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Investigating Fear, Shyness, and Discomfort Related to Menstrual Hygiene Management in Rural Cambodia

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Abstract

Over the last decade, increasing attention has been given to understanding girls' menstrual hygiene management (MHM) experiences in school. However, little has been done to understand girls' MHM experiences in other contexts, such as the home environment. The purpose of this study was to explore the knowledge, attitudes, and practices of MHM and menstrual related experiences among rural Cambodians, with an expanded scope to include both the home and school environments, and five participant perspectives. Our study was conducted in eight rural secondary schools and eight rural villages from two Cambodian provinces, Banteay Meanchey and Kratie. Our target participants included girls (14+ years, post-menarche; n=120), mothers (n=88), fathers (n=15), teachers (n=37; 54.1% female), and boys (14+ years; n=59), for a total of 346 participants. Qualitative and quantitative data were collected using structured interviews (n=165), structured focus groups (SFGs) (24 SFGs: n=180), and observational latrine surveys (n=8). Qualitative analysis employed inductive approaches derived from Grounded Theory. Based on our findings, although girls expressed feeling capable of managing their menses each month, fear, shyness, and discomfort (FSD) associated with their menstrual experience was a major theme. As such, emergent categories from girls' responses and other participant groups revealed three primary determinants of FSD: (1) relational impacts on FSD, regarding girls' social experiences during menstruation; (2) knowledge-related impacts on FSD, indicating areas of knowledge that influenced MHM and FSD; and (3) managerial impacts on FSD, dealing with the material and WASH resources that were most pragmatic for MHM and influential on FSD. A fourth theme considered the impact of FSD on girls' behavior. Quantitative and qualitative analysis showed that FSD had a significant impact on girls' confidence, relationships, and decision-making regarding MHM. Evidence and recommendations from this study support the tailoring of programs and interventions to target overt social, educational, and environmental challenges and underlying factors that contribute to girls' FSD, in order to meet the traditionally unserved MHM needs of women and girls.

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Introduction

Menstrual hygiene management (MHM) has broadly been defined as self-efficacy regarding menstrual care, including having access to clean and reliable absorbent materials, safe and functional facilities for changing and cleaning, convenient and acceptable disposal methods, and accurate knowledge of health behaviors and hygienic practices during menstruation [1-3]. Over the last decade, increasing attention has been given to MHM, with a considerable focus on its impact on adolescent girls' health and educational outcomes and the need for improved water, sanitation, and hygiene (WASH) facilities to create MHM-friendly school environments [1, 3-9]. In the February 2016 PLOS article, "A Time for Global Action: Addressing Girls' Menstrual Hygiene Management Needs in Schools," various stakeholders called for a ten year action plan to mobilize the coordination of resources, programming, and policy development to ensure that MHM for schoolgirls is clearly prioritized on global, national, and local agendas [10]. Despite the growing body of evidence suggesting that challenges to MHM impact adolescent girls' self-esteem, dignity, and educational experience, the article highlights an ongoing need for understanding the causal linkages and mechanisms by which MHM impacts educational achievement among school-aged girls [10].

In the school setting, studies have shown that "menstrual poverty", or the inability to practice MHM due to a lack of resources or necessary supports, can contribute to physical and psychological distress, absenteeism from school, and disengagement due to concerns of staining, odors, and teasing from peers [1, 7, 10]. Furthermore, despite the increasing demand for gender-sensitive WASH facilities, many school environments continue to lack basic WASH facilities and amenities, increasing the difficulties girls face at school during their menstruation [6, 10, 11]. Given the most recent Sustainable Development Goals to improve women's and girls' health and educational outcomes, these findings provide compelling evidence for the enhancement of school environments to support girls' MHM needs [12-14].

There is a considerable gap in the literature related to MHM across environments beyond the school setting, namely in the home or work environments. Given that successful MHM depends on being able to routinely attend to changing sanitary materials and frequently cleaning with soap and clean water, there has been surprisingly few acknowledgements that WASH facilities are needed across environments for MHM [1]. One study in India assessed how the home environment affected MHM practices and the risk for urinary tract infections (UTI) [15]. Based on their analysis, home environments that enabled women to care for their MHM indoors, including an indoor water supply and convenient place to change, were also found to be protective against UTIs compared to women who had to change or clean themselves outdoors [15]. Few studies have looked at MHM's impact on women in the workplace, but some have suggested that impediments to MHM, such as limited access to WASH amenities and difficulties addressing pain and discomfort due to menstruation, may impact women at work [16]. Therefore, exploring the features of closely related environments across an adolescent girls' and woman's life course is valuable, considering that menstrual and WASH-based challenges may be present during schooling and beyond [17].

Although the portrayal of MHM as essential to girls' educational success has been consistent throughout the literature, there are those who suggest the current framing of the issue is too narrow [18, 19]. Joshi et al. highlight that although a need for WASH interventions and improved transfer of MHM-related knowledge exists, a more nuanced understanding of the social dynamics involved in menstruation and how these affect girls' experiences in schools must also be examined [18]. Such an appraisal emphasizes the need to expand our understanding of any additional factors affecting adolescent girls' experiences of menstruation in the school environment.

As the majority of MHM findings have come from Africa and South Asia, research is being conducted to understand menstrual and MHM experiences across Southeast Asia. Prior work in this region included an investigation of the role of MHM in Cambodian schoolgirls' experiences, examining both urban and rural school environments [20, 21]. Findings from this study indicated key gaps in menstrual and MHM knowledge among Cambodian schoolgirls, the need for enhanced WASH facilities, and cultural beliefs at the onset of menarche that at times contributed to school absenteeism [20]. The study was limited primarily to girls' school experiences and focused on only three study sites to allow for more in-depth qualitative findings.

In an effort to expand the research on MHM needs in Southeast Asia and Cambodia, this study sought to explore the experiences of rural Cambodians regarding menstruation and MHM from a variety of perspectives. The scope of this study was not limited to only the school environment, but also sought to capture menstrual and MHM experiences in the home environment. Based on our findings, although girls expressed feeling capable of managing their menses each month, fear, shyness, and discomfort (FSD) associated with their menstrual experience was a major theme. The aim of this report is to examine the social, educational, and environmental determinants of FSD among rural Cambodian adolescent girls, as well as its consequences for adolescent girls' perceived well-being and education. In recognizing the influence of authority figures and peers on girls' understanding of and feelings towards menstruation, a strength of this study is the inclusion of perspectives from parents, teachers, and male students, who were also engaged to learn more about their roles, responsibilities, and perceptions regarding MHM. The evidence from this study will serve to expand the contextual framework from which Cambodian schoolgirls' menstrual experiences emerge and to identify actionable steps to inform the design, implementation, and improvement of MHM-related programming for local institutions and NGOs in Cambodia.

Study Setting

This study was based in rural Cambodia, specifically in Banteay Meanchey (BMC) province in the northwest and Kratie (KT) province in the northeast. The rationale for working in rural Cambodia was that rural schools and villages may have fewer amenities, in terms of WASH and access to supplies, compared to urban areas, thus presenting unique challenges to rural adolescent girls and women during menstruation. Nationally, at the school level, 54.1% of urban schools (pre-school through college; n = 1,382) lacked a reliable water supply, and 34.7% of

urban schools lacked a latrine according to the 2014-2015 Education Statistics and Indicators of Cambodia [22]. Comparatively, of the 745 schools in BMC, 63.5% lacked a water supply, and 38.5% were without a latrine [22]. Likewise, of the 373 schools in KT, 51.7% lacked a reliable source of water and 35.5% lacked a latrine [22]. At the household level, the 2014 Cambodia Demographic Health Survey (DHS) indicated that urban households more often used an improved source of drinking water during the dry season (Urban: 95.0%; Rural: 60.1%) and during the rainy season (Urban: 97.6%; Rural: 81.4%) than rural households [23]. The increase in use of improved water sources during the rainy season among rural households was attributable to an increase in the use of rainwater as a reliable source of drinking water (Dry season: 10.1%; Rainy season: 40.8%) [23]. In terms of latrine coverage, the 2014 Cambodian DHS also indicated that 50.4% of rural households across Cambodia had no latrine or WASH facility coverage, compared to only 6.9% lack of facilities among urban households [23]. Given the connection between WASH and MHM, a lack of access to a latrine and/or reliable source of clean water would present barriers to appropriate MHM.

Particular to our study's timeframe is that students were preparing for their final exams. Additionally, previous efforts had been made by the Ministry of Education, Youth, and Sport to distribute "Growth and Changes" booklets describing menstruation and MHM in the local language of Khmer to select schools, some of which participated in our study. At this time, Cambodia's National Ministry of Education, Youth, and Sport and the National Ministry of Rural Development currently do not have action plans to address MHM at the school or household level, respectively [24, 25]. However, it has been reported that Cambodia's government aims to have a new standard for the number of students per latrine, taking into consideration the differing needs of girls and boys [20].

Methods

Study Design Overview

To explore menstrual experiences and MHM among rural Cambodians, a knowledge, attitudes, and practices (KAP), mixed-methods study design was chosen (Figure 1). The primary partner for this study was Samaritan's Purse (SP) Cambodia, whose interest in MHM and improving WASH and Health programming in this area was instrumental to the design and implementation of the study. For provincial selection, BMC and KT were chosen because both provinces are within SP's target areas for their programs and met our criteria for working in rural settings. SP's ongoing collaborations the Provincial Departments of Education, Youth and Sport in BMC and KT were useful in facilitating our partnerships with local schools and villages. Locations for recruitment and data collection were chosen in two stages. First, five districts in BMC and one district in KT were chosen through purposive sampling, based on being in a rural area and being within logistically feasible distance from our study bases in each province. Second, secondary schools were chosen from each district using a list of the school names in those districts, provided by each provincial Ministry of Education, Youth, and Sport as our sampling frame. Schools were chosen using purposive sampling, following the criteria of being located in a rural area, and variation was introduced in the size of the schools chosen and

whether they were lower (usually grades 7-9) or upper (usually grades 10-12) secondary schools. Based on the schools selected, communes (collections of villages) that fed students into those schools were eligible to participate in our study, and one village from each commune was selected based on convenience sampling. In KT, SP has partnered with six local health centers to construct birthing centers and to improve onsite WASH facilities at the health centers. Two of the six health centers were randomly selected for this study.

Our final study design included five secondary schools and five villages in BMC, and three secondary schools, three villages, and two health centers in KT. In the interest of gaining a variety of perspectives related to menstruation and MHM, six key stakeholders were targeted for participation: adolescent girls attending secondary school, mothers, fathers, secondary school teachers (male and female), adolescent boys attending secondary school, and health center staff (male and female). In order to gain both qualitative and quantitative information on personal knowledge, attitudes, and practices related to menstrual experiences and MHM, we conducted structured interviews (SI) with 165 participants. Given that group sessions can be beneficial in ascertaining even greater insight into topics of consideration through open, shared experiences, we conducted 24 structured focus groups (SFG) with 181 participants, as well.

Ethical Considerations

Ethical approval for this study was granted from the institutional review board of Yale University's Human Subjects Committee and from the Cambodian National Institute of Public Health's National Ethics Committee for Health Research. Only villages, schools, and health centers that willingly agreed to participate were included in this study, and minors under 18 years of age were required to obtain parental permission using parental opt-out forms.

Interview and Focus Group Questionnaire Development

Relevant literature on MHM and input from WASH and Health practitioners¹ was explored prior to questionnaire design. The Social Ecological Model (SEM) was the theory-based framework used in our approach [26]. The SEM recognizes that health outcomes have individual, social, and environmental influences, and our interest was in learning how these levels of influence affected menstrual experiences and MHM among rural Cambodians to determine potential targets for intervention. The SI and SFG guides were developed with questions tailored to each participant group (Figure 2). All questions were finalized after internal review, quality checks, and field testing and were translated into Khmer. All SFG leaders, SI interviewers, and enumerators for note-taking were trained in study methods to understand the questions and engage participants.

