise, L., Pettifor, A., Silverwood, R. J., Selin, A., MacPhail, C., Delany-Moretlwe, S., Kahn, K., Gómez-Olivé, F. X., & Hughes, J. P. (2016). Transactional sex among young women in rural South Africa: prevalence, mediators and association with HIV infection. *Journal of the International AIDS Society*, 19(1), 20749.
- Rastogi, S., Khanna, A., & Mathur, P. (2019). Educational interventions to improve menstrual health: Approaches and challenges. *International Journal of Adolescent Medicine*, 33(5), 20190024.
- Retnowuni, A., Devy, S. R., & Triyoga, R. S. (2017). The Effect of Health Education on Hygiene During Menstruation and Personal Hygiene of Santriwati (Female Student) at Boarding School. *Health Notions*, 1(4), 414-420.
- Sahiledengle, B., Atlaw, D., Kumie, A., Beressa, G., Tekalegn, Y., Zenbaba, D., Woldeyohannes, D., Desta, F., Assefa, T., & Bogale, D. (2022). Earning pocket money and girls' menstrual hygiene management in Ethiopia: a systematic review and meta-analysis. *BMC Women Health*, 22(1), 1-13.
- Sampa, M., Musukuma, M., Fisa, R., Musonda, P., & Young, T. (2021). Interventions for keeping adolescent girls in school in low-and middle-income countries: a scoping review. *Frontiers in Education*, 5, <https://doi.org/10.3389/feduc.2020.614297>
- Santhanakrishnan, I., & Athipathy, V. (2018). Impact of health education on menstrual hygiene: An intervention study among adolescent school girls. *International Journal of Medical Science and Public Health*, 7(6), 468-474.
- Sanz-Barbero, B., Barón, N., & Vives-Cases, C. (2019). Prevalence, associated factors and health impact of intimate partner violence against women in different life stages. *PloSone*, 14(10), e0221049.
- Sekine, K., & Hodgkin, M. E. (2017). Effect of child marriage on girls' school dropout in Nepal: Analysis of data from the Multiple Indicator Cluster Survey 2014. *PloS one*, 12(7), e0180176.
- Shah, S. P., Nair, R., Shah, P. P., Modi, D. K., Desai, S. A., & Desai, L. (2013). Improving quality of life with new menstrual hygiene practices among adolescent tribal girls in rural Gujarat, India. *Reproductive health matters*, 21(41), 205-213.
- Shah, V., Nabwera, H., Sonko, B., Bajo, F., Faal, F., Saidykhan, M., Jallow, Y., Keita, O., Schmidt, W.-P., & Torondel, B. (2022). Effects of menstrual health and hygiene on school absenteeism and drop-out among adolescent girls in rural Gambia. *International journal of environmental research and public health*, 19(6), 3337-3360.

- Shah, V., Nabwera, H. M., Sosseh, F., Jallow, Y., Comma, E., Keita, O., & Torondel, B. (2019). A rite of passage: a mixed methodology study about knowledge, perceptions and practices of menstrual hygiene management in rural Gambia. *BMC Public Health*, 19(1), 1-15.
- Shallo, S. A., Willi, W., & Abubeker, A. (2020). Factors Affecting Menstrual Hygiene Management Practice Among School Adolescents in Ambo, Western Ethiopia, 2018: A Cross-Sectional Mixed-Method Study. *Risk Management and Healthcare Policy*, 13, 1579–1587
- Sharma, A., McCall-Hosenfeld, J. S., & Cuffee, Y. (2022). Systematic review of menstrual health and hygiene in Nepal employing a social ecological model. *Reproductive Health*, 19(1), 1-21.
- Sharma, S., Mehra, D., Brusselaers, N., & Mehra, S. (2020). Menstrual Hygiene Preparedness Among Schools in India: A Systematic Review and Meta-Analysis of System-and Policy-Level Actions. *International journal of environmental research and public health*, 17(2), 647-674.
- Shrestha, N., Dangal, G., Khanal, G., & Bhandari, T. R. (2020). Knowledge of menstrual hygiene management among adolescent girls: what does evidence show? *Nepal Journal of Obstetrics and Gynaecology*, 15(1), 9-17.
- Sigdel, D., Joshi, A., Thapa, T., Koirala, P., & Sharma, K. (2023). Prevalence and predictors of dysmenorrhoea and it's effects among adolescent girls in Chitwan, Nepal. *Journal of Chitwan Medical College*, 13(1), 15-23.
- Singh, A., & Kushwaha, S. (2022). Awareness about reproductive tract infection, its relation with menstrual hygiene management and health seeking behaviour: A cross-sectional study among adolescent girls of Lucknow. *Journal of Family Medicine and Primary Care*, 11(11), 6690-6696.
- Singh, S., Kandpal, S., & Roy, D. (2011). Menstrual hygiene practices and RTI among ever-married women in rural slum. *Indian Journal of Community Health*, 23(1), 41-43.
- Smith, A. D., Muli, A., Schwab, K. J., & Hennegan, J. (2020). National monitoring for menstrual health and hygiene: is the type of menstrual material used indicative of needs across 10 countries? *International journal of environmental research and public health*, 17(8), 2633-2649.
- Sommer, M., Ackatia-Armah, N., Connolly, S., & Smiles, D. (2015). A comparison of the menstruation and education experiences of girls in Tanzania, Ghana, Cambodia and Ethiopia. *Compare: A Journal of Comparative and International Education*, 45(4), 589-609.
- Sommer, M., & Connolly, S. (2012). Growth and changes. *Grow and Know, Inc., Cambodia*.
- Sommer, M., Hirsch, J. S., Nathanson, C., & Parker, R. G. (2015). Comfortably, safely, and without shame: defining menstrual hygiene management as a public health issue. *American Journal of Public Health*, 105(7), 1302-1311.

- Sommer, M., Lee, C., Liu, D., & Gruer, C. (2020). The extent to which menstruation-related issues are included in graduate-level public health curricula. *Frontiers of Public Health*, 8, 442-450.
- Srinivasan, D., Agrawal, T., Attokaran, T., Fathima, F. N., & Johnson, A. R. (2019). Awareness, perceptions and practices regarding menstruation and menstrual hygiene among students of a college in Bengaluru Urban district, South India: a cross sectional study. *International Journal Of Community Medicine And Public Health*, 6(3), 1126-1132.
- Ssewanyana, D., & Bitanhirwe, B. K. Y. (2019). Menstrual hygiene management among adolescent girls in sub-Saharan Africa. *Global health promotion*, 26(1), 105-108.
- Su, J. J., & Lindell, D. (2016). Promoting the menstrual health of adolescent girls in China. *Nursing & health sciences*, 18(4), 481-487.
- Sverdlov, O., & Ryznik, Y. (2019). Implementing unequal randomization in clinical trials with heterogeneous treatment costs. *Statistics in Medicine*, 38(16), 2905-2927.
- Tahiru Lukman. (2023). Wa East District: 83% of adolescent girls engage in sex for monies to buy sanitary pad — Study. *Modern Ghana*. https://www.modernghana.com/news/1157188/wa-east-district-83-of-adolescent-girls-engage.html#google_vignette
- Tamiztousi, T., Rafiee, M., Rakhshanizadeh, F., Azizi, M., Khakpour, M., Khorasani, F., Roozbeh, N., & Ghazanfarpour, M. (2019). Education for menstrual hygiene promotion in Iranian girls: a systematic review and meta-analysis. *International Journal of Pediatric*, 7(6), 9507-9515.
- Tash, M. J. (2018). *The influence of chronic absenteeism on graduation rate and post secondary participation in New Jersey high schools*. Seton Hall University.
- Tegegne, T. K., & Sisay, M. M. (2014). Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia. *BMC Public Health*, 14(1), 1-14.
- Tembo, M., Weiss, H. A., Larsson, L. S., Bandason, T., Redzo, N., Dauya, E., Nzanza, T., Ishumael, P., Gweshe, N., & Ndlovu, P. (2023). A mixed-methods study measuring the effectiveness of a menstrual health intervention on menstrual health knowledge, perceptions and practices among young women in Zimbabwe. *BMJ open*, 13(3), e067897.
- Tey, N.-P., Siow-Li, L., & Ng, S.-T. (2019). Age at menarche and sexual debut among young Filipino women. *Journal of biosocial science*, 51(1), 77-94.
- Thakur, H., Aronsson, A., Bansode, S., Stalsby Lundborg, C., Dalvie, S., & Faxelid, E. (2014). Knowledge, practices, and restrictions related to menstruation among young women from low socioeconomic community in Mumbai, India. *Frontiers in public health*, 2, 72-79.
- Torgerson, D. J., & Campbell, M. K. (2000). Use of unequal randomisation to aid the economic efficiency of clinical trials. *BMJ*, 321(7263), 759.
- Torondel, B., Ferma, J., Francis, S. C., Caruso, B. A., Routray, P., Reese, H., & Clasen, T. (2022). Effect of a combined household-level piped water and sanitation intervention on

- reported menstrual hygiene practices and symptoms of urogenital infections in rural Odisha, India. *International journal of hygiene and environmental health*, 239, 113866.
- Torondel, B., Sinha, S., Mohanty, J. R., Swain, T., Sahoo, P., Panda, B., Nayak, A., Bara, M., Bilung, B., & Cumming, O. (2018). Association between unhygienic menstrual management practices and prevalence of lower reproductive tract infections: a hospital-based cross-sectional study in Odisha, India. *BMC infectious diseases*, 18(1), 473-485.
- Udayar, S. E., Jeeragyal, D. P., & Kruthika, K. (2022). Predictors of Dysmenorrhea and Its Impact on Quality of Life among Tribal Adolescent Girls in India. *Unnes Journal of Public Health*, 11(1), 23-32.
- UNICEF. (2019). *Guidance on Menstrual Health and Hygiene*. <https://reliefweb.int/sites/reliefweb.int/files/resources/UNICEF-Guidance-menstrual-health-hygiene-2019.pdf>
- UNICEF. (2020). *Guidance for Monitoring Menstrual Health and Hygiene*. UNICEF. <https://www.unicef.org/media/85461/file/MHM-Monitoring-Resource.pdf>
- Valizadeh, S., Asadollahi, M., Mirghafourvand, M., & Afsari, A. (2017). Educating mothers and girls about knowledge and practices toward puberty hygiene in Tabriz, Iran: A randomized controlled clinical trial. *Iranian Red Crescent Medical Journal (IRCMJ)*, 19(2), e28593.
- Vashisht, A., Pathak, R., Agarwalla, R., Patavegar, B. N., & Panda, M. (2018). School absenteeism during menstruation amongst adolescent girls in Delhi, India. *Journal of family & community medicine*, 25(3), 163-168.
- Vaughn, J. G. (2013). *A review of menstruation hygiene management among schoolgirls in sub-Saharan Africa*. <https://doi.org/10.17615/5dpf-1g60>
- Vishwakarma, D., Puri, P., Sharma, S. K. (2021). Interlinking menstrual hygiene with Women's empowerment and reproductive tract infections: Evidence from India. *Clinical Epidemiology and Global Health*, 10, 100668.
- Wall, L. L., Teklay, K., Desta, A., & Belay, S. (2018). Tending the 'monthly flower:' a qualitative study of menstrual beliefs in Tigray, Ethiopia. *BMC women's health*, 18(1), 183-191.
- Weckman, A. M., Ngai, M., Wright, J., McDonald, C. R., & Kain, K. C. (2019). The impact of infection in pregnancy on placental vascular development and adverse birth outcomes. *Frontiers in Microbiology*, 10, 1924-1935.
- WHO/UNICEF Joint Monitoring Programme. (2012). *Meeting report of the JMP Post-2015 global monitoring working group on hygiene*.
- Wijesiri, H. S. M. S. K., & Suresh, T. S. (2013). Knowledge and attitudes towards dysmenorrhea among adolescent girls in an urban school in Sri Lanka. *Nursing & health sciences*, 15(1), 58-64.
- Wilbur, J., Torondel, B., Hameed, S., Mahon, T., & Kuper, H. (2019). Systematic review of menstrual hygiene management requirements, its barriers and strategies for disabled people. *PloS one*, 14(2), e0210974.