Sample Selection and Recruitment

Our target participants included adolescent girls (henceforth referred to as 'girls') (n=120), mothers (n=88), fathers (n=15), male and female teachers (n=20 female, 17 male), adolescent boys (henceforth referred to as 'boys') (n=59), and male and female health center

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staff (n=13 female, 4 male), for a total of 346 participants (Figure 2). In schools, our interest was to speak with at least six teachers (preferably three male and three female, either individually in SIs or together in SFGs), interview twelve girls and six boys, and hold at least one SFG with girls or boys with up to ten participants. In villages, our interest was to hold one SFG with at least six mothers and interview four mothers and two fathers. Due to the exam schedule in KT, we modified our student sample to interview at least eight girls, and held SIs with a minimum of three teachers instead of holding a SFG, when needed.

The recruitment process began by meeting with school directors, commune chiefs, and village chiefs at a target school of interest in order to introduce the study and to obtain the appropriate permissions to conduct the study. After receiving permission to conduct the study in their school and village, we explained our recruitment procedures. Village chiefs were asked to select at least thirteen mothers (nine for SFG, four for SI) and two fathers in their villages according to our eligibility criteria. School directors were asked to approach teachers to ask if they would be interested in participating. At each school, at least fourteen girls and eight boys for SIs and another ten girls or boys for SFGs were randomly selected from class lists in order to obtain a random sample of students. Informed consent forms were either given directly to the students by the research team or distributed to the students by the school director. The students were informed about the nature of the study, and information was provided for parental consideration. The parental opt-out forms were to either be signed and returned, signifying that the student could not participate, or kept at home as indication of consent. We anticipated that some students would not receive parental permission. We verified the validity of this approach given that a small number of parents did opt out their children for reasons of not wanting to interrupt their studies.

To recruit mothers and fathers, village chiefs were asked to transect their communities to find eligible participants. While the initial eligibility guidelines for parents included being 40 years or older and having at least one daughter who was 14 years old, recruitment by local leaders did not always align. Particularly for SFGs, mothers outside of the age guidelines who had traveled long distances or who were particularly interested in learning from the conversation would still ask to participate. Therefore, these mothers were invited to stay as “observers”, were consented, and their responses, if any, were recorded as ‘observer responses’ during note-taking. The study protocol was subsequently expanded to include younger mothers as normal participants, as well.

Secondary school teachers were eligible to participate if they were available on the day of our site visit for data collection. The teachers selected were from grades 7-12, which overlapped with the grades from which participating students were recruited. Girls were eligible to participate if they were 14 years or older and had already begun experiencing menstruation, so as to speak from personal experience of menstruation and MHM. Boys were eligible to participate if they were 14 years or older. Since steps were taken to ensure random selection of students, the bulk of participants were randomly selected; however, due to absence or exam schedules in some schools, alternative students were chosen by school staff rather than those on our original recruitment lists. Despite these substitutions, all students received consent forms to give to their

parents and time to receive parental permission. The overall study sample reflected a variety of socioeconomic backgrounds and educational experiences.

For health center staff recruitment, health center directors were contacted to introduce the study and ask permission to conduct the study at their health center. Upon permission, the health center director was asked to recruit nine staff members, who would be eligible to participate if they were at the health center on the day of our site visit. All health staff were provided with information on informed consent.

Data Collection

The research team consisted of the primary investigator and nine Cambodian women, made up of two team leaders and seven enumerators. All SFGs and SIs were conducted in Khmer and involved careful note taking by enumerators, who were trained in data collection. Team leaders were also requested to take field notes to further contextualize the responses noted during data collection. SFGs, whether in the villages, schools, or health centers, were held in private locations chosen by the village chief or institution director. The SIs were held in private classrooms in schools or outside in specified areas by local leaders. SFG leaders and interviewers used the SIs and SFG guides to ask the same set of questions tailored to each participant group, and they were not responsible for probing independently beyond the questionnaire questions. However, SFG leaders and interviewers would often probe further to obtain more detailed responses. For girls and boys, team leaders would privately ask about eligibility and parental consent prior to inviting them to participate. Demographic information was collected, and SFGs generally lasted one-and-a-half to two hours with a mid-way break, while SIs were generally one hour for mothers and girls and 30-45 minutes for fathers and boys. All participants were provided with a water, snack and/or soap, and “Growth and Changes” booklet (if they had not already received one) in appreciation of their participation. All SFGs were homogeneous, except teacher and health center staff SFGs, where men and women participated in SFGs together. This approach was chosen during the pilot when teachers expressed being comfortable speaking together on this topic, and health center staff also expressed feeling comfortable discussing these health issues together.

Specifically during school visits, school directors also gave permission to conduct latrine observational surveys. A school official would accompany the primary investigator and one of the research team members to answer questions related to latrine use, maintenance, and provision and privacy for students and teachers. Responses to the questions and any additional observations were recorded on the survey document (Appendix B).

Data Analysis

All Khmer transcripts were subsequently translated into English for analysis purposes. Both qualitative and quantitative data were collected during the study and were preliminarily processed using Dedoose data analysis software. For qualitative analysis, two coders collaboratively developed a code structure using inductive techniques borrowed from Grounded Theory [27]. Code structure was developed iteratively following two individual pilot coding exercises, and the final codebook represented themes ascertained both deductively from the

literature and inductively based on emerging themes in the transcripts. Girls' responses were a primary focus, and only mother, father, teacher, and adolescent boy perspectives were used in the analysis of this report. Health center staff SFG data were not used because it was clear upon analysis that saturation had been reached by the time their responses were collected. The thematic emphases that emerged from the analysis were (1) contrasts between feelings of self-efficacy and distress (fear, shyness, and discomfort [FSD]) related to menstruation and MHM, (2) social, knowledge-related, and managerial impacts on FSD, (3) environmental preference for home versus school during menstruation, and (4) impacts of FSD on girls' behavior. Quantitative data was derived from SI responses and latrine surveys. The Dedoose descriptor feature was used to input responses to close-ended SI guide questions. The descriptor output was subsequently analyzed using SAS for frequency measurements. Beyond demographic information, quantitative findings from SIs discussed in this paper are only from the girls' perspective.

Results

Results Overview

Participant Characteristics

The adolescent girls who participated in SIs were in grades 8-12 and were a median age of 16 years (yrs) (Range: 14-20 yrs). On average, girls reported the onset of menarche beginning at age 14.2 yrs (SD: 1.0; Range: 12-17 yrs) and that their menstrual cycle would last an average of 4.4 days (SD: 1.4; Range: 2.5-7 days). Girls reported having an average household size of 5.2 members (SD: 1.6), as well. Adolescent boys, also from grades 8-12, were a median age of 17 yrs (Range: 14-20 yrs) and reported having average household sizes of 5.2 members (SD: 1.5).

Parents (32.6% male) reported having a range of one to five daughters, with a median of two daughters who had already begun menstruating (Range: 1-5 daughters). Among mothers, 55.2% (n=29/31) were still experiencing menstruation personally at the time of our study. Of note, only 26.1% (n=46) of parents reported that any of their daughters were still in school. Some reasons cited for daughters no longer attending school included, parents not sending their daughters to school, daughters getting married at a young age, or parents not requiring their daughters to return to school after refusing to attend.

The composition of all teachers who participated in SFGs and SIs was 45.9% (n=17/37) male and 54.1% (n=20/37) female, working at four upper secondary schools and four lower secondary schools. For teachers participating in SFGs, specifically, the average number of years teaching was 6.3 yrs (SD: 4.2 yrs), and only one male teacher reported having a daughter who had started menstruation (Table 1).

Contrasts between Perceived Self-Efficacy and Distress during Menstruation

Menstrual self-efficacy for girls in rural Cambodia was discussed across both the home and school environments by all perspectives. When girls were asked whether they felt capable to manage their menstruation each month, 94.6% (n=74) of girls reported feeling capable of successfully managing their menstruation each month, given their current circumstances. Common reasons for self-efficacy included having access to supplies and facilities for changing and cleaning, knowing how to properly wear sanitary pads, having support systems, and repeated experience over time:

[I can manage] because I learned about menstruation many times and [have] experience[d] [it] frequently. [I] can prepare myself for supply all the time. (Girl, BMC, Grade 12)

[I can manage] because [my] parents often tell [*teach*] me, and I clean [my] vagina well. I am able to know about menstruation and what to do for well hygiene, and [I] have enough sanitary pad[s]. (Girl, KT, Grade 8)

Parents, teachers, and boys also identified similar reasons for self-efficacy, and all perspectives indicated that having knowledge of hygienic practices and a proper diet were key. Girls often associated self-efficacy with maturity and a need to become less dependent on others.

Despite confidence in their ability to care for their menstruation, adolescent girls also described feelings of fear, shyness, or being burdened in multiple aspects of their menstrual and MHM experiences. When asked how girls felt during menstruation, 65.3% (n=75) of all girls indicated feeling scared and/or shy. Another 17.3% (n=75) indicated feeling burdened, uncomfortable, or generally unhappy during menstruation, and only 20.0% (n=75) of girls described feeling normal or grown up. Few girls reported feeling happy or “excited” during their menstrual experience. Having regular menses was occasionally recognized as something to be happy about by some girls, and one girl said she felt happy about menstruation because it meant she was mature and would “be a future mother” (BMC, Grade 9). Girls in BMC reported feeling scared and/or shy more often than girls from KT; however, an equal percentage of girls in KT reported feelings of “fear and/or shyness” and “discomfort” (Table 2).

In explaining feelings of fear, shyness, and discomfort (FSD), many girls related back to the onset of menarche, with the majority of girls describing that they were unprepared and felt scared and/or shy because they had “never known” or seen menstruation before:

[I felt scared] because I don't ever know [menstruation before]. I saw [the] bleeding. I thought it is [*sic*] symptoms, and I told my mother. She told me that I am enough age for menstruation. (Girl, BMC, Grade 11)

One girl noted that she “would like to tell the girls that if they see [their] first menstruation, don't [be] scared because this is normal blood, and [they] have to care [for their] body during menstruation” (BMC, Grade 11).

However, even with experience, FSD persisted throughout ongoing menses. Staining was among the most commonly reported concerns associated with FSD beyond menarche. Staining resulted in girls feeling anxious, concerned about “being known” (recognized as experiencing menstruation), or fearful of teasing or being viewed as unhygienic:

At school, I feel scared of being stain[ed]. People look inappropriately, and [I am] afraid of [it] being [...] [said that] we are not hygien[ic]. (Girl, BMC, Grade 8)

Parents, teachers, and boys recognized these concerns and often noted changes in the girls’ behavior and impacts to their participation and engagement in otherwise normal and required activities. Some girls described feeling less afraid or shy over time. However, the majority of girls continued to experience some degree of FSD in various aspects of their menstrual care. Furthermore, despite similar challenges to MHM in the home and school environments, girls clearly expressed a preference for the home environment during menstruation, compared to school.

Three main thematic categories emerged from the girls’ responses describing factors that influenced the experience of FSD (Figure 3). Relational impacts on FSD concerned girls’ social experiences during menstruation and how relational dynamics affected FSD. Knowledge-related impacts on FSD uncovered areas in the girls’ preparation for and understanding of menstruation and MHM that impacted self-efficacy and FSD. Managerial impacts on FSD dealt with the environmental resources that were pragmatic for girls’ MHM and how a lack of resources contributed to FSD. Following the description of these themes, the impact of FSD on girls’ behavior is discussed.

Relational Impacts on FSD

It was evident from girls’ responses that social and relational factors could either positively or negatively influence FSD during menstruation (Figure 4). In considering relational supports, 93.3% (n=75) of girls said they felt supported through various relationships at the onset of menarche. Beyond menarche, relationships that enabled girls to better navigate MHM and helped alleviate FSD were considered supportive and preferable to girls during menstruation. However, girls often reported negative attitudes towards crowding or having to engage with others during menstruation, often due to factors that contribute to FSD:

[I] feel scared because [*school*] it is not home. Because at home, there are not many people, and I have sanitary pad. But I am afraid of being seen [with a] blood stain at school. (Girl, BMC, Grade 10)

In general, girls reported feeling more comfortable seeking assistance from other females regarding menstruation and MHM. Fathers, boys, or male teachers were often viewed as unsupportive or uncomfortable to interact with during menstruation, whereas mothers, female

relatives, female teachers, and other girls were often portrayed as supportive and easier to engage with during menstruation:

[I prefer learning from my mother] because I dare not to ask other people. My mother knows a lot, and she has experience before. (Girl, KT, Grade 8)

[I prefer a] female teacher because we are able to talk easily. I feel shy to talk about menstruation in the class among boys and male teacher. (Girl, BMC, Grade 8)

Mothers and Female Relatives

Having maternal support was often said to alleviate FSD. Mothers were viewed as a key support by girls, both in terms of access to knowledge and resources during menstruation. Girls frequently reported their mother as being the first person they confided in at the onset of menarche, with 91.5% (n=71) of girls saying they felt comfortable talking with their mothers about personal health issues. At the onset of menarche, girls said that mothers routinely explained that the bleeding they experienced was menstruation, introduced MHM related supplies and practices, and were the first to provide access to sanitary pads for the girls:

[I] sat at home, [and] immediately I [...] [felt] wet and scared when I [...] [saw] the blood. I ran to tell my mother, and she said not to [be] scared because it is normal for mature women. Then she told me how to use sanitary pad. (Girl, BMC, Grade 8)

Beyond menarche, although girls would at times express a desire to be more self-sufficient, mothers were still regularly involved in helping their daughters to access supplies and in sharing information regarding MHM:

[I've] got to love myself. I think that mother[s] can't help us all the time. [I] have enough supply. If not, [I] ask mother to buy. (Girl, BMC, Grade 8)

[I can manage] because when it is near menstruation, I told my mother, and she purchases [...] sanitary pad[s] [for me]. Sometimes, my mother has sanitary pad[s], so she gives [to] me. (Girl, KT, Grade 9)

[I can manage] because mother tells me, and I do according to her [instructions] about body care. (Girl, KT, Grade 10)

Girls often preferred their mother due to reasons of personal closeness and prior experience with menstruation and MHM. Other female relatives, such as sisters, aunts, and grandmothers, as well as female neighbors, were also viewed as supportive relationships during menstruation:

[At the onset of menarche, I felt] scared and [told my] mother and older sister. They tell me [the] reason, and I am not scared. (Girls 2 and 3, KT, SFG [n=10], Grade 9)

Although the majority of girls described their mothers as helpful, some girls described unsupportive mother-daughter interactions regarding menstruation and MHM. Some girls described hiding their menstrual concerns from their mothers for reasons of feeling shy:

At school, I did not realize [that I started menstruating] but my friend told me. And I was scared and ask[ed] permission from teacher going [sic] home. When I arrive home, I dared not to tell my mother. My mother wondered and kept asking me. I told her that I bled. My mother bought me disposal pad, and she told me that this is menstruation. (Girl, BMC, Grade 8)

A few girls said their mothers expressed confusion at the onset of their menarche, unsure of the source of bleeding:

[My] first menstruation [was] at the field, and I told my mother. She said let's wait to see next month because she thought that the leech suck during transplantation [*a farming practice*]. A few days later, she realize[d] that I experience[d] menstruation. (Girl, BMC, Grade 12)

[At the onset of menarche, I began to] feel tired, stomach pain, dizzy and uncomfortable. Mother wanted to call doctor for vaccinating serum because she worried. (Girl 1, KT, SFG [n=10], Grade 8)

Given the influence of maternal awareness and understanding of menstruation on FSD, maternal confusion may contribute to girls' FSD, as girls are unable to become immediately informed about what they are experiencing.

A few girls also reported other difficulties in asking mothers for supplies. Although an explanation was not often provided, some girls described their difficulties saying:

Sometimes, [I] ask [my] mother to buy sanitary pad, [but it is] difficult because she does not want to give. (Girl, BMC, Grade 8)

Many times, [I] wear many layer of pants. [I] always change them because I dare not to ask my mother [for] money to purchase sanitary pad[s]. (Girl, KT, Grade 8)

Given the role of mothers in access to supplies, it will be important to understand barriers to mother-daughter communication and to maternal ability to provide support. As one mother expressed, "Sometimes my daughter has supply, but sometimes not because I have no money" (BMC).

The majority of mothers generally agreed with the roles and responsibilities girls described during menstruation. When asked whose responsibility it should be to teach girls about MHM, mothers generally felt they should be responsible, as well as other female relatives depending on the circumstances:

Mother is responsible to tell because she first experience[ed] [menstruation] and [is] able to tell daughter about menstruation. (Mother, BMC)

Only older sisters can teach [girls about MHM] because no one stays at the village at daytime. They go to work and come back at night. (Mother, KT)

Most mothers said they felt confident and comfortable assisting their daughters with menstrual issues. Beside affirming their role in sharing knowledge and providing supplies, mothers also pointed out their role in their daughters' decisions about rest and diet during menstruation:

[I] help to look after [my] daughters when they experience menstruation [and] keep my eyes on each activities of my daughters. [When] my daughter doesn't know [*understand*] menstruation, I told her to clean body and buy sanitary pad for menstruation. (Mother, KT)

[I] don't want [my] daughter [to] work hard but get enough rest and eat enough meat and vegetable. (Mother, BMC)

Several mothers recognized their daughters' FSD at the onset of menarche or thereafter, and shared their efforts to be supportive to their daughters:

I advised her not to [be] scared, [that] nothing happen[ed] because mature people bleeding is normal and it is menstruation. (Mother, BMC)

A few mothers expressed not feeling as needed during their daughter's menstruation because the daughter had learned how to care for her own MHM. Others reported being challenged by their daughter's shyness during menstruation, which made it difficult for mothers to provide support:

[I] never talk [about menstruation] because [my] daughter knows herself. (Mother, BMC)

I did not tell my daughter because she hid about menstruation. My daughter feels shy to tell about menstruation. (Mother, BMC)

Although mothers expressed wanting to help their daughters, despite girls' FSD, mothers often expressed having had similar feelings at their time of menarche, as well:

[I] stayed home with [my] mother [at the onset of menarche], but I did not tell her because I feel shy. My mother knew when I experience second menstruation. (Mother, KT)

This generational pattern of girls hiding menstruation from their mothers may be impacting maternal awareness of the importance of communicating with their daughters about menstruation prior to the onset of menarche.

Fathers

Very few girls directly named their fathers as a primary support to them during menstruation. Girls often referred to their “parents” helping to provide money for supplies, but paternal support was not explicitly discussed. Mothers occasionally described father’s roles in helping to provide supplies through monetary contributions for their daughters:

[The] mother keeps money when father earned [it]. If [the] daughter needs something, she can ask from mother. (Mother, BMC)

One mother also added that her daughter felt shy around her father during menstruation, suggesting that fathers might be associated with FSD:

Interviewer: Whose responsibility should it be to teach your daughter(s) about MHM?

Mother: [The] mother because she looks after [her] daughter, and she feels very shy to the father or others. (Mother, KT)

Despite this, girls would at times express having a positive relationship with their father or male siblings during menstruation:

Before menstruation, my father and younger brother always play and go somewhere with me, and now it is still the same. (Girl, BMC, Grade 8)

Before, my father brought me outside, but now he knows that I am having menstruation. He still bring me. (Girl, BMC, Grade 11)

Implicit in these statements is that not all girls are uncomfortable to be around their fathers during menstruation.

Alternatively, some girls noticed changes in their father’s behavior towards them post-menarche and during menstruation:

Before, [when] my father went somewhere, he took me. But [when] I experience menstruation, he stops taking me because he thinks I grow up. (BMC, Grade 8)

[My] father plays with me when I have not experienced menstruation, but when I experience, he does not allow me to follow him. (Girl, BMC, Grade 11)

These changes indicated a shift in intimacy between fathers and daughters. Such changes in paternal behavior may send negative messages to their daughters about their menstrual experiences and further contribute to FSD around other males.

Fathers, on the other hand, described generally being supportive to their wives and daughters during menstruation, despite some reservations about their role as a male in an otherwise “female matter”. When asked if they felt comfortable assisting their wives or daughters during menstruation, 86.7% (n=15) of fathers said yes. Fathers described being willing to assist in a variety of ways, with an emphasis on allowing their wives and daughters to rest during menstruation:

[I] provide money to buy supply, accompany them to hospital, help [with] some work at the fields, and [I] let my wife and daughter rest at home. (Father, BMC)

[I] help them not to worry. [I] help financially, accompany to hospital, provide soap, fetch the water for my daughter and wife, [and do] not let them do heavy work. But [I] have them take a break for 3-5 days. (Father, KT)

These efforts were among the ways in which fathers attempted to help alleviate FSD for their daughters.

Fathers still predominantly felt that menstruation was best attended to by girls’ mothers:

The mother is responsible to teach the daughter because she had experience [of menstruation] before, and [my] daughter feels comfortable to tell [her] mother about her menstruation. (Father, BMC)

However, fathers also said their daughters generally did not inform them of their menstrual needs:

I never tell my daughter because she never talks to me about menstruation. (Father, KT)

This lack of sharing therefore may necessitate the mother taking on a more predominant role.

At times, fathers said their daughter’s behavior would change towards them during menstruation, often due to shyness:

Before menstruation, I get close to my daughter, such as [to] sit and talk. After menstruation, my daughter feels shy to get closed, but we talk as usual, [just] not sit close to each other. (Father, BMC)

In recognizing this, many fathers tried to avoid making their daughters feel uncomfortable by limiting their involvement in the issue:

I didn't know when my daughter experienced menstruation because I never asked. If I ask her, she feels shy and thinks that I want to know her personal issue. As a father, I did not manage this issue. (Father, BMC)

Taken together, paternal involvement that seemed conservative may have been limited in an effort to help alleviate FSD. Increasing awareness and understanding of how fathers can help reduce FSD and promote MHM may help fathers and daughters overcome communication barriers about menstruation and MHM. As one father stated, "Men would like to know how their daughter [is] challenge[d] during menstruation" (BMC).