- Williams, D. R., Priest, N., & Anderson, N. B. (2016). Understanding associations among race, socioeconomic status, and health: Patterns and prospects. *Health Psychology, 35*(4), 407-411.
- Wong, W. C., Li, M. K., Chan, W. Y. V., Choi, Y. Y., Fong, C. H. S., Lam, K. W. K., Sham, W. C., So, P. P., Wong, K., & Yeung, K. H. (2013). A cross-sectional study of the beliefs and attitudes towards menstruation of Chinese undergraduate males and females in Hong Kong. *Journal of Clinical Nursing, 22*(23-24), 3320-3327.
- World Bank. (2019, May 24, 2019). *Its Time For Action: Investing in Menstrual Hygiene Management is to Invest in Human Capital*. Retrieved December 7 from <https://www.worldbank.org/en/news/feature/2019/05/24/menstrual-hygiene-day-2019>
- Yadav, R. N., Joshi, S., Poudel, R., & Pandeya, P. (2017). Knowledge, attitude, and practice on menstrual hygiene management among school adolescents. *Journal of Nepal Health Research Council, 15*(3), 212-216.
- Yu, E. J., Choe, S.-A., Yun, J.-W., & Son, M. (2020). Association of early menarche with adolescent health in the setting of rapidly decreasing age at menarche. *Journal of pediatric and adolescent gynecology, 33*(3), 264-270.
- Yu, J.-L., Su, Y.-F., Zhang, C., Jin, L., Lin, X.-H., Chen, L.-T., Huang, H.-F., Wu, Y.-T. (2022). Tracking of menstrual cycles and prediction of the fertile window via measurements of basal body temperature and heart rate as well as machine-learning algorithms. *Reproductive Biology and Endocrinology, 20*(1), 1-12.
- Zakaria, M., & Jarin, K. T. N. (2020). Dyadic Communication between Mother and Adolescent Daughter regarding Menstruation. *Communication and Media in Asia Pacific (CMAP), 3*(1), 98-117.
- Ziba, F. A., Adams, Y., Dapare, P. P. M., Nanao, E. Y.-O., Ayalbire, M. A., & Baba, E. M. (2019). Dysmenorrhea and Associated Risk Factors among Adolescent Girls in Junior High School of Upper East Region, Ghana. *International Journal of Research and Reports in Gynaecology, 1*-12.



Appendix

Appendix 1: Bivariate analysis of the association between participant characteristics and outcome variables

Table 1: Association between participant characteristics and engagement in school activities during menstruation

Characteristics	Low engagement n (%)	High engagement n (%)	Chi-square	p-value
Age of participants (years)				
13-14	51(42.5)	69(57.5)	2.59	0.27
15-17	193(43.5)	251(56.5)		
18-19	22(56.4)	17(43.6)		
Class of participants				
JHS 1	109(46.8)	124(53.2)	1.06	0.30
JHS 2	162(42.5)	219(57.5)		
Religion				
Christianity	96(37.6)	159(62.4)	11.21	<0.01
Islam	167(47.9)	182(52.1)		
Other (traditional)	6(85.7)	1(14.3)		
Ethnicity				
Kusasi	168(40.5)	247(59.5)	10.59	0.01
Bissa	57(53.8)	49(46.2)		
Moshie	35(56.5)	27(43.5)		
Others (Fulani, Frafra)	10(37.0)	17(63.0)		
Mother's education level				
None	69(39.2)	107(60.8)	6.31	0.27
Primary	70(47.9)	76(52.1)		
Junior High School	52(43.7)	67(56.3)		
Senior High School	24(46.2)	28(53.8)		
Tertiary	13(65.0)	7(35.0)		
Don't know/other	40(42.6)	54(57.4)		
Father's education level				
None	63(44.1)	80(55.9)	2.17	0.82
Primary	55(46.2)	64(53.8)		
Junior High School	58(42.6)	78(57.4)		
Senior High School	41(50.0)	41(50.0)		
Tertiary	14(38.9)	22(61.1)		
Don't know/other	38(41.3)	54(58.7)		
Mother's occupation				
Unemployed	22(47.8)	24(52.2)	5.38	0.25
Farmer	142(46.3)	165(53.7)		
Trader	75(41.7)	105(58.3)		
Seamstress/ hairdresser	27(41.5)	38(58.5)		
Others (teacher)	0(0)	5(100)		
Father's occupation				
Unemployed	20(62.5)	12(37.5)	11.62	0.02
Farmer	182(43.2)	239(56.8)		
Trader	36(50.0)	36(50.0)		
Capenter/mason	14(37.8)	23(62.2)		
Others (teacher)	3(16.7)	15(83.3)		
Stays with				
Both parent	128(40.6)	187(59.4)		
Mother only	73(50.3)	72(49.7)		

Characteristics	Low engagement n (%)	High engagement n (%)	Chi-square	p-value
Father only	18(54.5)	15(45.5)	5.44	0.24
Grandmother	43(42.6)	58(57.4)		
Others (auntie)	8(47.1)	9(52.9)		
Access to radio				
Yes	161(41.4)	228(58.6)	3.22	0.07
No	109(48.9)	114(51.1)		
Access to television				
Yes	153(44.3)	192(55.7)	0.05	0.81
No	115(43.4)	150(56.6)		
Access to pocket money				
Yes	172(40.6)	252(59.4)	6.08	0.01
No	95(51.4)	90(48.6)		

Table 2: Association between school characteristics and engagement in school activities during menstruation

Characteristics	Low engagement n (%)	High engagement n (%)	Chi-square	p-value
Toilet room has an odor.				
No	142(35.3)	269(64.7)	35.98	< 0.01
Yes	129(60.6)	84(39.4)		
Changing place has lockable doors.				
No	91(50.3)	90(49.7)	4.13	0.04
Yes	179(41.3)	254(58.7)		
Toilet has dustbin.				
No	145(51.8)	135(48.2)	12.95	0.03
Yes	123(37.3)	207(62.7)		
School has handwashing facility (HF)				
No			24.89	< 0.01
Yes	106(59.9)	71(40.1)		
	164(37.8)	270(62.2)		
HF is regularly supplied with water.				
No	81(53.3)	71(46.7)	8.35	<0.01
Yes	181(39.9)	273(60.1)		
HF is regularly supplied with soap.				
No	101(53.2)	89(46.8)	9.88	<0.01
Yes	166(39.5)	254(60.5)		
HF is regularly supplied with tissue				
No	113(52.3)	103(47.7)	10.61	<0.01
Yes	151(38.6)	240(61.4)		
Sanitary pad for emergency				
No	143(56.5)	110(43.5)	26.48	< 0.01
Yes	128(35.6)	232(64.4)		
School has a source of water.				
No	121(51.5)	114(48.5)	8.79	<0.01
Yes	148(39.3)	229(60.7)		
School has toilet rooms for girls.				
No	78(47.9)	85(52.1)	1.42	0.23
Yes	191(42.4)	259(57.6)		

Table 3: Association between menstrual characteristics and engagement in school activities during menstruation

Characteristics	Low engagement n (%)	High engagement n (%)	Chi-square	p- value
Experience menstrual pains				
No	63(34.6)	119(65.4)	9.65	<0.01
Yes	208(48.3)	223(51.7)		
Experience heavy bleeding				
No	116(41.0)	167(59.0)	2.41	0.12
Yes	155(47.3)	173(52.7)		
Regular menstrual cycle				
No	70(49.3)	270(57.7)	2.15	0.14
Yes	198(42.3)	72(50.7)		
Sought treatment for menstrual pains				
No	130(41.7)	182(58.3)	3.39	0.18
Yes	104(48.8)	109(51.2)		
No menstrual pains	29(39.2)	45(60.8)		

Table 4: Association between menstrual hygiene practices and engagement in school activities during menstruation

Menstrual hygiene practices	Low engagement n (%)	High engagement n (%)	Chi-square	p – value
Frequency of changing materials				
One time	9(42.9)	12(57.1)	12.72	<0.01
Two times	112(44.3)	141(55.7)		
Three times	123(40.6)	180(59.4)		
Four or more times	27(71.1)	11(28.9)		
Changing place at home				
Toilet/latrine	51(44.0)	65(56.0)	0.53	0.76
Bedroom	82(42.1)	113(57.9)		
Bathroom	138(45.4)	166(54.6)		
Changing place at school				
Toilet /latrine	124(45.4)	149(54.6)	1.62	0.44
Urinal	91(46.0)	107(54.0)		
Changing room	55(39.6)	84(60.4)		
Washed hand before changing				
Never	20(50.0)	20(50.0)	0.70	0.70
Sometimes	72(45.0)	88(55.0)		
Every time	173(43.4)	226(56.6)		
Washed hands after changing				
Never	9(64.3)	5(35.7)	2.50	0.28
Sometimes	53(45.3)	64(54.7)		
Every time	207(43.3)	271(56.7)		
Frequency of washing genitals				
Once per day	9(45.0)	11(55.0)	5.58	0.06
Twice per day	133(39.7)	202(60.3)		

Menstrual hygiene practices	Low engagement n (%)	High engagement n (%)	Chi-square	p – value
Thrice or more per day	127(49.4)	130(50.6)		
Washed genitals with soap				
Never	112(37.3)	188(62.7)		
Sometimes	45(47.9)	49(52.1)	11.42	<0.01
Every time	114(51.8)	106(48.2)		
Disposal of materials at home				
Toilet	173(56.5)	133(43.5)		
Dustbin	84(29.4)	202(70.6)	48.49	< 0.01
Never disposed	15(65.2)	8(34.8)		
Disposal of material at school				
Toilet	175(54.9)	144(45.1)		
Dustbin	82(31.7)	177(68.3)	32.18	< 0.01
Never disposed	13(36.1)	23(63.9)		
Wrapped before disposal				
No wrapping	11(50.0)	11(50.0)		
Wrapped in plastic	230(42.4)	313(57.6)	6.80	0.03
Wrapped in paper	30(61.2)	19(38.8)		
Stored menstrual materials				
No	35(66.0)	18(34.0)	11.05	<0.01
Yes	236(42.3)	322(57.7)		
Where materials were stored				
In a bag with cloth	181(42.1)	249(57.9)		
Under a bed	49(46.2)	57(53.8)	1.76	0.41
Toilet room	11(33.3)	22(66.7)		
Wrapped in				
Plastic	203(42.5)	275(57.5)		
Fabric	30(44.8)	37(55.2)	0.13	0.93
No wrapping	10(41.7)	14(58.3)		
Same location for urinating at home				
Never	105(39.6)	160(60.4)		
Sometimes	97(44.9)	119(55.1)	3.72	0.15
All the time	56(50.0)	56(50.0)		
Same location for urinating at school				
Never				
Sometimes	113(37.5)	188(62.5)		
All the time	107(54.0)	91(46.0)	13.21	<0.01
	46(43.4)	60(56.6)		
Container for washing reusable cloth				
Shared bucket	27(52.9)	24(47.1)		
Own bucket	81(50.6)	79(49.4)	0.08	0.77
Used soap to wash reusable cloth				
Never	7(46.7)	8(53.3)		
Sometimes	30(63.8)	17(36.2)	4.02	0.13
Every time	70(47.3)	78(52.7)		
Place of drying reusable cloth				
Outside hanging	41(40.2)	61(59.8)		
Outside but covered	31(56.4)	24(43.6)	9.51	<0.01
Inside the room	35(64.8)	19(35.2)		
Reusable cloth dried in the sun				
Never	15(57.7)	11(42.3)		
Sometimes	25(55.6)	20(44.4)	1.16	0.55
Every time	68(48.6)	72(51.4)		