Teachers

Girls had mixed attitudes towards teachers during menstruation. Many girls said they felt teachers were generally supportive during times of menstruation. Although female teachers were more often preferred, some girls said that male teachers could be supportive as well:

Both male and female teachers [can help]. He is able to know the girl['s] needs. Female teachers experience menstruation. She knows about lot menstruation. (Girl, BMC, Grade 12)

[A] male teacher or female teacher can teach about menstruation and body hygiene during menstruation. (Girl, KT, Grade 8)

When girls were asked if teachers were helpful to them during menstruation, many girls discussed that teachers wanted to help alleviate FSD, and this influenced girls' attitudes towards them:

Teachers can help because they don't want us to be embarrassed. (Girl, KT, Grade 9)

Yes, [teachers are helpful] because it is hard to see [*referring to when girls have challenges*]. [They] worry about us and [are] afraid [of] us being embarrassed. (Girl, BMC, Grade 12)

They can help because they know that I have more problems during menstruation. (Girl, KT, Grade 9)

Girls said teachers would sometimes help provide sanitary pads, offer advice and instruction about menstruation and MHM, and give them permission to rest or care for MHM needs:

They [*teachers*] can help [to] give the idea [and] provide supply, if we tell them.
(Girl, KT, Grade 10)

[Female teachers] can help because they have experienced menstruation earlier than us, and they have the knowledge earlier than us [and are] able to teach us. (Girl, KT, Grade 9)

Teachers are helpful because they let me rest. (Girl, BMC, Grade 12)

Girls also appreciated that teachers would allow them to leave school early to go home during menstruation. Often, girls associated teachers' willingness to allow them to leave the school environment with teachers caring about their feelings and menstrual needs, which helped alleviate FSD:

[I] tell teachers and ask them to go home. It helps me not to feel scared.
(Girl, BMC, Grade 12)

Female teachers are helpful because they let my friends to accompany me home. It is hard to ride a bike. [They understand] because they have experience before us and [are] same [gender as] us. (Girl, BMC, Grade 9)

Girls reported feeling that teachers were capable of being supportive because they were older and educated. Female teachers, in particular, were preferred due to personal experiences of menstruation and having a feminine perspective on girls' needs. Girls said those qualities made them feel more comfortable when asking a teacher questions about their menstrual needs:

I like to talk to teachers because he or she can help. [The] teacher is old[er] and knows better, so we need teacher[']s help. (Girl, BMC, Grade 9)

Female teachers [are] who I would like to learn [from] because I am not scared and shy, and they experience menstruation earlier than us. (Girl, KT, Grade 9)

However, despite these positive attitudes, some girls did not view teachers as supportive for a variety of reasons. A few girls said that teachers were "too busy", or that they did not have anything to offer them in the way of sanitary pads:

[Teachers] can't help because they have nothing to help me. (Girl, KT, Grade 8)

[Teachers] can't help because they don't bring sanitary pad along with them.
(Girl, BMC, Grade 12)

Teachers are not helpful because they are busy to teach and [have] no spare time.
(Girl, BMC, Grade 8)

Yet, the primary reason girls gave for why teachers were not supportive was because girls often did not feel comfortable telling teachers about their menstrual concerns. One girl reflected this sentiment saying, “Teachers are not helpful because students don’t tell teachers, and they [*girls*] feel shy” (BMC, Grade 12).

Similar to fathers, teachers also recognized FSD as an underlying reason of why girls hesitated to reach out to them during times of menstruation. Some teachers noted that besides asking to go home or to use the bathroom, girls often did not ask them for help during menstruation:

SFG Leader: Please describe how menstruation issues are handled at school.

Male teachers 2-4 & 6, Female teacher 5: [Girls] never ask for help because feeling shy.

Female teacher 1: There [...] [was] one female student [who] came to ask me [for a] sanitary pad, and I gave [it to] her.

(Teacher SFG, KT [n=6, 4 male, 2 female], Grades 7-9)

Teachers tended to discuss their roles in girls’ menstrual needs as mostly relegated to teaching girls about the importance of hygiene and understanding menstruation as a physical process. However, a few teachers described giving advice to their female students that was both instructive and comforting, aimed at helping girls resolve FSD surrounding menstruation:

Yes, [I give advice]. [I] tell the girls firstly, don’t [...] feel shy to tell the mother so [that] she can purchase sanitary pad and [be] able to tell how to care [for] the body.

(Female teacher, KT)

Alternatively, a few teachers also confirmed the reasons girls gave as to why teachers were not supportive:

[I] never [give advice] with the students because I just come to teach and have not much time. But for my young[er] sister, I used to advise her to clean body [and] manage her health during menstruation. (Male teacher, KT)

Overall, the responses of girls and teachers suggest that teacher support, while present, is at best limited.

Female Peers

Female peers were frequently associated with being supportive and reducing FSD. Girls said their female friends were comforting because they were also female and experienced menstruation, expressed empathy for one another, and were thought to be reliable:

[I talk to] friends because I am not shy, and they are female [...] [like] me.
(Girl, KT, Grade 10)

Friends can help because they don't want me to [...] [feel] difficult during menstruation.
(Girl, KT, Grade 8)

Female peers were often referred to as confidants during menstruation, and girls tried to support one another when accidents or an unexpected menses took place at school. In terms of helping to either prevent or hide stains, girls said female friends' would support each other by helping each other access supplies or by helping to hide stains if an accident occurred. If a girl felt the need to return home, girls said their female friends would also help to ask for teachers' permission to leave school and at times accompany each other home. Girls described these experiences, saying:

[If I have an accident, I] feel scared and ask friends to purchase sanitary pad.
(Girl, KT, Grade 9)

[I] talk to friends, [and] they can help to accompany me home. They help to buy medicine, find the shirt to hide behind, and remind me not to play much because afraid of being seen.
(Girl, KT, Grade 10)

[I feel] shy at people [if] someone talks behind when I [go to] change [my] sanitary pad at home. [I] ask friends [to] change [the] table [*desk*] if the stain [is] there and ask them to hide it. (Girl, BMC, Grade 10)

[I] talk to female friends, [and] they are able to help. Sometimes they share experience, and they help to get permission. (Girl, BMC, Grade 12)

In sharing experiences with one another, girls also appreciated that their female friends could share knowledge about menstruation and MHM with them, as this helped girls address concerns that contributed to FSD:

[I talk to] friends because they can help to advise [me] because they are women, and they understand about the difficulty of women during menstruation. (Girl, KT, Grade 8)

[I talk to] friends, [and] they help to explain about how to use sanitary pad properly, product of hygiene, and give sanitary pad because they understand about the issue and consider me their best friend. (Girl, BMC, Grade 12)

However, even with the various ways girls supported one another during menstruation, some girls pointed out that their friends were sometimes limited in how they could help. Some

girls said that their friends did not always know how to help or were too busy with their studies. Other girls pointed out that their friends would sometimes lack supplies themselves, preventing sharing supplies:

[I] always talk to friends, but they can't help because they are young and know nothing. (Girl, KT, Grade 8)

[I] talked to [my] younger god-sister, who learns with me. She can't help because she has no sanitary pad with [her]. [She] can't send me home [because she] [...] goes [a] different way. (Girl, BMC, Grade 10)

[I] talked to friends, and sometimes they can help; sometimes they can't help because we have same experience and issue. Some friends are busy to study, [so] they can't help. (Girl, BMC, Grade 11)

Given these limitations, it would help girls to have access to other resources at school (e.g. emergency supplies) to help alleviate FSD in times of 'menstrual emergencies' and to better support girls when their friends cannot. Relationally, however, girls tried to work together to help preserve each other's dignity and prevent FSD.

Male Peers (Boys)

When asked about how they felt around boys during menstruation, the majority of girls expressed experiencing FSD around male peers, and they did not want boys to know they were experiencing menstruation. Compared to other social contexts, girls especially emphasized their fear of staining in relation to male students. For some girls, this was the primary contributing factor to experiencing FSD around boys:

[I feel] shy at them because [of] blood stain during menstruation. However, I am not shy if there is no blood stain. (Girl, BMC, Grade 11)

Coupled with concerns about staining, the girls' consistent feelings of shyness and embarrassment around boys were often associated with and heightened by fears of being teased. Girls described their concerns about boys discussing their menstrual experiences, saying:

[I] feel shy and [am] afraid that the boys talk to others. (Girl, KT, Grade 8)

[I] want to hide, and [I feel] shy because afraid of being known. I am not closed to boys. Afraid of being smell at people, being stained, and [that] people [will] talk from mouth to mouth about this. (Girl, BMC, Grade 10)

[I feel] shy because they are boys [who] never experience menstruation. [I am] afraid of being seen [with] the stain, and they [...] [say] that we don't know how to clean our body.
(Girl, BMC, Grade 8)

Based on girls' responses, girls' feelings of FSD regarding boys seemed to be a challenge even if boys were unaware of girls' menstruation.

Some girls described male students as not being particularly bothersome during menstruation. However, this did not change girls' feelings about not wanting them to know they were experiencing their menstruation at school:

SFG Leader: Do boys behave differently around girls when a girl is experiencing her menstruation?

Girl 1 (Grade 11): [I] feel [they behave as] usual.

Girl 2 (Grade 11): The boys may know but dare not to talk.

Girls 3-9 (Grades 8-10): [They behave as] usual because I don't want the boys know, and they don't know.

(Girls SFG, KT [n=9], Grades 8-11)

Very few girls described boys in a supportive light. Only one girl said she felt that boys recognizing stains was a good thing, as they could alert the girl about the issue. This, however, would not eliminate the FSD associated with boys seeing stains or knowing a girl was experiencing menstruation.

Boys also expressed feeling shy of approaching or interacting with girls during menstruation, either because they did not want to upset girls or did not understand the girls' needs at that time:

I want to help but I dare not because the girls and I are shy. (Boy, KT, Grade 9)

[When a] girl becomes mature, I dare not to get close because we [are] shy [with] each other. We are close before because we play[ed] like brother and sister.

(Boy, BMC, Grade 11)

When boys were asked whether they thought they should help girls during menstruation, boys had mixed opinions. Several boys said that they thought they should help girls and gave ideas of how they could assist girls during menstruation:

[Boys] should help. [I] encourage, not mock [or] tease her. [I try to] be happy with her when she [is] experiencing menstruation to avoid [being] offended by me.

(Boy, BMC, Grade 12)

[I could] help to buy medicine, look after [her], let her get more rest, [and] replace and lighten her work like [...] school work. (Boy, BMC, Grade 8)

[I could] help to do housework which is heavy. [I could help] wash the dishes and clean the house. (Boy, KT, Grade 8)

[I] should help because they are my friend. And I get to know when my younger sister [is] having menstruation, she is uncomfortable, same as other people. (Boy, BMC, Grade 8)

However, some boys said they did not think they should help girls, either because they did not know how or because they were concerned about upsetting her:

[Boys] should not help because it can influence her [to be] shy. Only women can understand and help each other, but men can talk a bit about how to care the health. (Boy, BMC, Grade 11)

I don't know how to help or what to do. (Boy, KT, Grade 9)

Taken together, it was apparent from girls and boys responses that there is presently a lack of communication about menstruation and MHM. FSD among boys and girls appears to contribute to this ongoing social dynamic.

Knowledge-related Impacts on FSD

Understanding menstruation and having knowledge of appropriate MHM practices was influential in girls' perceived self-efficacy and FSD (Figure 5). In general, girls understood that menstruation was a process that happened to women, involved monthly periods of bleeding, and that it was important to care for their MHM by showering, wearing sanitary pads, and managing pain and discomfort:

[I] know that the menstruation is the blood from vagina, [and that] we need to use sanitary pads to stop bleeding [to] not let the stain on clothes. And menstruation occurs to women. (Girl, BMC, Grade 11)

Menstruation was also known to be associated with girls' process of maturing, and some girls indicated having heard about the biological reasons for menstruation:

Menstruation occurs when the woman becomes mature, or [a] young woman who [is] able to get married or pregnant. (Girl, KT, Grade 9)

SFG Leader: How would you describe why menstruation occurs?

Girl 1 (Grade 11): at enough age, mature

Girl 6 (Grade 11): have ovulation, ovary, uterus

Girl 2 (Grade 10): have hormones and it breaks

Girl 6 (Grade 11): thick uterus membrane [...] [will] die to come as menstruation

(Girl SFG, BMC [n=9], Grades 10 & 11)

Girls reported learning about menstruation from a variety of sources, including mothers, teachers, friends, booklets, the internet, and television. When girls were asked how they would prefer to learn about menstruation and MHM, 45.3% (n=75) of girls preferred a booklet, often for reasons of privacy, and 40.0% (n=75) preferred learning from their mothers. Teachers were also preferred by 30.7% (n=75), and only 8.0% (n=75) of girls preferred learning from a nurse or health worker. No girls preferred learning through a drama or skit (Table 3). These findings suggest that privacy and people who girls regularly encounter influence girls' preferences. The timing and content of the knowledge gained would often impact girls' feelings of their personal MHM and FSD.

Pre-Knowledge of Menstruation and MHM

Girls reported having a wide range of knowledge about menstruation and MHM prior to the onset of menarche. When asked about what girls learned before menstruation, some girls reported having no prior knowledge of menstruation before menarche, whereas others had more timely instruction on MHM practices:

[I] heard people talking about it rarely, but I did not understand what they said.
(Girl, KT, Grade 9)

Teachers tell me that first menstruation causes stomach pain, need to clean the body frequently, and keep changing sanitary pad. (Girl, KT, Grade 9)

Many girls reported learning about menstruation and MHM at the onset of menarche. However, lack of knowledge on these topics prior to menarche was described as a contributor to FSD. When girls were asked about their first experience of menstruation, several girls reported being fearful and confused at what they were experiencing:

When I was grade 8, at home, I got up to the toilet and see the blood from vagina. I was scared with thought of disease. I asked my mother, and she said that this is menstruation. She bought me sanitary pad and show me how to use. At that time, I was so stomach pain. (Girl, BMC, Grade 12)

When I picked up mangos, I saw the blood. I told my older sister, and she had me to use [a] napkin. I wear it and feel scared because I have never experience. I didn't know menstruation [would] cause me [to feel] difficult. (Girl, KT, Grade 8)

The implications from the girls' responses was that the information received had not been timely enough to avoid FSD at the onset of menarche. For some girls, this also made the initiation of MHM practices more difficult.

Knowledge of MHM Practices

Girls reported that having knowledge of MHM practices helped alleviate FSD, as this helped girls feel more confident about caring for themselves during menstruation:

[I can manage] because I know how to keep hygiene, clean, pain release, [and] have enough supply [...] [for] changing. (Girl, BMC, Grade 11)

Most girls had knowledge of MHM practices, such as showering and cleaning the vagina with soap; using sanitary pads to prevent staining; and changing sanitary pads multiple times per day. However, a meaningful gap in knowledge for some girls was in how to properly wear sanitary pads. Girls sometimes reported that they or other girls they knew did not always know how to properly position pads or use them to keep them in place:

[At school, I] feel scared [that] we wear sanitary pad improperly, [because it will] stain the skirt. (Girl, BMC, Grade 9)

[I feel] shy sometimes. I don't wear sanitary pad properly and afraid of being stain the skirt. And sometimes I dare not to go out the class. If I want to eat I ask my friends to buy. I sit always and dare not to play, always feel bored. (Girl, BMC, Grade 8)

Lack of knowledge in this area was said to contribute to staining, which was a primary reason for FSD. Many girls reported that their mothers taught them how to use sanitary pads at the time of their first menstruation. However, given this deficiency in some girls' knowledge, it is clear that this was not always the case.

When girls were asked if they wanted to learn more about menstruation and MHM, 98.7% (n=75) said that they were interested in learning more. Among those who answered yes, 48.0% (n=75) were interested in learning about infections related to poor MHM and 44.0% (n=75) were interested in learning more about how to improve hygiene. Only 24.0% (n=75) of girls were interested in learning more about the biology of menstruation, whereas 29.3% (n=75) were interested in more information on proper disposal methods (Table 3). Based on these responses, it was apparent that girls were interested in pragmatic knowledge of how to care for their menses even more so than understanding the basic biology of their experience.

Dietary Understanding during Menstruation

Girls often referenced the importance of knowing what to eat during menstruation as a relevant area of menstrual knowledge. Many girls felt that diet had a direct impact on their menstruation. Eating sour, spicy, and fermented foods was thought to cause menstrual problems, such as irregular menstruation, odors, and stomach pain. Menstrual-friendly foods, however, were generally non-sour fruits and green vegetables:

[To manage, I] use sanitary pad by changing frequently [and] not use it again. [I] need to clean body with soap, eat clean food, drink clean water, and eat something [...] [with] nutrition, such as green vegetable: watercress and morning glory. (Girl, BMC, Grade 9)

[I] can't eat sour [food] because it [will] cause menstruation [to] come irregularly. (Girl, KT, Grade 8)

[I do] not do heavy work because it causes menstruation [to] cease. I do not eat sour [food] because [I am] afraid of [...] smell[ing] bad. (Girl, KT, Grade 10)

Given that irregular menses, odors, and increased stomach pain increased FSD for girls, having knowledge of foods that were thought to help alleviate these issues was seen as beneficial.

Other Perspectives on the Value of Knowledge Regarding Menstruation and MHM

Parents, teachers, and boys all recognized the importance of girls having knowledge of menstruation and MHM to help alleviate FSD and promote wellbeing. Parents emphasized wanting their daughter(s) to know more about hygiene, diet, and what should be done to maintain regular menses. Mothers particularly emphasized wanting their daughters to know how to wear sanitary pads properly. Fathers often shared concerns for wanting their wives and daughters to know how menstruation related to their overall health:

[I would like my daughter to have] the information related to food [she] can eat during menstruation and using sanitary pads. (Mother, BMC)

[I] would like my daughters [to] know about hygiene through people coming to teach or from different booklet because I am old, become forgetful, and don't know a lot. (Mother, BMC)

[I want my wife and daughter to have] information about cleaning [their] body, [and] what they [need to] do to get healthy. [I want them to have] information about women diagnosis because I see some villagers sick. So I want them [to] prevent [sickness] and look after their health. (Father, BMC)

Although mothers, fathers, teachers, and boys felt it should be the mother's responsibility to teach and prepare their daughters about menstruation, it was apparent from mothers' responses that they did not always feel well-informed about menstruation and MHM. Often, mothers had questions about irregular menses, how to care for stomach pain, and how to better dispose of menstrual supplies. Therefore, information about these topics may not have been comprehensively gained by girls in the home environment, even after menarche.

Gaining knowledge of menstruation and MHM was seen as the predominant support in the school environment. Girls reported learning about hygiene, the use of sanitary pads, diet, and

more about the biology of menstruation from teachers and booklets received at school. When teachers were asked about whether any curriculum existed to teach on menstruation and MHM, teachers at each school said there was a curriculum to cover those topics:

SFG Leader: Does any curriculum exist to teach on menstruation and MHM at the school?

All Teachers: Yes.

Male teacher 3: Curriculum talks about growth of the girl.

Female teacher 6: Body change

Female teacher 4: Menstrual cycle

Male teacher 3: Curriculum talks about menstrual care.

Female teacher 6: Care for body change during menstruation
(Teacher SFG, BMC [n=7; 3 Male, 4 Female], Grades 7-9)

When asked if they felt the curriculum was helpful, teachers generally agreed that they felt the material was helpful to girls. Teachers often highlighted ways that it could help alleviate FSD, if used to teach girls about MHM, as well:

SFG Leader: Have you and female students found the MHM curriculum helpful? Why or why not?

All Teachers: Curriculum is helpful for student.

Female Teacher 7: [It helps them] care about hygiene and not [be] smelly at others.

Male Teacher 1: [We] encourage students during the class to apply after learning.

Male Teacher 3: After learning, the girls won't be scared to see blood.

(Teacher SFG, BMC [n=7; 3 Male, 4 Female], Grades 7-9)

Although the school setting appeared useful for teaching girls about MHM, teachers would also acknowledge girls' FSD in relation to asking questions about menstruation and MHM. It appeared that it was more common for girls to ask questions one-on-one than in classroom settings:

[We] can teach but students dare not to ask in the class. [They] keep questions to ask later.

(Female teacher, SFG participant, BMC, Grades 7-12)

When teachers were asked whether they felt male and female teachers could teach on the topic of menstruation and MHM, teachers had mixed opinions. At five of the seven schools where teachers participated in SFGs or SIs, the majority of teachers felt that both male and female teachers could teach on menstruation and MHM. However, within the same school, teachers did not always reach consensus:

SFG Leader: Do you think male and female teachers can teach on this topic?

Female teacher 1 & 5, Male teacher 3: Both male and female teachers because they can help the students in some situation.

Male teacher 2: Both male and female teachers because it is general knowledge.

Male teacher 4: Female teachers because they are closer to female students, and the girls are not shy.

Male teacher 6: Male and female teachers because some schools don't have female teachers, so male teachers are able to teach also.

(Teacher SFG, KT [n=6, 4 male, 2 female], Grades 7-9)

Given girls' expressed preferences for female teachers and general discomfort with being around boys during menstruation, better understanding of what will help girls feel comfortable learning about menstruation and MHM in school will be valuable for improving curriculums and teacher preparation in this area.

Boys also felt that pragmatic knowledge for girls was important for their menstrual experiences and MHM, as one boy said, "[I] would like women [to] know [how] to clean, use sanitary pad, medicine for pain, not do heavy work and rest more" (BMC, Grade 11). Boys were also asked what information they felt they needed to know about menstruation in order to be considerate of girls' needs. In response, boys suggested several topics that they felt were important for boys to know regarding girls' menstrual needs, including understanding the basics of menstruation, what girls' needs are for MHM, and how boys can be supportive. One boy suggested:

Boys need to know that sanitary pad is important for her, and [that] she needs [...] [medicine] when she is pain. [Boys] need to know about hygiene and health care.
(Boy, BMC, Grade 9)

Given the girls' concerns about boys that contributed to FSD, educating boys on these topics may prove effective for creating a more socially-friendly MHM environment for girls at school.

Managerial Impacts on FSD

Given the predominant role of staining and hygiene-related factors in FSD, girls emphasized the importance of being able to comfortably practice MHM, in order to alleviate FSD across environments (Figure 6). Although specific MHM practices varied between girls, successful MHM largely depended on reliable access to supplies, acceptable latrines, clean water, private disposal options, and resources for pain and discomfort management. In the absence of these supports, girls experienced difficulties navigating MHM and FSD, as inadequate MHM contributed to stains and lower standards of hygiene care. Two girls described these challenges, saying:

My friend does not have enough water. I saw her pants was blood stain[ed] because she did not put pad. She did not have money to buy [a] pad. [She has] no toilet at her house, and she used [the] toilet of her neighbor. (Girl, BMC, Grade 8)

[At school, I] feel scared because I don't know where I [will] change and how I [will] throw sanitary pad. (Girl, BMC, Grade 11)

Although managerial challenges were described in both the home and school environments, the school environment presented the most challenges for girls practicing MHM.

Access to Absorbent Materials and Clothing

Girls commonly identified absorbent materials, such as sanitary pads, napkins, or cloths, as a primary need for successful MHM. All girls reported using disposable sanitary pads (100.0%, n=75). When girls were asked how they commonly accessed supplies for menstruation, 70.8% (n=72) of girls said they received money from home to purchase supplies, and 33.3% (n=72) received supplies from a family member. Only a handful of girls reported accessing supplies from other sources, such as a friend, making supplies at home, or receiving supplies from school. Additionally, 73.2% (n=71) of girls reported not having experienced a time when they lacked enough supplies for MHM. However, for the vast majority of girls, this was much more likely to be the case in the home environment, as 100.0% (n=75) of girls said they commonly had difficulty accessing supplies at school.

When girls were asked what they did if they came to school unprepared and began their menstruation, girls described different approaches to addressing the challenge of not having sanitary pads with them:

[I] ask [my] teacher to go home early or sit still without getting out. [I] wait until everyone [is] gone and I leave after. (Girl, KT, Grade 9)

[I] ask friends to buy sanitary pad and ask them to get skirt. If [it is an] exam day, I will not go home, but if not, I ask permission to go home. (Girl, BMC, Grade 8)

[I] have friends walk behind [me to] not let people know [there is a stain], and [I] use [a] sweater to tie [it around my] waist. [I] ask [my] friend, who lives near school, for [a] new skirt to wear home. (Girl, BMC, Grade 9)

As described, having access to new skirts and other changes of clothes was also important for MHM. Although the girls described being resourceful, the implication was that a lack of emergency supplies available at school limited girls to seeking assistance primarily from other female friends, or, occasionally, female teachers. If relational support was unavailable, girls would occasionally have the resources to purchase their own supplies. However, for the majority of girls, the remaining option was to simply return home.