Menstrual hygiene practices	Low engagement n (%)	High engagement n (%)	Chi-square	p – value
Ironed reusable cloth				
Never	34(55.7)	27(44.3)	1.53	0.46
Sometimes	29(53.7)	25(46.3)		
Every time	44(46.3)	51(53.7)		

Table 5: Association between social support and engagement in school activities during menstruation

Access to social support during period	Low engagement n (%)	High engagement n (%)	Chi-square	p– value
Parent talk about menstruation				
No	64(47.4)	71(52.6)	0.76	0.38
Yes	206(43.2)	271(56.8)		
Parents give money for pad				
No	67(58.3)	48(41.7)	12.20	<0.01
Yes	200(40.3)	296(59.7)		
Menstruation taught at school				
No	41(61.2)	26(38.8)	8.97	<0.01
Yes	229(41.9)	317(58.1)		
Can ask teacher about period				
No	71(56.8)	54(43.2)	10.20	<0.01
Yes	200(40.9)	289(59.1)		
Can ask classmate about period				
No	54(52.4)	49(47.6)	3.50	0.06
Yes	217(42.4)	295(57.6)		
Taboo to attend school on period				
No	231(42)	319(58)	9.00	<0.01
Yes	40(61.5)	25(38.5)		
Taboo to enter mosque on period				
No	85(42.5)	115(57.5)	0.25	0.61
Yes	184(44.7)	228(55.3)		
Taboo to cook food during period				
No	177(40.9)	256(59.1)	6.63	0.01
Yes	94(52.2)	86(47.8)		

Table 6: Association between access to sanitary pads and engagement in school activities during menstruation

Access to sanitary pads	Low engagement n (%)	High engagement n (%)	Chi-square	p – value
Able to buy all sanitary products				
No	125(57.6)	92(42.4)	25.30	< 0.01
Yes	145(36.5)	252(63.5)		
Wants pad price subsidized				
No	24(42.9)	32(57.1)	0.01	0.93
Yes	235(43.4)	306(56.6)		
Exchanged sex for money or pad				
	239(42)	330(58)	14.68	0.01

No	31(72.1)	12(27.9)
Yes		

Table 7: Association between participant characteristics and symptoms of urogenital infections

Characteristics	Non-infected n (%)	Infected n (%)	Chi-square	p -value
Age of participants (years)				
13-14	58(48.7)	61(51.3)	20.90	< 0.01
15-17	152(33.4)	303(66.6)		
18-19	4(10.3)	35(89.7)		
Class of participants				
JHS 1	91(38.4)	146(61.6)	2.07	0.15
JHS 2	126(32.7)	259(67.3)		
Religion				
Christianity	106(41.1)	152(58.9)	7.78	0.02
Islam	111(31.2)	245(68.8)		
Other (traditional)	1(14.3)	6(85.7)		
Ethnicity				
Kusasi	154(36.7)	266(63.3)	4.08	0.25
Bissa	32(29.6)	76(70.4)		
Moshie	18(28.6)	45(71.4)		
Others (Fulani, Frafra)	12(44.4)	15(55.6)		
Mother's education level				
None	60(34.1)	166(65.9)	6.32	0.27
Primary	51(34.5)	97(65.5)		
Junior High School	37(30.8)	83(69.2)		
Senior High School	17(30.4)	39(69.6)		
Tertiary	7(33.3)	14(66.7)		
Don't know/other				
Father's education level				
None	43(29.9)	101(70.1)	10.17	0.07
Primary	42(35.0)	78(65.0)		
Junior High School	38(27.9)	98(72.1)		
Senior High School	36(41.9)	50(58.1)		
Tertiary	15(38.5)	24(61.5)		
Don't know/other	40(44.4)	50(55.6)		
Mother's occupation				
Unemployed	15(31.3)	33(68.8)	2.63	0.62
Farmer	122(36.2)	197(63.8)		
Trader	59(32.4)	123(67.6)		
Seamstress/ hairdresser	28(42.4)	38(57.6)		
Others (teacher)	2(40.0)	3(60.0)		
Father's occupation				
Unemployed	7(21.2)	26(78.8)	5.55	0.23
Farmer	148(34.8)	277(65.2)		
Trader	28(37.3)	47(62.7)		
Capenter/mason	13(34.2)	25(65.8)		
Others (teacher)	10(52.6)	9(47.4)		
Stays with				
Both parent	116(36.7)	200(63.3)	3.98	0.40
Mother only	52(34.7)	98(65.3)		
Father only	9(26.5)	25(73.5)		
Grandmother	30(29.4)	72(70.6)		

Characteristics	Non-infected n (%)	Infected n (%)	Chi-square	p -value
Others (auntie)	8(47.1)	9(52.9)		
Access to radio				
Yes	145(36.5)	252(63.5)	1.12	0.28
No	72(32.3)	151(67.7)		
Access to television				
Yes	132(37.4)	221(62.6)	1.87	0.17
No	85(32.1)	180(67.9)		
Access to pocket money				
Yes	161(37.6)	267(62.4)	4.72	0.03
No	54(28.6)	135(71.4)		

Table 8: Association between school characteristics and symptoms of urogenital infections

Characteristics	Non-infected n (%)	Infected n (%)	Chi-square	p -value
Toilet room has an odor.				
No	168(41.3)	239(58.7)	19.94	< 0.01
Yes	51(23.4)	167(76.6)		
Changing place has lockable doors.				
No	57(30.8)	128(69.2)	2.12	0.14
Yes	162(36.9)	277(63.1)		
Toilet has dustbin.				
No	90(31.6)	195(68.4)	2.87	0.09
Yes	128(38.1)	208(61.9)		
School has handwashing facility (HF)				
No	55(30.2)	127(69.8)		
Yes	162(36.9)	277(63.1)	2.52	0.11
HF is regularly supplied with water.				
No	46(30.1)	107(69.9)	2.18	0.14
Yes	170(36.6)	294(63.4)		
HF is regularly supplied with soap.				
No	59(30.3)	136(69.7)	2.81	0.09
Yes	158(37.2)	267(62.8)		
HF is regularly supplied with tissue				
No	65(29.7)	154(70.3)	3.75	0.05
Yes	149(37.4)	249(62.6)		
Sanitary pad for emergency				
No	79(30.5)	180(69.5)	3.92	0.04
Yes	139(38.2)	225(61.8)		
School has a source of water.				
No	78(32.6)	161(67.4)	0.86	0.35
Yes	139(36.3)	244(63.7)		
School has toilet rooms for girls.				
No	57(34.5)	108(65.5)	0.03	0.84
Yes	162(35.4)	296(64.6)		
Witnessed period teasing in school				
No	183(38.4)	294(61.6)	9.99	<0.01
Yes	34(23.9)	108(76.1)		

Table 9: Association between menstrual characteristics and symptoms of urogenital infections

Characteristics	Non-infected n (%)	Infected n (%)	Chi-square	p -value
Experience menstrual pains				
No	86(46.2)	100(53.8)	14.29	<0.01
Yes	133(30.4)	304(69.6)		
Experience heavy bleeding				
No	119(41.5)	168(58.5)	8.97	<0.01
Yes	100(29.9)	234(70.1)		
Regular menstrual cycle				
No	49(33.6)	97(66.4)	0.18	0.66
Yes	168(35.5)	305(64.5)		
Sought treatment for menstrual pains				
No	116(36.5)	202(63.5)	12.86	<0.01
Yes	61(28.1)	156(71.9)		
No menstrual pains	38(50.7)	37(49.3)		

Table 10: Association between menstrual hygiene practices and symptoms of urogenital infections

Menstrual hygiene practices	Non-infected n (%)	Infected n (%)	Chi-square	p -value
Frequency of changing materials				
One time	4(18.2)	18(81.8)	3.71	0.29
Two times	96(37.8)	158(62.2)		
Three times	106(34.3)	203(65.7)		
Four or more times	13(33.3)	26(66.7)		
Changing place at home				
Toilet/latrine	41(33.9)	80(66.1)	0.07	0.96
Bedroom	69(35.2)	127(64.8)		
Bathroom	108(35.2)	199(64.8)		
Changing place at school				
Toilet /latrine	95(34.5)	180(65.5)	1.02	0.60
Urinal	67(33.3)	134(66.7)		
Changing room	55(38.5)	88(61.5)		
Washed hand before changing				
Never	14(34.1)	27(65.9)	1.36	0.50
Sometimes	51(31.5)	111(68.5)		
Every time	148(36.6)	256(63.4)		
Washed hands after changing				
Never	5(31.3)	11(68.8)	1.43	0.48
Sometimes	36(30.5)	82(69.5)		
Every time	175(36.2)	309(63.8)		
Frequency of washing genitals				
Once per day	7(33.3)	14(66.7)	0.07	0.96
Twice per day	122(35.7)	220(64.3)		
Thrice or more per day	90(34.9)	168(65.1)		
Washed genitals with soap				
Never	124(41.1)	178(58.9)	9.06	0.01
Sometimes	29(30.9)	65(69.1)		
Every time	66(29.1)	161(70.9)		
Disposal of materials at home				
Toilet	95(29.7)	225(70.3)	9.06	0.01
Dustbin	117(41.3)	166(58.7)		
Never disposed	7(31.8)	15(68.2)		

Menstrual hygiene practices	Non-infected n (%)	Infected n (%)	Chi-square	p-value
Disposal of material at school				
Toilet	102(30.9)	228(69.1)	6.30	0.04
Dustbin	99(38.7)	157(61.3)		
Never disposed	17(47.2)	19(52.8)		
Wrapped before disposal				
No wrapping	8(34.8)	15(65.2)	5.50	0.06
Wrapped in plastic	201(36.5)	349(63.5)		
Wrapped in paper	10(20)	40(80)		
Stored menstrual materials				
No	14(25.9)	40(74.1)	2.14	0.14
Yes	203(35.9)	363(64.1)		
Where materials were stored				
In a bag with cloth	158(36.3)	277(63.7)	0.83	0.65
Under a bed	36(33.6)	71(66.4)		
Toilet room	10(29.4)	24(70.6)		
Wrapped in				
Plastic	185(37.9)	303(62.1)	8.01	0.01
Fabric	14(21.2)	52(78.8)		
No wrapping	6(26.1)	17(73.9)		
Same location for urinating at home				
Never	106(39.7)	161(60.3)	5.45	0.06
Sometimes	65(29.5)	155(70.5)		
All the time	41(35.3)	75(64.7)		
Same location for urinating at school				
Never	116(38.4)	186(61.6)	6.41	0.04
Sometimes	57(28.2)	145(71.8)		
All the time	43(39.1)	67(60.9)		
Container for washing reusable cloth				
Shared bucket	19(35.8)	34(64.2)	<0.01	1.00
Own bucket	57(35.8)	102(64.2)		
Used soap to wash reusable cloth				
Never	4(28.6)	10(71.4)	4.17	0.12
Sometimes	11(23.9)	35(76.1)		
Every time	60(35.5)	91(60.3)		
Place of drying reusable cloth				
Outside hanging	38(37.3)	64(62.7)	1.79	0.40
Outside but covered	16(29.6)	38(70.4)		
Inside the room	23(41.8)	32(58.2)		
Reusable cloth dried in the sun				
Never	11(42.3)	15(57.7)	2.68	0.26
Sometimes	12(26.1)	34(73.9)		
Every time	53(38.1)	86(61.9)		
Ironed reusable cloth				
Never	24(39.3)	37(60.7)	0.39	0.82
Sometimes	20(35.7)	36(64.3)		
Every time	32(34.4)	61(65.6)		

Table 11: Association between social support and symptoms of urogenital infections

Access to social support during period	Non-infected n (%)	Infected n (%)	Chi-square	p-value
Parent talk about menstruation				
No	48(34.8)	90(65.2)	<0.01	0.9767

Yes	169(34.9)	315(65.1)		
Parents give money for pad				
No	33(28.0)	85(72.0)	3.40	0.06
Yes	186(37.0)	317(63.0)		
Menstruation taught at school				
No	21(29.2)	51(70.8)	1.25	0.26
Yes	198(35.9)	354(64.1)		
Can ask teacher about period				
No	38(29.2)	92(70.8)	2.35	0.12
Yes	180(36.4)	314(63.6)		
Can ask classmate about period				
No	36(33.6)	71(66.4)	0.11	0.74
Yes	183(35.3)	335(64.7)		
Taboo to attend school on period				
No	205(36.7)	353(63.3)	6.59	0.01
Yes	14(20.9)	53(79.1)		
Taboo to enter mosque on period				
No	76(36.7)	131(63.3)	0.30	0.57
Yes	143(34.5)	272(65.5)		
Taboo to cook food during period				
No	162(37.3)	274(62.8)	2.84	0.09
Yes	56(30.1)	130(69.9)		

Table 12: Association between access to sanitary pads and symptoms of urogenital infections

Access to sanitary pads	Non-infected n (%)	Infected n (%)	Chi-square	p -value
Able to buy all sanitary products				
No	58(25.8)	167(74.2)	13.41	<0.01
Yes	161(40.4)	238(59.6)		
Wants pad price subsidized				
No	15(25.4)	44(74.6)	2.62	0.10
Yes	197(36)	350(64)		
Exchanged sex for money or pad				
No	211(36.6)	366(63.4)	10.96	<0.01
Yes	5(11.6)	38(88.4)		

Table 13: Association between participant characteristics and menstruation-related school absenteeism

Characteristics	Yes n (%)	No n (%)	Chi-square	p -value
Age of participants (years)				
13-14	17(14.4)	101(85.6)		
15-17	100(22.1)	353(77.9)	19.13	<0.01
18-19	18(48.6)	19(51.4)		
Class of participants				
JHS 1	37(15.7)	198(84.3)	9.90	<0.01
JHS 2	102(26.6)	281(73.4)		
Religion				
Christianity	51(20.1)	201(79.9)		
Islam	85(23.9)	270(76.1)	1.42	0.49
Other (traditional)	2(28.6)	5(71.4)		
Ethnicity				
Kusasi	86(20.6)	331(79.4)		

Characteristics	Yes n (%)	No n (%)	Chi-square	p -value
Bissa	31(28.4)	78(71.6)	6.47	0.09
Moshie	17(28.3)	43(71.7)		
Others (Fulani, Frafra)	3(10.7)	25(89.3)		
Mother's education level				
None	38(21.7)	137(78.3)	2.74	0.73
Primary	32(21.8)	115(78.2)		
Junior High School	26(21.5)	95(78.5)		
Senior High School	16(28.6)	40(71.4)		
Tertiary	7(33.3)	14(66.7)		
Don't know/other	20(22.0)	71(78.0)		
Father's education level				
None	30(21.8)	111(78.2)	1.23	0.94
Primary	31(25.6)	90(74.4)		
Junior High School	29(21.2)	108(78.8)		
Senior High School	19(22.4)	66(77.6)		
Tertiary	10(25.6)	29(74.4)		
Don't know/other	18(20.7)	69(79.3)		
Mother's occupation				
Unemployed	11(22.0)	39(78.0)	3.35	0.50
Farmer	77(25.1)	230(74.9)		
Trader	38(21.2)	141(78.8)		
Seamstress/ hairdresser	12(18.5)	53(81.5)		
Others (teacher)	0(0)	5(100)		
Father's occupation				
Unemployed	5(15.6)	27(84.4)	5.74	0.22
Farmer	98(23.1)	326(76.9)		
Trader	21(28.4)	53(71.6)		
Capenter/mason	7(18.4)	31(81.6)		
Others (teacher)	1(5.6)	17(94.4)		
Stays with				
Both parent	59(18.7)	257(81.3)	7.72	0.10
Mother only	43(29.3)	104(70.7)		
Father only	10(30.3)	23(69.7)		
Grandmother	22(21.6)	80(78.4)		
Others (auntie)	4(23.5)	13(76.5)		
Access to radio				
Yes	89(22.5)	307(77.5)	<0.01	0.93
No	49(22.2)	172(77.8)		
Access to television				
Yes	76(21.7)	274(78.3)	0.08	0.76
No	60(22.7)	204(77.3)		
Access to pocket money				
Yes	82(19.2)	344(80.8)	7.73	0.01
No	55(29.4)	132(70.6)		

Table 14: Association between school characteristics and menstruation-related school absenteeism

Characteristics	Yes n (%)	No n (%)	Chi-square	p -value
Toilet room has an odor.				
No	70(17.2)	336(82.8)	17.10	< 0.01
Yes	68(31.8)	146(68.2)		
Changing place has lockable doors.				

No	51(27.7)	133(72.3)	4.44	0.03
Yes	87(20)	348(80)		
Toilet has dustbin.				
No	66(23.2)	218(76.8)	0.51	0.47
Yes	69(20.8)	262(79.2)		
School has handwashing facility (HF)				
No	56(30.6)	127(69.4)		
Yes	82(18.9)	352(81.1)	10.16	<0.01
HF is regularly supplied with water.				
No	46(29.7)	109(70.3)	7.00	<0.01
Yes	89(19.5)	368(80.5)		
HF is regularly supplied with soap.				
No	54(27.8)	140(72.2)	4.98	0.02
Yes	83(19.8)	337(80.2)		
HF is regularly supplied with tissue				
No	56(25.6)	163(74.4)	2.21	0.13
Yes	80(20.4)	313(79.6)		
Sanitary pad for emergency				
No	78(30.5)	178(69.5)	16.69	0.01
Yes	60(16.6)	302(83.4)		
School has a source of water.				
No	63(26.7)	173(73.3)	4.12	0.04
Yes	75(19.7)	306(80.3)		
School has toilet rooms for girls.				
No	45(26.9)	122(73.1)	2.98	0.08
Yes	92(20.4)	358(79.6)		
Witnessed period teasing in school				
No	82(17.3)	391(82.7)	28.87	< 0.01
Yes	55(38.7)	87(61.3)		

Table 15: Association between menstrual characteristics and menstruation-related school absenteeism

Characteristics	Yes n (%)	No n (%)	Chi-square	p -value
Experience menstrual pains				
No	32(17.4)	152(82.6)	3.91	0.04
Yes	107(24.7)	327(75.3)		
Experience heavy bleeding				
No	58(20.4)	226(79.6)	1.38	0.24
Yes	81(24.4)	251(75.6)		
Regular menstrual cycle				
No	36(25)	108(75)	0.68	0.40
Yes	102(21.7)	368(78.3)		
Sought treatment for menstrual pains				
No	62(19.8)	251(80.2)		
Yes	64(29.4)	154(70.6)	10.61	0.01
No menstrual pains	10(13.5)	64(86.5)		

Table 16: Association between menstrual hygiene practices and menstruation-related school absenteeism

Menstrual hygiene practices	Yes n (%)	No n (%)	Chi-square	p -value
Frequency of changing materials				
One time	5(25.0)	15(75.0)		

Two times	51(20.1)	203(79.9)	13.78	<0.01
Three times	65(21.2)	242(78.8)		
Four or more times	18(46.2)	21(53.8)		
Changing place at home				
Toilet/latrine	35(29.4)	84(70.6)		
Bedroom	39(20.1)	155(79.9)	4.39	0.11
Bathroom	64(20.8)	243(79.2)		
Changing place at school				
Toilet /latrine	68(25.3)	201(74.7)		
Urinal	43(21.2)	160(78.8)	2.47	0.29
Changing room	27(18.9)	116(81.1)		
Washed hand before changing				
Never	11(26.2)	31(73.8)		
Sometimes	30(19.0)	128(81.0)	1.60	0.44
Every time	94(23.3)	309(76.7)		
Washed hands after changing				
Never	5(31.3)	11(68.8)		
Sometimes	28(23.9)	89(76.1)	1.04	0.59
Every time	104(21.6)	377(78.4)		
Frequency of washing genitals				
Once per day	4(20.0)	16(80.0)	4.14	0.12
Twice per day	66(19.6)	271(80.4)		
Thrice or more per day	69 (26.5)	191(73.5)		
Washed genitals with soap				
Never	57(19)	243(81)		
Sometimes	25(26.3)	70(73.7)	3.71	0.15
Every time	56(25.0)	168(75.0)		
Disposal of materials at home				
Toilet	90(28.6)	225(71.4)		
Dustbin	42(14.9)	240(85.1)	16.88	<0.01
Never disposed	7(30.4)	16(69.6)		
Disposal of material at school				
Toilet	96(29.4)	230(70.6)		
Dustbin	35(13.6)	223(86.4)	21.48	< 0.01
Never disposed	6(17.6)	28(82.4)		
Wrapped before disposal				
No wrapping	5(21.7)	18(78.3)		
Wrapped in plastic	118(21.6)	428(78.4)	2.84	0.24
Wrapped in paper	16(32.0)	34(68.0)		
Stored menstrual materials				
No	19(34.5)	36(65.5)	5.25	0.02
Yes	118(21.1)	442(78.9)		
Where materials were stored				
In a bag with cloth	91(21.2)	339(78.8)		
Under a bed	25(23.6)	81(76.4)	0.36	0.8356
Toilet room	8(23.5)	26(76.5)		
Wrapped in				
Plastic	100(20.8)	380(79.2)	5.77	0.05
Fabric	23(33.3)	46(66.7)		
No wrapping	4(17.4)	18(82.6)		
Same location for urinating at home				
Never	51(19.3)	213(80.7)		
Sometimes	48(21.5)	175(78.5)	2.02	0.36
All the time	29(25.9)	83(74.1)		
Same location for urinating at school				
Never	59(19.6)	242(80.4)		

Sometimes	48(23.5)	156(76.5)	3.15	0.20
All the time	29(27.6)	76(72.4)		
Container for washing reusable cloth				
Shared bucket	19(38.0)	31(62.0)	1.82	0.17
Own bucket	45(28.0)	116(72.0)		
Used soap to wash reusable cloth				
Never	4(26.7)	11(73.3)	0.08	0.95
Sometimes	14(30.4)	32(69.6)		
Every time	45(30.2)	104(69.8)		
Place of drying reusable cloth				
Outside hanging	26(26.0)	74(74.0)	1.73	0.42
Outside but covered	20(35.7)	36(64.3)		
Inside the room	17(32.1)	36(67.9)		
Reusable cloth dried in the sun				
Never	12(46.2)	14(53.8)	3.88	0.14
Sometimes	15(32.6)	31(67.4)		
Every time	37(27.0)	100(73.0)		
Ironed reusable cloth				
Never	22(36.1)	39(63.9)	1.38	0.50
Sometimes	16(28.6)	40(71.4)		
Every time	25(27.5)	66(72.5)		

Table 17: Association between social support and menstruation-related school absenteeism

Access to social support during period	Yes n (%)	No n (%)	Chi-square	p -value
Parent talk about menstruation				
No	34(25.6)	99(74.4)	1.10	0.29
Yes	103(21.3)	381(78.7)		
Parents give money for pad				
No	40(34.2)	77(65.8)	11.92	<0.01
Yes	97(19.4)	402(80.6)		
Menstruation taught at school				
No	30(41.7)	42(58.3)	17.56	< 0.01
Yes	108(19.8)	438(80.2)		
Can ask teacher about period				
No	37(28.2)	94(71.8)	3.39	0.06
Yes	101(20.7)	387(79.3)		
Can ask classmate about period				
No	29(26.6)	80(73.4)	1.44	0.23
Yes	109(21.3)	402(78.7)		
Taboo to attend school on period				
No	109(19.7)	445(80.3)	20.06	< 0.01
Yes	29(43.9)	37(56.1)		
Taboo to enter mosque on period				
No	38(18.7)	165(81.3)	1.94	0.16
Yes	98(23.7)	316(76.3)		
Taboo to cook food during period				
No	88(20.2)	347(79.8)	3.87	0.04
Yes	50(27.5)	132(72.5)		

Table 18: Association between access to sanitary pads and menstruation-related school absenteeism

Access to sanitary pads	Yes	No	Chi-square	p -value
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	n (%)	n (%)		
Able to buy all sanitary products				
No	73(32.3)	153(67.7)	21.35	< 0.01
Yes	64(16.3)	329(83.7)		
Wants pad price subsidized				
No	15(24.2)	47(75.8)	0.24	0.62
Yes	116(21.5)	424(78.5)		
Exchanged sex for money or pad				
No	120(21.0)	452(79.0)	6.11	0.01
Yes	16(37.2)	27(62.8)		

Appendix 2: Questionnaire for adolescent girls

CODE:.....