Moreover, girls acknowledged that it was not only access to sanitary pads that mattered, but also the quality of sanitary pads, which had a direct impact on FSD and MHM. Girls reported using multiple brands of sanitary pads during menstruation, each having different features that made them more or less preferable (Appendix C). Girls said pads were useful to prevent

accidents and generally met their needs. However, girls indicated that poor adhesive, inappropriate sizing, inadequate thickness, and failure to prevent odors made pads unreliable. Girls also described pads having limited absorbent capacity, thus contributing to leakage. When asked specifically about what caused staining-accidents, girls indicated these poor features of pad design, as well as ill-fitting underwear, as reasons for leakage:

The pads turn over when [they] get wet. [The] pad sticker isn't used properly, [and] underwear isn't fitting well for putting pad. (Girl, BMC, Grade 9)

The pads turn over for [the] sticker isn't good. The pads are thin and short, [and there is] too much blood. Accidents happen especially when sleeping and playing.
(Girl, BMC, Grade 11)

Although the girls said better brands existed, girls agreed that difficulties accessing better quality sanitary pad were often financial.

Water, Sanitation, and Hygiene (WASH) Facilities and Amenities

Girls reported habits of wanting to shower or clean themselves two or more times per day, and 66.7% (n=72) of girls preferred to change their sanitary pads three or more times a day. These MHM practices required access to at least four key resources: (1) an acceptable WASH facility, (2) clean water, (3) cleaning supplies, including soap, tissue, or towels, and (4) non-embarrassing disposal options. Privacy was highly valued, as well.

In general, girls reported having better access to these resources at home compared to being at school:

[At home, I] have enough sanitary pad, clean water, [and a] toilet for using during menstruation. (Girl, KT, Grade 8)

[At home, I] take a shower in the morning, two times per day, and change sanitary pad properly. At home, there is privacy; [I am] not shy and have enough supply.
(Girl, BMC, Grade 12)

Despite this, similar barriers in WASH facilities and amenities existed across environments.

Girls emphasized wanting to use a clean latrine (“toilet”), especially during menstruation. During latrine observations in the schools, it was common to observe cobwebs on the walls, no soap, and mud tracked on the floors (Appendix B). In the villages, communal latrines that were observed were often in similar condition. Across environments, girls noted their dissatisfaction with using dirty latrines:

[I] bring sanitary pad from home, [and do] not change at school because [the] toilet is not clean and dare not to throw [*refers to disposal options*]. When I need to change, I go home. (Girl, BMC, Grade 10)

[*Referring to the community*] During menstruation, most people lack hygiene and use improper sanitary pad. [Another challenge is an] unclean toilet, which is difficult to use. (Girl, BMC, Grade 10)

FSD associated with dirty school latrines was not only an issue of comfort, but also a matter of girls' health. Girls' dissatisfaction with school latrines contributed to some girls wearing sanitary pads throughout the school day without changing. As one girl said, despite the presence of latrines at her school, "[I] must be careful and can't change. I need to use same sanitary pad because there is no toilet to change" (BMC, Grade 12). When girls were asked about other health concerns related to MHM, girls sometimes described feeling "itchy" on their vaginas, which would be alleviated after cleaning and changing their sanitary pad. If girls are wearing sanitary pads beyond the recommended length of time, there may be a greater possibility for itching or chaffing due to unchanged pads.

When girls were asked what they would do to improve current latrines at school, they consistently recommended having supplies available to help keep the latrines clean:

The toilet should have clean water, soap, bucket, broom and water for cleaning [the] toilet and should have towel and tissue. (Girl, BMC, Grade 10)

We must clean and take care [of the toilet] everyday, not throw the trash in the toilet. (Girl, KT, Grade 8)

Having access to clean water was of pragmatic importance for MHM, as it was clearly implicated in girls' desires to shower, clean themselves, and wash stains as regular MHM practices. Across environments, girls expressed their dissatisfaction with not having a reliable source of clean water to use during menstruation:

[At home, girls] lack medicine, [find it] difficult to clean, [and] they don't know about hygiene. [It is] hard [to] find the place for disposal, clean water is not enough, and [the] toilet is not clean. (Girl, BMC, Grade 9)

[It is] difficult when coming to school. [There is] no clean water, and [I am] afraid of being stained and shy. (Girl, BMC, Grade 11)

At home, 33.3% (n=75) of girls reported not having access to clean water even for washing hands. Lack of clean water in the home environment also impacted girls' ability to prepare themselves for attending school during menstruation. Many girls emphasized the importance of showering before school to avoid problems with odors, which contributed to FSD:

[I manage my MHM at school] by wearing sanitary pad and change it frequently. Before coming to school, [I] need to take shower [to] avoid the smell at others.
(Girl, BMC, Grade 10)

Lack of clean water also contributed to FSD because many girls associated unclean water with the risk of getting an infection. The term for “virus” commonly referred to many types of infections (e.g. bacterial, yeast infection). As one girl said, “[I] do not take [a] shower in the pond because [I am] afraid of being transmitted [a] virus from unclean water” (BMC, Grade 10).

To address the issue of needing clean water inside latrines, two girls recommended providing jars inside the latrines to store water for use, as needed, during menstruation. This simple approach would enable girls to discretely clean themselves or wash stains, provided that latrines are improved to meet higher standards of cleanliness, as well.

Practices around disposal often proved to be context dependent and influenced by FSD. At home, 28.0% (n=75) of girls said they did not have access to a private place of disposal for their used sanitary materials. However, for the majority of girls, disposal options generally involved burying, burning, or non-specifically throwing their used sanitary materials away from their homes, particularly if a trash receptacle was not an option:

[I] put [used materials] in [a] black plastic bag and burn [it] at the back of my house.
(Girl, KT, Grade 8)

[I] put [used materials] in the black plastic bag and throw away far from home.
(Girl, KT, Grade 10)

Although these options existed, girls often felt that they were insufficient methods of disposal, as they still posed problems for girls in terms of feasibility and privacy:

During [the] raining season, [it is] difficult to bury sanitary pad. (Girl, BMC, Grade 9)

[There is] no place for disposal and store [of used materials] for burning. When having guest visit, I dare not to throw [...]. (Girl, BMC, Grade 10)

The school environment presented even fewer options for disposal, with 81.3% (n=75) of girls saying they did not feel they had a satisfactory place to dispose of their used sanitary materials. All eight schools did not have trash cans directly in latrine stalls (Appendix B). To avoid having to throw away used supplies in a trash container outside of the latrine stall, girls reported keeping their used pads with them during the school day to dispose of them after school:

[I] bring sanitary pads to change 2-3 hour [...], and [I] change at the toilet. For used pads, [they are] [...] put in [a] plastic bag to throw at home. (Girl, BMC, Grade 10)

[I] bring [my] sanitary pad after use back home. (Girl, KT, Grade 9)

Although this approach saved girls from the discomfort of having to publicly dispose of their sanitary materials, girls occasionally reported ongoing concerns about odors from keeping the used materials, as well. In essence, one concern was simply replaced with another.

As described, similar barriers existed in both the home and school environment regarding WASH facilities and amenities. However, the school environment presented yet additional challenges for girls in terms of privacy. Several of the latrines observed at school had holes in the door that could allow for peaking. Likewise, some of the locks on the doors were found to be broken, which made it difficult to ensure that someone else would not be able to come in. It was observed on occasion that girls would accompany one another to the bathroom to help keep watch at the door until the girl using the latrine was finished. These dynamics were often highlighted in SFG discussions about challenges with existing school facilities:

SFG Leader: What are some challenges that female students face in managing their menstruation at school with the current toilet facilities? (*from multiple SFGs*)

[The] toilet has no lock, afraid of someone come in. (Girl 9, KT SFG [n=9], Grade 8)

[The] door [to the] toilet can be sneak[ed] to see, or it doesn't close.
(Girl 8, BMC SFG [n=8], Grade 9)

[It is] difficult to use the toilet together, and it is dirty. (Girl 10, KT SFG [n=10], Grade 8)

Based on girls' responses, it was clear that although the school environment was most resource-deficient, improvements needed to be made across environments to ensure that girls could appropriately and comfortably attend to their MHM needs.

Pain and Discomfort Management

Pain and discomfort (PD) were commonly reported by girls during menstruation, often due to stomach pain, headaches, and general discomfort. When asked how often girls experienced PD, 43.7% (n=71) of girls said "sometimes" and 14.1% (n=71) of girls said they "always" experienced PD during menstruation. Girls described managing pain by taking medicine, resting, or, if able, using warm water bags to rest on their stomachs:

I take medicine for pain and put warm water under belly. This makes me better.
(Girl, BMC, Grade 8)

I handle this issue [of PD] by taking rest. (Girl, KT, Grade 9)

Managing PD was considered convenient in the home environment, as girls had more freedom to rest and practice PD management techniques. In the school environment, girls felt less able to practice PD management. Girls often said that schools did not have medicine available for girls who were experiencing menstrual PD, and there was no indication that private areas to rest were available:

[At school, I] lack sanitary pad, clean water, hygiene, [and] room for women to change sanitary pad. And [there is] no medicine for women who have menstrual problem.
(Girl, BMC, Grade 11)

Without these resources, girls' experiences of FSD increased, affecting their overall school experience. As one girl described, "[Menstruation is] difficult and disturb[s] my study because sometime I feel stomach pain, [and I] can't do anything" (Girl, KT, Grade 10).

Other Perspectives on Managerial Supports and Challenges

Parents, teachers, and many boys agreed with girls about the kinds of managerial supports that were needed during menstruation. They also often recognized several of the challenges present at home and at school that made navigating MHM more difficult, thereby contributing to FSD. While some parents said there were no challenges to MHM in their homes, many parents said that their main challenge was not having a latrine. This finding is in keeping with the 2014 Cambodian DHS data showing that nearly 50.0% of rural households do not have latrine coverage [23]. Fathers and mothers both acknowledged that lacking a source of clean water and an available toilet presented several challenges to their daughters:

[There are challenges because] menstruation comes irregularly, and lack [of a] toilet makes [it] difficult to change sanitary pad and shower because [there is] no place to hide. (Mother, BMC)

[My wife and daughter] lack toilet and water during dry season. [They have to] take [a] shower at [a] far place, [and there is] no place to change sanitary pad.
(Father, KT)

Mothers also said that access to supplies could be a challenge in the home, contributing to FSD. Despite this, some mothers would explain that even if they lacked supplies, their daughter would have enough:

My daughters feel[s] shy. They have [a] problem with supply not enough, hygiene and health. (Mother, BMC)

[I] lack supply frequently and find napkin instead, [but my] daughter has enough.
(Mother, BMC)

Both male and female teachers often recognized the need for improved bathrooms, spaces for changing, and amenities for girls at school:

SFG Leader: What are some challenges that female students face in managing their menstruation at school with the current toilet facilities?

SFG 1:

Female teacher 3: [The] toilet is not clean, not enough water, [and lacks] soap.

Male teacher 2: Very few toilets, [so we] can't go when we want.

Male teacher 1: [We] lack [an] educator on menstrual cycle.

Male teacher 2: [There is] no medicine to release pain.

(BMC, [n=5, 2 male, 3 female], Grades 7-12)

SFG 2:

Female teacher 5: Unclean water

Female teacher 7: The toilet is narrow and dirty.

Male teacher 1: [The] toilet is broken, lacks water, and [the] door can't lock.