Title of study: Cluster-randomized trial of menstrual hygiene interventions to improve health and educational outcomes among adolescent girls in the Binduri and Pusiga Districts of Ghana

Hello. Good morning/afternoon/evening.

My name is Emmanuel Anongeba Anaba. I am conducting a study that requires your opinions about menstrual hygiene-related issues. Participation in this study is voluntary and if we should come to any question, you do not want to answer, we will go to the next question; or you can stop the interview at any time. However, I hope that you will participate in this study since your views are very important.

At this time, do you want to ask me anything about the study?

Participant signature

No.	SECTION A: Knowledge about menstruation and hygiene
1.	What organ/part of the body does menstrual blood comes from? Vagina [] Uterus [] Stomach [] Don't Know [] Others.....
2.	At what age range does menstruation usually start? 8-18 years [] 10-19 years [] 15-19 years [] Don't Know [] Others.....
3.	What causes or regulates menstruation? The food we eat [] Hormones [] Disease [] Don't Know [] Others.....
4.	What is the average duration of a menstrual cycle? 20 days [] 35 days [] 28 days [] Don't Know [] Others.....
5.	Drinking warm water during menstruation can reduce menstrual pains True [] False [] Don't know []

6.	At what time of the menstrual cycle does ovulation occur or a woman can get pregnant? Before period [] Middle of cycle [] Any time [] Don't Know [] Others.....
7.	What is the best place to dispose of used menstrual materials? Toilet [] Bush [] Dustbin [] Don't Know [] Others.....
8.	In what direction should a girl wash her vagina during menstruation? Up to down [] Front to back [] Back to front [] Don't Know [] Others.....
9.	What materials should be used to wash the vagina during menstruation? Soap and water [] Only water [] Chemicals and water [] Don't Know [] Others.....
10	It is normal for menstruation to last for eight (8) or more days in a month? Yes [] No [] Don't know []

	MENSTRUAL HYGIENE PRACTICES
	SECTION B: Menstrual material use
1	What were all the materials you used to catch/absorb your menstruation during your last menstrual period? (select all that apply) Cloth/towel [] Disposable pad [] Toilet roll/tissue [] Reusable pad [] Other.....
	SECTION C: Changing menstrual materials
1	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) 1 time [] 2 times [] 3 times [] 4 or more times [] Other.....
2	Where did you most often change your menstrual materials when you were at HOME during your last menstrual period? (select one) Latrine/toilet [] Bedroom [] Bathroom [] Other
3	Where did you most often change your menstrual materials when you were at SCHOOL during your last menstrual period? (select one) Latrine/toilet [] Urinal [] Another room in the school [] Other
	SECTION D: Handwashing
1	Did you wash your hands BEFORE changing your menstrual materials during your last menstrual period? (select one) Never [] Sometimes [] Every time []
2	Did you wash your hands AFTER changing your menstrual materials during your last menstrual period? (select one) Never [] Sometimes [] Every time []
	SECTION E: Genital washing
1	How often did you wash your genitals/vagina during your last menstrual period? (select one) Once per day [] Twice per day [] Three or more times per day [] Other
2	When you washed your genitals/vagina, did you use soap? (select one) Never [] Sometimes [] Every time []
	SECTION F: Disposal of menstrual materials
1	Where did you most often dispose of your used menstrual materials when you were at HOME during your last menstrual period? (select one) Into the toilet [] Dustbin in the toilet [] Didn't dispose of any materials [] Other.....
2	Where did you most often dispose of your used menstrual materials when you were at SCHOOL during your last menstrual period? (select one) Into the toilet [] Dustbin in the toilet [] Didn't dispose of any materials []

	Other.....
3	When disposing of your used menstrual materials, did you usually wrap them? (<i>Select one</i>) No [] Yes, plastic bag/pad cover [] Yes, toilet roll/paper [] Other (specify)
	SECTION G: Storage of menstrual materials
1	After your last menstrual period, did you keep your menstrual materials? No [] Yes [] Don't know [] (<i>if NO, skip Question 2 and Question 3</i>)
2	Where did you store your menstrual materials after your last menstrual period? In a bag with clothes [] Under a bed [] In the toilet room [] Other, specify.....
3	Did you store your menstrual materials inside any wrapping, packaging or case? (<i>select one</i>) Wrapped in plastic [] Wrapped in fabric [] No wrapping [] Other(specify)
	SECTION H: Toilet/latrine practice during menstruation
1	When you were at HOME did you use the same location for urination as when you do not have your period? Never [] Sometimes [] All the time []
2	When you were at SCHOOL did you use the same location for urination as when you do not have your period? Never [] Sometimes [] Every time []
	SECTION I: Washing materials (<i>Skip to SECTION L, if you did not use a cloth or reusable materials</i>)
1	Where did you most often wash your menstrual materials during your last menstrual period? (<i>select one</i>) Shared bucket [] Own bucket [] Well/waterway [] Other(specify).....
2	Did you use soap or detergent to wash or soak your menstrual materials? (<i>select one</i>) Never [] Sometimes [] Every time []
	SECTION J: Drying materials
1	Where did you most often dry your menstrual materials during your last menstrual period? Outside hanging [] Outside but covered [] Inside the room [] Other.....
2	When your menstrual materials were drying, were they in the sun? Never [] Sometimes [] All the time []
3	During your last period, were your menstrual materials completely dry before you used them? Never [] Sometimes [] Every time []
	SECTION K: Additional sterilisation practices
1	Did you use an iron on your CLOTH/FABRIC menstrual materials before you reuse them? (<i>select one</i>) Never [] Sometimes [] Every time []

SECTION L: Participation in SCHOOL activities		Response		
1	In your last period, did you go home before the closing time due to menstruation?	YES	NO	Don't Know
2	In your last period, did you miss a class/exercise/test/exam due to menstruation?	YES	NO	Don't Know
3	In your last period, was your attention in class affected due to menstruation?	YES	NO	Don't Know
4	In your last period, was your movement in class affected due to menstruation?	YES	NO	Don't Know
5	In your last period, were you comfortable standing up in class to do something?	YES	NO	Don't Know
6	In your last period, did you miss sports/exercises in school due to	YES	NO	Don't Know

	menstruation?			
7	In your last period, did you miss school because of menstruation?	YES	NO	Don't know
SECTION M: Period stigma and anxiety				
1	Did you worry about period teasing?	YES	NO	Don't Know
2	Have you ever been teased for soiling your uniform?	YES	NO	Don't Know
3	For the past three months, have you witnessed period teasing in your school?	YES	NO	Don't Know
4	Did you worry about leakages/stains?	YES	NO	Don't Know
5	Did you worry about where to get a pad in school during an emergency?	YES	NO	Don't Know
6	Did you worry about how to afford/buy sanitary pads?	YES	NO	Don't Know
7	Did you worry about where to dispose of your menstrual materials?	YES	NO	Don't Know
SECTION N: Menstrual characteristics				
1	Do you experience pains/cramps during menstruation?	YES	NO	Don't Know
2	Do you experience heavy menstrual bleeding?	YES	NO	Don't Know
3	Do you experience a regular menstrual cycle?	YES	NO	Don't Know
4	What was the duration of your last menstruation?	days		Don't Know
5	What was the length of your last menstrual cycle?	days		Don't Know
SECTION O: Symptoms of urogenital infections				
1	Urinate more frequently	YES	NO	Don't Know
2	Burning or itching in the genitalia	YES	NO	Don't Know
3	Abnormal vaginal discharge	YES	NO	Don't Know
4	Burning or itching while urinating	YES	NO	Don't Know
SECTION P: Health-seeking behaviours				
1	Did you seek treatment for your menstrual problems/ pains? Yes [] No [] I do not have any menstrual pains/problems []			
2	If yes, where did you seek treatment? (Select all that apply) Hospital/clinic [] Pharmacy/drug store [] Herbalist [] Self-medication [] Other.....			

No	SECTION Q: Attitudes towards menstruation	Response		
1.	It is embarrassing to be seen by a man when buying sanitary pads.	Agree	Disagree	Don't Know
2.	Girls should not cook food during menstruation.	Agree	Disagree	Don't Know
3.	Girls should not go to church during menstruation.	Agree	Disagree	Don't Know
4.	Girls should not go to the mosque during menstruation.	Agree	Disagree	Don't Know
5.	Girls should keep their menstruation a secret.	Agree	Disagree	Don't Know
6.	Girls should feel ashamed of menstruation.	Agree	Disagree	Don't Know
7.	It is shameful for girls to dry menstrual materials outside.	Agree	Disagree	Don't Know
8.	Girls are unclean, dirty or impure during menstruation.	Agree	Disagree	Don't Know
9.	Menstruation is God's curse/punishment for women.	Agree	Disagree	Don't Know

SECTION S: Practical and emotional support				
1	Do your parents/guardians talk to you about menstruation?	Yes	No	Don't know
2	Do your parents/guardians give you money to buy a sanitary pad?	Yes	No	Don't know
3	Do you get information about menstruation at school?	Yes	No	Don't know
4	If you need advice about menstruation, can you ask a teacher in your school?	Yes	No	Don't know
5	If you need advice about menstruation, can you ask your classmates?	Yes	No	Don't know
SECTION T: Access to MH facilities at SCHOOL				
1	While at school was the place you changed yourself smelling bad? (Odour)	Yes	No	Don't know
2	While at school was the place you changed yourself having lockable doors?	Yes	No	Don't know

3	While at school was the place you changed yourself having a disposable facility?	Yes	No	Don't know
4	Does this school have functioning handwashing facilities (i.e veronica buckets)?	Yes	No	Don't know
5	Is the handwashing facility regularly supplied with water?	Yes	No	Don't know
6	Is the handwashing facility regularly supplied with soap?	Yes	No	Don't know
7	Is the handwashing facility regularly supplied with tissue paper?	Yes	No	Don't know
8	Can you get a sanitary pad in this school during an emergency?	Yes	No	Don't know
9	Does this school have a functioning source of water (i.e bole hole/pipe/well)?	Yes	No	Don't know
10	Does this school have a separate functioning toilet facility for only girls?	Yes	No	Don't know
	SECTION U: Social norms			
1	In this town, is it taboo for girls to go to SCHOOL during menstruation?	Yes	No	Don't know
2	In this town, is it taboo for girls to go to MOSQUE during menstruation?	Yes	No	Don't know
3	In this town, is it taboo for girls to COOK FOOD during menstruation?	Yes	No	Don't know
	SECTION V: Access to menstrual materials			
1	Are you able to buy all the menstrual materials (i.e pad) you need?	Yes	No	Don't know
2	Do you want the price of disposable sanitary pads to be subsidized/reduced?	Yes	No	Don't know
3	What is the price/cost of the disposable sanitary pad you use during menstruation? I do not use disposable pad []			GH¢.....
4	How much do you want a pack of disposable sanitary pads to be sold? Don't know []			GH¢.....
5	In the past 12 months, did you enter into a sexual relationship with a man mainly in order to get things that you need, money, gifts, or other things that are important to you? Yes [] No []			
	SECTION W: Participant characteristics			
1	What is your level of education? JHS 1 [] JHS 2 [] JHS 3 []			
2	Which religious group are you affiliated to? Christianity [] Islam [] Traditional [] No religion [] Others			
3	Which ethnic group do you associate with? Kusaasi [] Bissa [] Moshie [] Others			
4	How old are you (in years)? years.			
5	How old were you when you had your first menstruation? Don't Know [] [.....years].			
6	What is your mother's level of education? None [] Primary [] JHS [] SHS [] Tertiary [] Don't Know [] Other.....			
7	What is your mother's occupation? Unemployed [] Farmer [] Trader [] Seamstress/hair dresser [] Others.....			
8	What is your father's level of education? None [] Primary [] JHS [] SHS [] Tertiary [] Don't Know [] Others.....			
9	What is your father's occupation? Unemployed [] Farmer [] Trader [] Carpenter/mason [] Other.....			
10	Whom do you stay with? Both parents [] Mother only [] Father only [] Grandmother [] Other.....			
11	Do you have a radio set in your house? Yes [] No []			
12	Do you have a television set in your house? Yes [] No []			
13	Do your parents/guardians give you pocket/chop money?			

Yes [☐]	No [☐]
SECTION X: Comments:	

THANK YOU!

Appendix 3: Focus group guide for adolescent girls

What is the name of your school?

Demographics: Age, level of education, religion.

Menstrual problems

- i. Do you experience menstrual cramps /pains? If yes, can you describe the pains?
- ii. Can you describe your menstrual flow? i.e light, normal or heavy menstrual flow?
- iii. Can you describe your menstrual cycle? i.e irregular or regular etc.
- iv. What other problems do you experience during menstruation?
- v. What have you done about these menstrual problems? i.e seek treatment, if not why?
- vi. How do these menstruation-related problems affect you?
-school attendance, concentration, movement, participation, sports in school etc.

Access to information about menstruation

- i. Who was the first person/source to talk/hear about menstruation?
- ii. What were your reactions/experiences at menarche?
- iii. What does your mother tell you about menstruation?
- iv. What does your father tell you about menstruation?
- v. What do your siblings tell about menstruation?
- vi. What support do your parent give you during menstruation? i.e. money to buy pad, underwear, soap, advice, house chores etc.

- vii. Who teaches you about menstruation in school? i.e teachers, health workers, etc
- viii. What do they teach you about menstruation?
- ix. What are the attitudes of teachers toward teaching menstruation?
- x. What are the attitudes of boys toward discussing menstruation in class?
- xi. What support do you get from your teachers/school during menstruation? i.e pads
- xii. What would you like to know/learn about menstruation?

Access to WASH facilities menstrual materials at SCHOOL

- i. What are all the materials you use during menstruation?
- ii. Where do you usually change your menstrual materials when at school?
- iii. What is the state/condition of the place now? i.e clean, odour, lockable doors etc.
- iv. Where do you wash your hand before/after changing your pad or visiting the toilet?
- v. Where do you get soap to wash your hands? i.e availability of water and soap.
- vi. Where do you dispose your menstrual materials after changing in school? i.e bins
- vii. Where do students of this school defecate? i.e., Girls only toilet, cleanliness
- viii. How do girls cope when menstruation starts in school? i.e access to pad etc.
- ix. How do girls in this school manage menstrual cramps? i.e. pain killers
- x. What are the things you need in this school when it comes to menstruation?
- xi. How frequent do girls in this school experience period teasing? i.e who are the teasers, girls reaction during teasing.

Access to WASH facilities and menstrual materials at HOME

- i. Where do you normally change your menstrual materials when at **home**?
- ii. What is the state/condition of the place now? i.e clean, odour, lockable doors etc.

- iii. Where do you wash your hand before/after changing your pad or visiting the toilet?
- iv. Where do you get soap to wash your hands? i.e availability of water and soap.
- v. Where do you dispose your menstrual materials after changing at home?
- vi. Where do members of your house defecate? i.e.
- vii. How do you manage menstrual cramps/pains at home?
- viii. What are the menstrual restrictions/taboos in your house? i.e cooking, praying, eating

Social norms

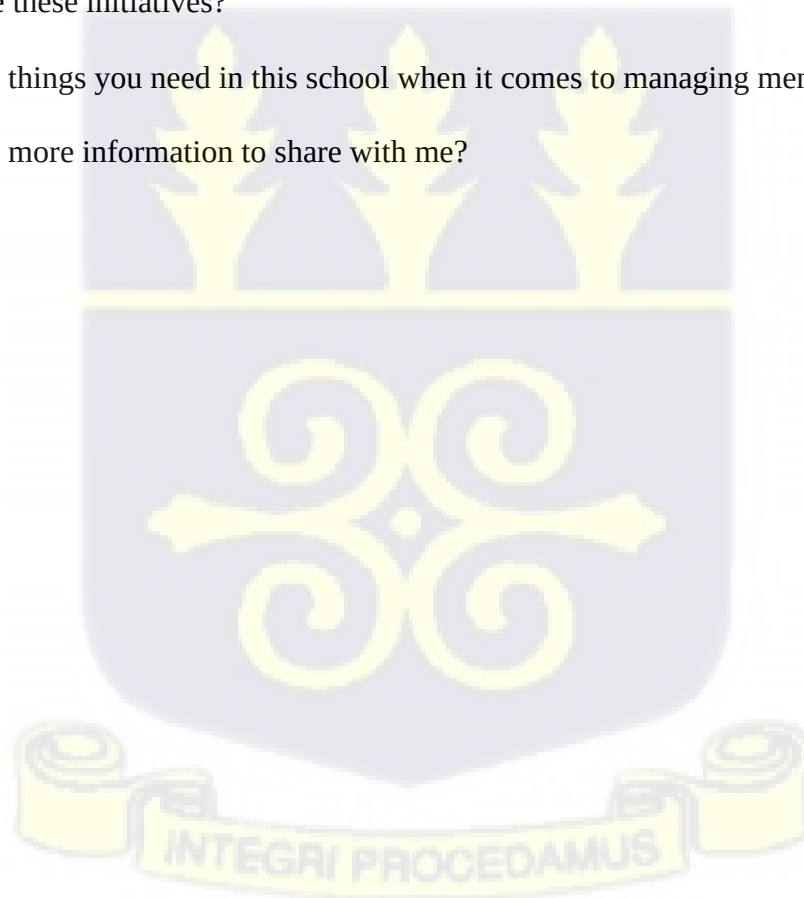
- i. What are the restrictions imposed on girls/women in this community during menstruation? i.e religious activities, cooking, going to school, farm etc
- ii. What are the consequences for breaking these norms and taboos?
- iii. What are the attitudes of community members towards period? i.e dirty, secret, spirits
- iv. Where do you buy sanitary pad in this community? i.e. price, able to afford all the time, want subsidy, how much girls can pay for a pack of pad.
- v. Do you have more information to share with me?

Appendix 4: Interview guide for teacher/headmaster

Demographics: Name of school, Position, age, level of education, religion,

- I. In your own words, what is menstruation?
- II. Where do girls in this school get information about menstruation? i.e textbooks, teachers, health workers?
- III. What menstrual hygiene topics are being taught in this school?
- IV. Where do the girls in this school change their pads during menstruation?
- V. Where do girls defecate? What is the state/condition of the toilet now? (i.e. clean, lockable doors, odour etc)

- VI. Where do girls get water to wash their hands before/after changing pad? i.e veronica bucket
- VII. Where do girls get soap to wash their hands? i.e availability of soap
- VIII. Where do girls dispose of menstrual materials in school? i.e bins
- IX. How do the girls cope when menstruation starts in school? i.e pad available
- X. How do girls in this school cope with menstrual pains? i.e pain killers available
- XI. How does menstruation affect girls in this school? (i.e school attendance, concentration, participation etc)
- XII. Do girls in this school sometimes experience teasing during menstruation? If yes, how frequent, who are the teasers, how do girl react, etc.
- XIII. Is there any initiative/ project or activities in this school to promote menstrual hygiene? If yes, what are these initiatives?
- XIV. What are the things you need in this school when it comes to managing menstruation?
- XV. Do you have more information to share with me?



Appendix 5 : Informed Consent Form

UNIVERSITY OF GHANA



Official Use only Protocol number

Ethics Committee for Humanities (ECH)**PROTOCOL CONSENT FORM****Section A- BACKGROUND INFORMATION**

Title of Study:	Cluster-randomized trial of menstrual hygiene interventions to improve health and educational outcomes among adolescent girls in the Binduri and Pusiga Districts of Ghana
Principal Investigator:	Emmanuel Anongeba Anaba
Certified Protocol Number	

Section B- CONSENT TO PARTICIPATE IN RESEARCH**General Information about Research**

Adolescent girls in developing countries like Ghana experience poor menstrual hygiene. Unhygienic menstrual practices put girls at risk of infections and complications. Adolescent girls who do not have access to safe menstrual materials sometimes miss or drop out of school. The purpose of this research is to explore barriers and facilitators to optimal menstrual hygiene among adolescent girls. In addition, a two-arm intervention will be implemented and evaluated among adolescent girls. One group will receive training on menstrual hygiene and subsidized sanitary pads.

Benefits/Risks of the study

Benefits: There is no direct benefit for you. However, findings from this study will help promote adolescents' reproductive health and wellbeing through policies and programmes. It will also help improve girls understanding of menstrual hygiene and menstruation-related school absenteeism.

Risks: You will be required to answer questions about yourself and your menstrual experiences, hence there will be minimal risk and discomfort. You can contact the Principal Investigator (Mr. Anaba Anongeba Emmanuel) on +233241787287 to channel your concerns. Also, there is a counselor on standby to counsel you if you experience any emotional challenges. You can contact the counselor (Dr. Asampong Emmanuel) on +233244278453. All your concerns will be addressed promptly. In addition, a field team comprising female research assistants will visit you to conduct an interview.

Confidentiality

We will protect information about you to the best of our ability. Information provided by you will be saved on a computer with a password so no one else can see it. Your real name and other identifiable information will not be shared with anyone else and you will be given a study identity number with which we will identify you. The qualitative interview will be audio recorded for it to be transcribed into word format. This recording will not have any record of your name or any easily identifiable information. It will only be available to the research team.

Compensation

There will be no monetary compensation for you. However, girls who participate in a training session would be given soft drinks and pastries (snacks) at the end of every training session.

Withdrawal from Study

Your participation in this study is voluntary and you can drop out at any time of the study period if you wish to end your participation. You or your legal representative will be informed promptly if information becomes available that may be relevant to your willingness to continue participation or withdraw. You may do so without any consequences. The findings will be reported in a thesis report and submitted to the School of Graduate Studies, University of Ghana as well as disseminated in scientific journals and conferences. This study is strictly for academic purposes and your name or any identifiable information will not appear in any publication or presentation.

COVID-19 protocols to be observed

Both interviewers and interviewees will wear a nose mask during interviews and training sessions. Veronica buckets with water and soap will be provided at training centers for regular handwashing. Also, hand sanitizers will be provided at training centers. A physical distance of at least one meter will be observed. A thermometer gun will be provided for checking the temperature of participants and the research team.

Contact for Additional Information

Please for further information about this project or related injuries, contact the:

Student Investigator

Emmanuel Anongeba Anaba
Department of Population, Family & Reproductive Health
University of Ghana School of Public Health
P. O. Box LG 13 Legon
Tel: +233 241 787 287
+233 209 571 132
Email: emmaanaba24@gmail.com
eaanaba002@st.ug.edu.gh

- If you have any questions about your rights as a research participant in this study you may contact the Administrator of the Ethics Committee for Humanities, ISSER, the University of Ghana at ech@ug.edu.gh or 00233- 303-933-866.