Female teacher 4: Lack trash bin

(BMC, [n=7, 3 male, 4 female], Grades 7-9)

When asked how to improve the situation for girls at school, teachers made several recommendations in keeping with the girls' responses, adding to them suggestions to have the boys and girls latrines separated:

[At school, we should] have enough clean water, [...] separate toilet[s] for female students, soap in the toilet, sanitary pad[s] and [a] place for disposal. (Female teacher, KT)

[We should] have some supply ready at school (soap, sanitary pad, tissue, tiger balm, ointment, pain release, trash bin inside the toilet, bathroom, black plastic bag, teacher counselors). (Male teacher, KT)

However, the main obstacle teachers discussed in seeing changes made was lack of budget to purchase new materials and supplies.

When boys were asked what improvements could be made at school or home to help girls have better menstrual experiences and MHM, some boys gave thoughtful responses, saying:

[It is important to] encourage the girls not to [be] scared[d] [or] shy. School should have toilet for girls or women, clean water, warm water, educate about menstrual hygiene, and have pain killer sometimes. Family should pay attention [to] girls [and] can prepare medicine, warm water and sanitary pad. (Boy, BMC, Grade 12)

[The school] should have female and male toilet separated, clean water, and help to educate them. School should have sanitary pad for women use. (Boy, BMC, Grade 11)

School should have medicine for female students when they have problem with headache or stomach pain during menstruation. [School] should have sanitary pad and clothes to change when they [are] stained. (Boy, BMC, Grade 12)

The school should explain about menstrual hygiene. Home should have toilet (have toilet supply), water inside the toilet, and [a] jar for cleaning during menstruation and cleaning house. (Boy, BMC, Grade 9)

Some boys admitted that they did not know what would help girls at school or at home during menstruation. Nevertheless, although boys were not routinely thought of as comforting to girls during menstruation, it appears that some boys have been thoughtful enough to recognize ways to improve girls' experiences. Given the agreement between girls' requests and the boys' observations, boys could potentially help girls by asking teachers to support similar changes that would work well for girls during menstruation.

Impact of FSD on Behavior

Although some girls said that experiencing menstruation did not impact their participation or performance in the home or school environments, several girls indicated that times of menstruation coincided with disruption in their regular activities and engagement (Table 4). Girls, parents, teachers, and boys all generally agreed that girls should not do 'heavy work'² during menstruation, as this was said to contribute to PD. Some girls went so far as to think 'heavy work' would cause irregular menses, an idea that was sometimes affirmed by mothers:

[I can manage because I] take shower[s] to clean [my] body, [and I do] not let people see the stain. [I do] not do heavy work because afraid of menstruation cease or come irregularly. [I] wash the clothes with soap properly.
(Mother still experiencing menstruation, BMC)

In the home environment, 50.0% (n=74) of girls said FSD and/or corresponding menstrual related challenges caused them to miss activities at home or in the community. Several girls described missing weddings, visits to neighbors or friends, activities working in the field, and general household activities during menstruation for various reasons:

[I] do not go [to] other's house because I am afraid that someone see [*referring to knowing it's her menstruation*], and sometimes the girls forget there is blood staining on clothes. [It] feels hard, and [there is] back pain for each menstruation. (Girl, BMC, Grade 8)

² 'Heavy work' referred to many degrees of labor, from simply carrying something heavy to working in the fields or cutting logs.

[I] missed going to [a] wedding reception because [I was] afraid of being smelled and stained. (Girl, KT, Grade 9)

[I] missed my friend[’s] launching house, some celebration, [and I do] not do housework because feeling stomach pain [and they a] lack clean toilet for washing at place of celebration. (Girl, BMC, Grade 8)

[I] should not clear the grass at the cassava plantation, transplant at the rice field, [or] go out to the neighbor’s house because it is shame[ful] if [I am] [...] seen [with] the stain when [doing] transplantation or clear the grass. (Girl, KT, Grade 8)

In each case, it was clear that FSD and/or a lack of resources were contributing to whether girls felt safe and comfortable attending otherwise favorable or routine activities. Some girls reported that their perceptions about menstrual odors prevented them from performing certain activities:

[I] should not do housework because it is smelly during menstruation. [The] smell [...] can affect the food. (Girl, KT, Grade 9)

Such logic demonstrated the perception of menstrual stains and odors as contaminating and unclean, which impacted girls’ decision-making in regards to which activities to participate in.

Due to issues associated with sanitary pads not providing adequate protection against leakage and stains, girls also described transit between locations (e.g. home to school, home to the market) being difficult and related to FSD:

[I] should not walk far, sit [for a] long [time], [or] ride motor to market because [this] can get us wet or cloth stain that people can see. (Girl, KT, Grade 8)

[During menstruation, it is] difficult to sit when bleeding too much, [...] to come to class by the bike or motor, [or] [...] to do heavy work because stomach pain.
(Girl, BMC, Grade 9)

The implication of FSD in transit is that girls may be arriving to school, in particular, already experiencing FSD even before the additional challenges of navigating the school environment begin.

In the school environment, girls expressed varying degrees of impact of FSD on their behavior. In terms of participation, 36.0% (n=75) of girls reported missing days due to menstrual related challenges, and 37.3% (n=75) of girls said their participation in class was affected. Several girls described FSD and related factors affecting their mood, concentration, and interactions with teachers and peers in various ways:

[At school, I feel] bored, afraid of being seen and shy, no mood to study. I want to go home and want to be alone. (Girl, BMC, Grade 11)

SFG Leader: Does a girl's menstruation affect her behavior in class?

Girl 1 (Grade 9): Yes, I can't focus on [the] teacher['s] explanation.

Girl 2 (Grade 9): Yes, I have no mood to listen [to the] teacher['s] explanation.

Girl 3-5 (Grade 9) & 10 (Grade 8): No *[no effect on behavior]*

Girl 6 & 9 (Grade 8): Yes, I dare not to do exercise at the whiteboard and afraid of being stained.

Girl 7 (Grade 8): Yes because afraid of being stained, smell and dare not to do exercise. (Girl SFG, KT [n=10], Grades 8&9)

Teachers and parents also observed that menstrual challenges and/or FSD sometimes had an impact on girls' ability to attend school or participate normally in class:

SFG Leader: Do you notice any changes in female students' behavior when they are experiencing their menstruation compared to when they are not?

All teachers: [They] have [a] change of behavior.

Female teacher 7: Female students don't play much like before and [do] not get closer with friends.

Female teacher 4: [They] dare not [to] express [their] opinion, activity and answer.

Female teacher 5: [Their] behavior [...] [is] more mature.

(Teacher SFG, BMC [n=7, 3 male, 4 female], Grades 7-9)

I see my daughter feel shy with teachers and male students when she experience menstruation. (Mother, BMC)

SFG Leader: How has your daughter's experience of menstruation affected her experience at school?

Mother 1: My daughter miss the school for 1-2 days.

Mother 2: My daughter miss the school for 1 day.

Mother 4 & 5: [It does] not affect because she prepares sanitary pad.

Mother 6-8: [It does] not affect because she has supply to change.

(Mother SFG, BMC [n=8])

When boys were asked if their interactions or friendships with girls were affected during her times of menstruation, many boys said they did not know because they were often unaware when their girl-friends were experiencing menstruation. However, in closer relationships, such as with siblings, one boy shared his observation of how menstruation changed their interactions with each other, saying, "Before my older sister and I play and learn together. When she experienced menstruation, I don't get closed to her. Because she is shy when I talk about menstrual issue to her" (Boy, BMC, Grade 12). Other boys who did notice changes at school

reported mostly observing girls not wanting to play as often or not feeling well, though they did not necessarily understand why.

In this context, it was interesting to hear girls describe being willing to participate and engage despite the challenges they faced with FSD and related factors. Based on girls' responses, this resiliency was sometimes linked with a girl's sense of duty, which would outweigh her own discomfort due to menstrual challenges or FSD. Some girls described that despite FSD, there were still compelling reasons to attend activities in the home or in regards to work:

The activity is important, such as planting potato, which [I] can't miss.
(Girl, BMC, Grade 8)

Even [if] I feel pain, I have to go because my grandparents are old. I go on behalf of them.
(Girl, BMC, Grade 8)

Likewise, in the school setting, girls displayed resiliency when it came to taking exams that coincided with their times of menstruation. Overall, 84.0% (n=75) of girls said that experiencing menstruation did not impact their ability to take exams. Some girls noted that this was in part due to exams not falling on days of their menstrual cycle. However, if exams did occur during times of menstruation, there was still a general consensus from girls that exams were important to academic success, and they did not want to fall behind other students:

Because I think that menstruation of women is normal. Even [if] I feel stomach pain a little during menstruation, [...] I have to come because exam is important. (Girl, KT, Grade 9)

Menstrual day is not on the exam day, [but] I do not miss because I am afraid that my score is lower than my friends. I have to come even [if] I have menstruation on that day.
(Girl, BMC, Grade 8)

If girls did choose to miss an exam due to menstrual challenges, girls would ask for supplementary exams, as needed. Teachers were generally understanding if a girl needed to return home due to menstrual challenges. However, they sometimes shared that they did not think girls did as well when making up the exam:

SFG Leader: Please describe for me what happens when girls miss exams or assignments.

Female teacher 3: There is no problem when the students ask permission.

Male teacher 2: [The] exam is not good - low score.

Female teacher 4: [A] low score causes discourage[ment].

(Teacher SFG, BMC [n=5, 2 male, 3 female], Grades 7-12)

Taken together, FSD and menstrual challenges affected several areas of girls' decision-making and behavior. While not all girls were impacted the same way, some girls revealed how

FSD and associated challenges contributed to less engagement and participation, which had an impact on parents, teachers, and boys, as well.

Discussion

This study analyzed the menstrual-related experiences of rural Cambodian girls, boys, parents, and teachers at the household and school level, identifying several factors that impacted girls' experiences of menstruation and MHM. While relational, knowledge, and managerial supports during menstruation were associated with feelings of self-efficacy, challenges in these areas contributed to feelings of FSD, which had varying impacts on girls' behaviors. Common reasons for FSD among girls in this study included fears of staining, odors, being recognized as experiencing menstruation, and being viewed as unhygienic in the event of an accident. Often, these fears were associated with concerns about teasing, which further contributed to FSD. Prior research on Cambodian schoolgirls' experiences of MHM identified girls' fear and anxiety during menstruation, often due to factors such as lack of menstrual knowledge before menarche and staining [21]. Moreover, similar findings have been shown in several other countries, including Ethiopia, Tanzania, Ghana, Kenya, Nepal, and India, indicating that FSD associated with menstruation is a widespread challenge for many adolescent girls [20, 21, 28, 29].

In a multi-country, comparative study on schoolgirls' menstrual experiences in Ethiopia, Tanzania, Ghana, and Cambodia, the social dimensions of adult and peer influence on schoolgirls' experiences of menstruation were acknowledged, and a recommendation was made that further research was necessary to understand the "social challenges" girls face in the school environment during menstruation [21]. In this study, girls expressed that relationships with their parents, teachers, and peers impacted their experiences of FSD and MHM, with some relationships helping to alleviate FSD, while others contributed to it. Mothers were key to helping girls navigate menarche, explaining certain knowledge related to menstruation and MHM practices, providing supplies, and offering encouragement. However, mothers sometimes reacted with fear or confusion at the onset of their daughter's menarche, thereby contributing to FSD. Sommer et al. also found that Cambodian girls often sought assistance and information from their mothers, as well as from sisters and other female relatives [21]. As in our study, Sommer et al. showed that although Cambodian mothers were a primary support, most mothers were not adequately preparing their daughters for menstruation prior to the onset of menarche [21]. Similar circumstances have been found in other contexts, such as among rural Indian adolescent girls, who found their mothers to be supportive, but also ineffective, when it came to decision-making about menstrual health-related challenges [30].