Section C- PARTICIPANT AGREEMENT

"I have read or have had someone read all of the above, asked questions, received answers regarding participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for personal records."

Name of Participant

Signature or mark of Participant

Date

If the participant cannot read and or understand the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

Name of witness

Signature of witness / Mark

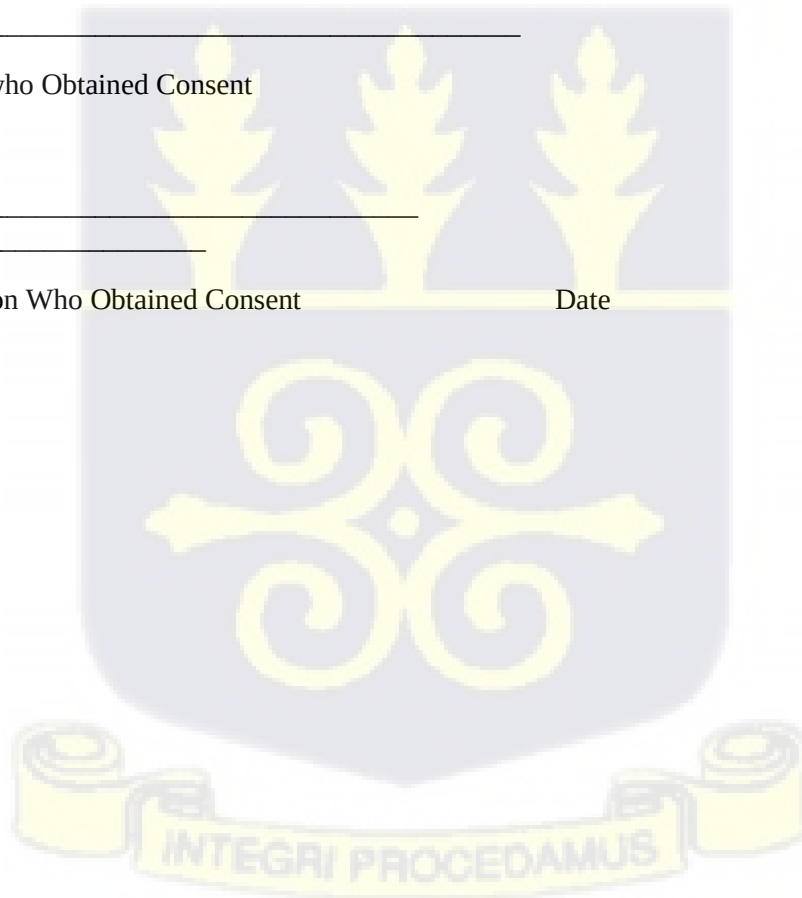
Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Name of Person who Obtained Consent

Signature of Person Who Obtained Consent

Date



Appendix 6: Parental consent form

UNIVERSITY OF GHANA



Official Use only Protocol number

Ethics Committee for Humanities (ECH)

GUARDIAN /PARENTAL PROTOCOL CONSENT FORM
--

Section A- BACKGROUND INFORMATION

Title of Study:	Cluster-randomized trial of menstrual hygiene interventions to improve health and educational outcomes among adolescent girls in the Binduri and Pusiga Districts of Ghana
Principal Investigator:	Emmanuel Anongeba Anaba
Certified Protocol Number	

Section B- CONSENT TO PARTICIPATE IN RESEARCH
--

General Information about Research

Adolescent girls in developing countries like Ghana experience poor menstrual hygiene. Unhygienic menstrual practices put girls at risk of infections and complications. Adolescent girls who do not have access to safe menstrual materials sometimes miss or drop out of school. The purpose of this research is to explore barriers and facilitators to optimal menstrual hygiene among adolescent girls. In addition, a two-arm intervention will be implemented and evaluated among adolescent girls. One group will receive training on menstrual hygiene and subsidized pads.

Benefits/Risks of the study

Benefits: There is no direct benefit for your daughter. However, findings from this study will help promote adolescents' reproductive health and wellbeing through policies and programmes. It will also help improve girls understanding of menstrual hygiene and school absenteeism.

Risks: Your daughter will be required to answer questions about herself and her menstrual experiences, hence there will be minimal risk and discomfort. You can contact the Principal Investigator (Mr. Anaba Anongeba Emmanuel) on +233241787287 to channel your concerns. Also, there is a counselor on standby to counsel you if your daughter if she experiences any emotional challenges. You can contact the counselor (Dr. Asampong Emmanuel) on +233244278453. All your concerns will be addressed promptly. In addition, a field team comprising female research assistants will visit your daughter to interview her.

Confidentiality

We will protect information about your daughter to the best of our ability. Information provided by her will be saved on a computer with a password so no one else can see it. Her real name and other identifiable information will not be shared with anyone else and she will be given a study identity number with which we will identify her. The qualitative interview will be audio recorded for it to be transcribed

into word format. This recording will not have any record of her name or any easily identifiable information. It will only be available to the research team. The findings will be reported in a thesis report and submitted to the School of Graduate Studies, University of Ghana as well as disseminated in scientific journals and conferences. This study is strictly for academic purposes and your daughter's name or any identifiable information will not appear in any publication or presentation.

Compensation

There will be no monetary compensation for your daughter. However, she will be given soft drinks and pastries (snacks) if she participates in a training session.

Withdrawal from Study

Your child's participation in this study is voluntary and she can drop out at any time of the study period if she wishes to end her participation. You or your legal representative will be informed promptly if information becomes available that may be relevant to her willingness to continue participation or withdraw. She may do so without any consequences.

COVID-19 protocols to be observed

Both interviewers and interviewees will wear a nose mask during interviews and training sessions. Veronica buckets with water and soap will be provided at training centers for regular handwashing. Also, hand sanitizers will be provided at training centers. A physical distance of at least one meter will be observed. A thermometer gun will be provided for checking the temperature of participants and the research team.

Contact for Additional Information

Please for further information about this project or related injuries, contact the:

Student Investigator

Emmanuel Anongeba Anaba
Department of Population, Family & Reproductive Health
University of Ghana
P. O. Box LG 13, Legon
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Email: emmaanaba24@gmail.com
eaanaba002@st.ug.edu.gh

- If you have any questions about your rights as a research participant in this study you may contact the Administrator of the Ethics Committee for Humanities, ISSER, the University of Ghana at ech@ug.edu.gh or 00233- 303-933-866.

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"I have read or have had someone read all of the above, asked questions, received answers regarding my child's participation in this study, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for personal records."

Name of Participant

Signature or mark of Participant

Date

If a participant cannot read and or understand the form themselves, a witness must sign here:

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Name of witness

Signature of witness / Mark

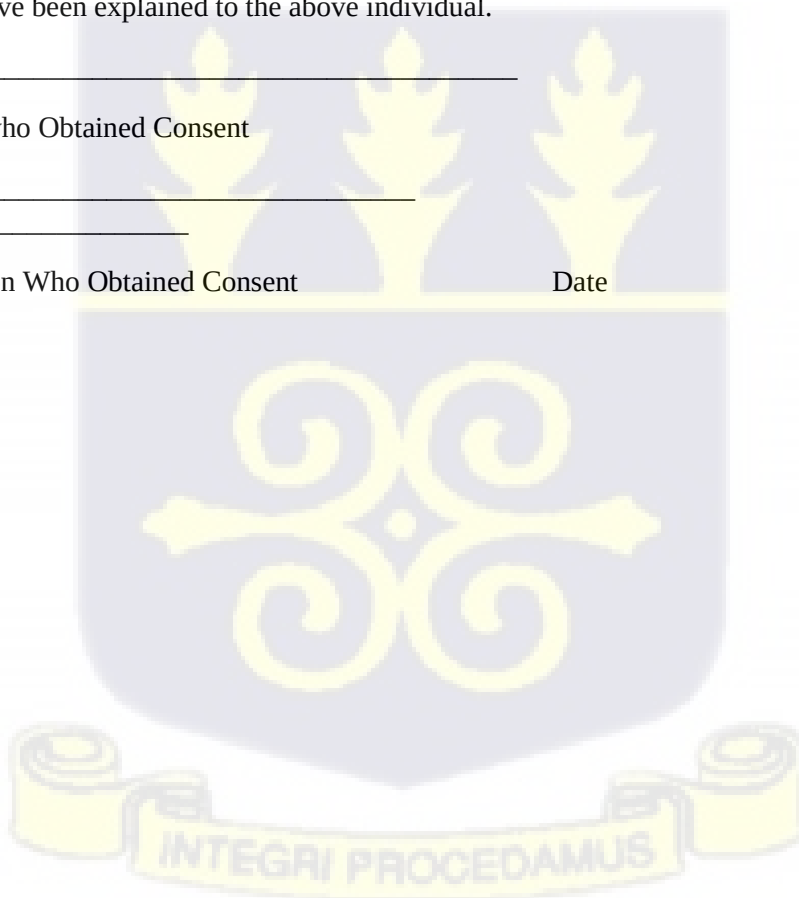
Date

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

Name of Person who Obtained Consent

Signature of Person Who Obtained Consent

Date



Appendix 7: Ethic Committee Approval of protocol



UNIVERSITY OF GHANA
ETHICS COMMITTEE FOR THE HUMANITIES
(ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No...ECH 175/20-21 ...

July 26, 2022.

Emmanuel Anongeba Anaba
Department of Population, Family and Reproductive
Health.
School of Public Health, University of Ghana
Ghana

ETHICAL CLEARANCE (ECH 175/ 20-21)

The amended protocol title below has been reviewed and approved by the ECH Committee.

TITLE OF PROTOCOL: CLUSTER-RANDOMISED TRIAL OF MENSTRUAL HYGIENE INTERVENTIONS TO IMPROVE HEALTH AND EDUCATIONAL OUTCOMES AMONG ADOLESCENT GIRLS IN THE BINDURI AND PUSIGA DISTRICTS OF GHANA.

PRINCIPAL INVESTIGATOR: MR. EMMANUEL ANONGEBA ANABA

Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till July 25, 2023. You are required to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,


Professor C. Charles Mate-Kole
ECH Chair

Cc: Professor Richmond N.O. Aryeetey, Dept. of Population, Family and Reproductive Health, UG
Dr. Emilia Asuqua Udofia, Dept. of Population, Family and Reproductive Health, UG

Tel: +233-303933866 Email: ech@ug.edu.gh



UNIVERSITY OF GHANA
DEPARTMENT OF POPULATION,
FAMILY AND REPRODUCTIVE HEALTH
SCHOOL OF PUBLIC HEALTH

Ref No.:5th November 2021

The District Chief Executive
Garu District Assembly
Upper East region

Dear Sir/Madam,

LETTER OF INTRODUCTION
EMMANUEL ANONGEBA ANABA

This is to introduce **Emmanuel Anongeba Anaba**, a Doctor of Philosophy (PhD) student with the Department of Population, Family and Reproductive Health, University of Ghana, School of Public Health, Legon.

As part of the requirement for the fulfillment of his PhD award, he is conducting research on **“CLUSTER-RANDOMISED TRIAL OF MENSTRUAL HYGIENE INTERVENTIONS TO IMPROVE HEALTH AND EDUCATIONAL OUTCOMES AMONG ADOLESCENT GIRLS IN THE BINDURI AND PUSIGA DISTRICTS OF GHANA”**

Mr Anaba is required to have the most recent information possible regarding

his study. We would be grateful if you could provide the needed permission and assistance in conducting his **pilot study** in your district. Any assistance you can offer him to obtain this information will be greatly appreciated.

Yours faithfully,



Prof. Kwasi Torpey
(Head of Department)

COLLEGE OF HEALTH SCIENCES

P.O.Box LG13, Legon, Accra, Ghana.

•Telephone: +233(0)289109021/22 •Email: pfrh@ug.edu.gh •Website: www.publichealth.ug.edu.gh



UNIVERSITY OF GHANA
DEPARTMENT OF POPULATION,
FAMILY AND REPRODUCTIVE HEALTH
SCHOOL OF PUBLIC HEALTH

Ref No.:5th November, 2021

Dear Sir/Madam,

LETTER OF INTRODUCTION
EMMANUEL ANONGEBA ANABA

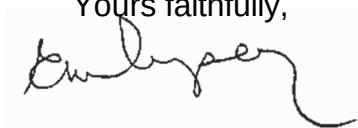
This is to introduce **Emmanuel Anongeba Anaba**, a Doctor of Philosophy (PhD) student with the Department of Population, Family and Reproductive Health, University of Ghana, School of Public Health, Legon.

As part of the requirement for the fulfillment of his PhD award, he is conducting research on **“CLUSTER-RANDOMISED TRIAL OF MENSTRUAL HYGIENE INTERVENTIONS TO IMPROVE HEALTH AND EDUCATIONAL OUTCOMES AMONG ADOLESCENT GIRLS IN THE BINDURI AND PUSIGA DISTRICTS OF GHANA”**

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Yours faithfully,



**Prof. Kwasi
Torpey (Head of
Department)**

Distribution:

The District Chief
Executive Binduri
District Assembly
Binduri, Upper East
region

The District Chief
Executive Pusiga
District Assembly
Pusiga, Upper East
region

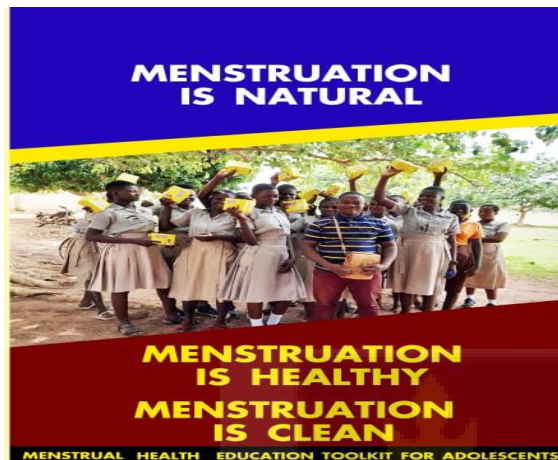
COLLEGE OF HEALTH SCIENCES

P.O.Box LG13, Legon, Accra, Ghana.

•**Telephone:** +233(0)289109021/22 •**Email:** pfrh@ug.edu.gh •**Website:** www.publichealth.ug.edu.gh

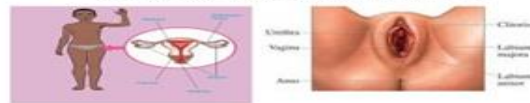


Appendix 8: Menstrual hygiene education material



TOPIC 1: THE FEMALE REPRODUCTIVE SYSTEM

Question: Why do women bleed but men do not?



The Vagina

•The vagina is connected to the uterus which is where we menstruate from and is used for sexual intercourse.

The Cervix

- The cervix is like the door to the uterus.
- It has a very small hole in it that allows sperm to pass into the uterus or blood to pass out.
- When a woman gives birth it becomes more stretchy to allow the baby to pass through.

The Uterus

- The uterus is like a bag.
- It has thick walls designed to protect a growing baby and it is lined with blood and soft tissue to help a baby grow.
- If a woman is not pregnant this lining is shed every month.

Ovary

- The ovaries are little sacks full of eggs.
 - Every girl is born with ovaries full of eggs waiting to be released.
- Fallopian tube
When the ovary releases an egg it travels down the fallopian tube to the uterus

TOPIC 2: MENSTRUATION

What is menstruation?

Menstruation is the monthly flow of blood from the uterus through the vagina.

It means a girl is growing up and her body is preparing for the future when she might get pregnant and have babies.

It is commonly referred to as Period.



- Menstruation is a sign of good reproductive health.
- The average amount of blood lost during a menstrual period is 30 to 72 millilitres (5 to 12 teaspoons).
- Menstruation occurs monthly for three to seven days, varying from female to female.

When does menstruation begins?

Menstruation starts between the ages of 10 and 19. A delay in the onset of menstruation is normal.

Most girls will have irregular menstruation from age 16 to 18.

When does menstruation stops?

A woman can expect to see her menstrual period continuously until she reaches her menopause.

This usually begins when she approaches her late 40s and 50s.



What regulates menstruation?

The menstrual cycle is controlled by hormones (substances or chemicals that act as messengers in the body).

However, being poorly nourished may change the amount of certain hormones your body makes, and this may alter the menstrual cycle.

We don't know of any scientific evidence that specific food and drinks can affect periods.

- Don't let menstruation stop you from
- 1. Going to school
- 2. Your concentration in class
- 3. Doing house chores
- 4. Going to work
- 5. Participating in social activities etc



Supporting girls during menstruation

- Girls need boys to be more understanding of what menstruations are so they can get through it easily.
- Assist girls with chores when they are experiencing menstrual pains.
- Talk to other girls and women such as your mother, sister, auntie, grandmother, female friend, an older woman in your community who you trust, or a teacher to get to know more about menstruation.

- Do not exclude girls from activities because they are in their menstruations.
- Empathize with girls going through their menstruation as menstruation is a normal process for every woman.
- You should not tease girls who are menstruating.
- Ask girls how you can support them



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Importance of knowing your menstrual cycle

Keeping track of your cycle is important to prepare for your next menstruation. A better understanding of your menstrual cycle can help you to notice any abnormalities or irregularities and seek for medical attention

TOPIC 4:

MENSTRUAL HYGIENE FACILITIES

These are materials girls /women need to be able to manage menstruation effectively.

Examples: Clean water, Soap, Menstrual materials, Disposable bins, Privacy, Handwashing facilities



Types of menstrual materials

(1) Disposable materials

Examples: Disposable sanitary pad, Tampons



(2) Re-usable materials

Examples: Menstrual cup, Reusable pad, Reusable cloth



Unsafe menstrual materials

- Examples: Old cloth, Toilet paper/roll, mattress, cotton, panty liners etc



Managing reusable pad/cloth

Follow this 3 step method to keep your menstrual cloth clean and ready for use during menstruation.

1. Fold cloth, place in plastic bag, before placing in your bag or pocket.
2. Wash with water and soap.
3. Make sure you dry in the sun. And fold for next use



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Sources of information about menstruation

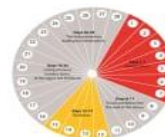
Parents/ mothers, Sisters/grandmothers, Teachers, Friends, Internet, Radio Newspaper, Televisions, Health workers



TOPIC 3:

MENSTRUAL CYCLE

- Your menstrual cycle is the interval between your first and your next menstrual period.
- On average, the length of the menstrual cycle is 28 days, but generally this varies from woman to woman.
- Regular cycles that are longer or shorter than this, from 21-35 days, are normal.



How to calculate your menstrual cycle

- Marking on a calendar the first day of your menstruation;
- Mark the calendar again in the next month, on the first day your menstruation begins.
- The total number of days in between the two dates will show you how many days make your cycle.
- The middle point between two menstruations marks ovulation.
- This is a time when females may get pregnant.
- You will need to make these calculations over a few months to know and get an average of your cycle.



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You can also tell your mother, father or your teacher if you do not have immediate access to a health professional.



TOPIC 8:

DEMISTIFYING MENSTRUATION



Having your monthly menstruation is normal. Remember, it is only for a short while. Talk to your parent, guardian, teacher or someone who can advise you, if you have any questions about your menstruation.

- Follow recommendations for food, drinks and physical exercises to make it more comfortable.
- Share your experiences with your friends, you are stronger together
- You are amazing, no matter what age you start your menstruation.
- It is normal to be moody during your menstruation.
- Let those close to you know your situation so they know how to relate with you during this time.
- Learning to manage your mood is a sign of maturity.



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- (2) Other symptoms girls may experience around menstruation:
 (3) Breast sensitivity
 (4) Sore, swollen and tender breasts.
 (5) Bloating stomach, hands, feet etc.
 (6) Abdominal pain, also known as menstrual cramps
 (7) Headache
 (8) Diarrhoea
 (9) Tiredness

Menstrual disorder

Your menstruation lasts longer than 8 days



Soak more than one pad every 1-2 hours



Menstruation becomes irregular



Bleeding or spotting blood in between menstruations



Unusual amount of pain before or during menstruation.
 See your health professional if you experience any of these.

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Vagina hygiene

Wash your private area to prevent the contamination of the vagina with harmful anal bacteria such as E.coli
 Only use water to wash your vagina, no soap.
 Wash your vagina at least twice a day during your menstruation.
 Do: Clean from front to back;
 Don't: Clean from back to front

Topic 6: DIET DURING MENSTRUATION

Eat well during menstruation.
 Below are some foods to eat when you are menstruating.
 • These foods also help to ease the pain during menstruation and replace lost blood.



Protein rich foods

- Meat, Egg-
- Protein rich food helps put sugar level in check, limiting cravings for sugar



Pain regulators

- Fish are rich in omega 3 fatty acids that helps with reducing of pain



Blood restorers

Cocoyam leaves (Kontomire) or spinach leaves –
 Restore iron lost in the blood during menstruation.



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How to handle disposable sanitary material?

- Do's
- Always wrap your sanitary materials before disposing of them in a latrine bin.
- Don't
- Do not dispose of your sanitary materials in toilet bowls or toilet pits
- Do not dispose of your sanitary pad on the toilet floor.
- Do not throw your used sanitary pad on a pile of refuse



TOPIC 5: PERSONAL HYGIENE DURING PERIOD

Importance of personal hygiene

It is important to keep yourself clean during your menstruation in order to prevent uncomfortable situations such as soiling your clothes or smelling bad.

Tips on personal hygiene

- Change your sanitary pad or old cotton fabric as often as possible to prevent pad rash or other infections.
- Wash your body regularly with water and soap.
- Always carry extra sanitary materials on you
- Wash your hands under running water with soap before and after changing pad.
- Bath well, so you smell good.



Reusable cloth/pad

- Soak reusable pad and underwear in soap and water before washing them.
- Dry reusable pad/cloth and underwear in sunlight.
- Iron reusable pad/cloth



Menstrual cups

- Boil menstrual cups in water for 5 minutes
- Wrap and store reusable materials in a clean place
- Avoid using the same place for urination during menstruation

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Mood regulators

Bananas – Boosts your mood during your menstrual cycle.
 Menstruation is not fun but you will be surprised how your body responds when you eat the right food.



TOPIC 7: MOOD CHANGES, MENSTRUAL PAINS AND



DISORDERS

Menstrual pains /cramps

Menstrual pain is normal and is caused by the muscles of the uterus contracting.

You can manage the pain by:

- (1) You can exercise
- (2) Use a warm towel to help ease the pain.



Managing pains and mood during period

It is Okay To Be Moody During Your Menstruation.
 Good Ways To Improve Your Mood During Menstruation
 Laughing, Exercising, Deep Breathing, Stretching



Some things to expect with menstruation

- (1) Some girls experience pre menstrual syndrome (PMS) which cause pimples and mood swings, just before their monthly menstruation begin.
- (2) Other symptoms girls may experience around menstruation:



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Appendix 9: Sensitization poster for classroom



Appendix 10: Photo Gallery



Figure 1: A nurse leading a training session with participants in a classroom(photo deliberately anonymized).



Figure 2: A nurse leading a training session with participants under a tree (photo deliberately anonymized).



Figure 3: Boxes of sanitary pads and gallons of liquid soap to be distributed to schools



Figure 4: A Veronica bucket and a dustbin delivered to a school



Figure 5: Participants in the control group received free sanitary pads at the end of the study (photo deliberately anonymized)