Girls rarely discussed their fathers' support during menstruation, but paternal support was often implied in the provision of supplies by their "parents". Mothers and fathers affirmed that role, but fathers offered additional insight into the ways they attempted to help their wives and daughters during menstruation. Fathers were clearly concerned about their wives' and daughters' overall health and often expressed not wanting to add to their daughter's FSD during menstruation. Fathers felt this could best be achieved by respecting their daughters' privacy and

enabling them to rest more when they were aware of their daughters' menstruation. Fathers often expressed having limited knowledge in the area of menstruation, thus transferring more responsibility to their wives. However, other studies have found that when fathers are educated and involved, there can be enhanced support for women in the household through increases in household budgets for sanitary materials and enhanced paternal motivation to create WASH infrastructure considerate of MHM needs [31].

In the school environment, girls had mixed attitudes towards teachers as supports during menstruation. Many girls said that they were not willing to inform their teachers about their MHM needs because of FSD and lack of trust. Girls also noted that it was difficult for teachers to help pragmatically because of the lack of emergency supplies at school. Despite this, girls often recognized teachers' willingness to give them permission to return home during menstruation as a form of support, a practice that Connolly and Sommer also identified in rural Cambodian secondary schools [20]. Since this practice can lead to absenteeism, it is important to understand what features or resources of the home environment might be transferable to the school environment to help girls remain at school during menstruation.

For some girls, both male and female teachers were viewed as supportive because of their ability to teach girls about menstruation and MHM. Many girls expressed a preference for having a female teacher instruct them on these topics due to their personal experience and understanding of menstruation. Some gender relationships tended to help alleviate FSD among girls. However, a few girls believed that male teachers were also capable of instructing on menstruation and MHM because they were perceived to be well educated. Connolly and Sommer noted that Cambodian schoolgirls had a tendency to value confidence even over gender at times, particularly when it came to teaching on menstruation and MHM at school [20, 21]. Our study adds the dimension of not only confidence, but also prior experience as being very important to rural Cambodian girls when they are seeking knowledge from others about menstruation and MHM.

Female peers were found to be the primary source of comfort for girls during menstruation at school. Female peers were said to help alleviate FSD due to shared experiences and expressing empathy for one another regarding challenges at school. Other studies have demonstrated the mutual support girls offer one another to protect each other's dignity when difficulties arise, such as sharing supplies or helping to hide stains [7]. However, it was unclear at times as to whether female students ever participated in teasing other girls, as well. Given the possibility, it is worth suggesting that both girls and boys may need to be sensitized to understanding menstruation and the impact teasing can have on girls' confidence and FSD.

Girls generally did not enjoy interacting with male students during menstruation due to FSD. Even though several girls said that boys usually did not know when a girl was experiencing her menstruation, girls consistently expressed feelings of FSD towards the possibility that a boy might discover she was having her menstruation. Staining was a constant concern among girls, and girls were particularly sensitive to being around boys given the possibility for staining

accidents or odors while at school. Since these issues could expose a girl during menstruation, girls often made it a point to avoid being very close to boys.

Boys were sometimes said to tease girls about not being hygienic in the event of an accident. This would further increase girls' FSD and contribute to girls having negative attitudes towards boys during menstruation. Studies in other contexts have also shown that when boys are not adequately sensitized to girls' needs, girls will sometimes be subject to antagonistic behaviors, such as teasing or shaming during menstruation [31]. However, in this study, many boys seemed interested in helping girls rather than showing negative attitudes towards girls during their times of menstruation. Several boys had ideas of how they could help girls have better menstrual experiences at school, such as helping them find supplies (e.g. medicine) or helping them ask for help from teachers. However, these ideas often seemed to contradict girls' desires to remain unidentified as experiencing menstruation at school, particularly among boys. Some boys described their difficulty in engaging girls about how they could help them because they did not want to contribute to girls' feelings of FSD, and some boys acknowledged their own FSD around approaching girls during menstruation. Given these dynamics, it seems advisable to first sensitize girls and boys to the idea that menstruation and MHM are topics that girls and boys can discuss together without FSD.

Knowledge-related impacts on FSD and MHM were another area of emphasis among all participant groups. Although access to knowledge was available at home and at school, girls indicated gaps in knowledge in relation to the biology of menstruation and pragmatic knowledge in terms of MHM practices. Prior findings among Cambodian schoolgirls also indicated gaps in knowledge in understanding the physiological processes associated with menstruation, including variability in timing, discomfort, and heaviness of flow [20]. Many girls expressed having had little to no knowledge about menstruation prior to the onset of menarche, thus contributing to FSD. Without prior knowledge of menstruation, some girls would even hide their experience of the onset of menarche from their parents, due to fear, confusion, and shyness. Sommer et al. likewise found that the majority of Cambodian schoolgirls had been unprepared for the onset of menarche in terms of prior guidance and instruction, leading to increased FSD at menarche [21]. This lack of pre-menarche knowledge has been identified as a particular failing of the home environment, as parents and close relatives are typically thought to be responsible for teaching girls about puberty and related topics [3]. In our study, mothers and other participant groups also felt the responsibility to teach girls about menstruation and MHM belonged to mothers or other female relatives. As such, it is important to encourage early communication between mothers and daughters when raising awareness of the importance of MHM.

Although some girls clearly recalled having information provided to them at school, other girls at the same school would sometimes report receiving no information, suggesting that the information shared may not have effectively delivered to engage all girls in need of menstrual guidance. As a preference, girls preferred to learn about menstruation and MHM from a booklet for reasons of privacy; their mothers due to relational closeness and prior experience; or predominantly female teachers, who were thought to be educated and could empathize as other

woman. These findings were in agreement with Connolly and Sommer, who found that Cambodian schoolgirls generally preferred female teachers [20]. Sommer et al. also demonstrated that using booklets to teach girls about menstruation and MHM can be highly effective in Tanzania and potentially in the Cambodian context, as well [21]. Given the number of girls expressing a preference for learning from a booklet or mother/female relative, even compared to a female teacher, our findings support educating both mothers and teachers on MHM to help facilitate communication between girls and adults and to ensure the transfer of reliable information to girls [20, 21, 32, 33].

Knowledge of specific MHM practices were a source of confidence for girls, who said learning about menstrual care helped them feel capable to manage their menses each month. A particular area of MHM knowledge that some girls lacked was understanding how to properly wear sanitary pads. Girls who did not understand proper sanitary pad use often experienced increased FSD, as this would contribute to staining. Mothers particularly wanted their daughter to understand this area, as they observed their daughters' challenges in this area. Similar challenges have been reported in other contexts, such as among Ghanaian schoolgirls in a study on providing girls with "pads-with-education" [13]. The "pads-with-education" intervention tested whether girls who were provided with sanitary pads, education on puberty, and education on how to properly use sanitary pads would have better school attendance outcomes compared to girls who only received puberty education with no additional supplies or instructions on their use [13]. The "pads-with-education" pilot among Ghanaian schoolgirls demonstrated that supplying girls with sanitary pads, education on puberty, and instructions on how to use sanitary pads resulted in a 9% increase in school attendance compared to girls who did not receive all three components [13]. The study found that school attendance also improved faster for girls who received "pads-with-education", with attendance rates improving in three months among intervention participants compared to five months among controls [13]. Such insights support comprehensive instruction for girls, including pragmatic knowledge, prior to and at the onset of menarche on how to adequately care for their menstruation.

Similar to our study's findings, Sommer et al. highlighted the importance Cambodian girls placed on certain dietary guidelines during menstruation [21]. As in previous findings, girls in this study found knowledge of what to eat during menstruation to be a valuable area of knowledge that impacted their FSD and MHM. Sommer and colleagues interpreted the girls' abstention to be a "reinforcement of the polluting nature of menstruation" rather than a consideration of how diet may have been impacting the girls' physiologic experiences associated with menstruation [21]. In this study, girls reported being taught about diet from their parents and teachers, and mothers consistently emphasized wanting their daughters to learn more about proper diet during menstruation. The recommended changes in diet included abstaining from certain sour, spicy, or fermented fruits, vegetables, and fish, and instead eating more green leafy vegetables. The abstained foods were thought to contribute to stomach pain, odors, and irregular menses, all of which contributed to FSD. According to the World Health Organization, girls of menstruating age lose iron during their menses and may be vulnerable to anemia [34]. If a girls'

diet is lacking in essential micro- and macronutrients during menstruation, it may affect her physiological experience of menstruation, thereby impacting FSD and shaping her understanding of what is appropriate to eat during menstruation. Given the importance of the topic to girls, parents, and teachers, it is important to incorporate information on appropriate nutritional intake during menstruation into educational programming.

In this study, questions of whether it was appropriate for girls and boys to learn about menstruation and MHM together were raised among teachers and students. Girls often articulated a desire to learn separately from boys in the school environment, which is consistent with studies in other contexts [33]. Parents at times expressed concern over their daughters interacting with boys at school, which may have impacted girls' attitudes as well. Teachers had mixed attitudes towards whether girls and boys should learn about menstruation separately or together, often for reasons related to girls' FSD, while recognizing the need to educate boys on a topic that inevitably affected the women in their lives. However, boys often expressed needing more information related to menstruation and MHM, in order to understand girls' experiences and better support girls.

In other contexts, a few studies have demonstrated that MHM education is very important for both adolescent girls and boys in the school environment. Play-based education, where students are introduced to new ideas and concepts through games and interactive activities, has proven effective in MHM education among girls and boys. One study that examined the effect of using a play-based approach to introduce MHM into Ghanaian school curricula showed that teacher engagement in the activities about menstrual knowledge resulted in girls being less shy to discuss menstrual needs with them at school [32]. Dorgbetor et al. found further that both girls and boys willingly participated with interest in the MHM related activities, showing the effectiveness of the play-based approach to overcome FSD [32]. Following these programming activities, girls and boys displayed greater confidence in openly discussing menstrual related experiences together without FSD [32]. Teachers who participated in the play-based study also found that after educating girls and boys together about menstruation, boys refrained from teasing girls and instead would respectfully and politely engage with girls about MHM [32]. Similar behavioral modifications among boys, after educating them about menstruation, have also been shown in Kenya, where boys subsequently made greater efforts to help clean school latrines following education [12]. These benefits even extended into the home environment, as boys also reported helping the women in their families with duties they would not have normally done at home [12]. Given these benefits, it will be important to determine acceptable, non-embarrassing methods to educate boys and girls about menstruation, potentially at the same time.

Managerial impacts on girls' menstrual experiences have been emphasized in the literature over the past decade, and it has often been found that school environments present several challenges to girls' ability to practice MHM [10]. In this study, girls, parents, teachers, and boys identified access to quality sanitary pads, access to WASH facilities and amenities, including disposal, and options for pain and discomfort management to be key to successful MHM and comfort across environments. Although girls and mothers noted greater convenience

in practicing MHM in the home environment compared to the school environment, managerial challenges and barriers were found in both settings. Access to sanitary pads was one of the strongest factors associated with self-efficacy and reduced FSD among girls, as it provided a greater sense of protection against staining. Girls expressed dissatisfaction with the lack of emergency supplies at school, and often described their challenges of being unprepared for their menstruation in school resulting in having to seek supplies from friends or teachers or in having to return home to change. Challenges of access to supplies and staining have been documented in other contexts, as well, such as in the menstrual experiences of schoolgirls' in Mali [33]. Trinies et al. found that Malian girls' limited ability to manage menstruation at school without fears of staining contributed to going home early from school and absenteeism [33]. In our study, girls also accredited staining to low quality, unreliable sanitary pads and ill-fitting underwear. Girls made recommendations regarding sanitary pads, such as improving the adhesive and making pads longer, signifying that both access to and the quality of sanitary pads are central to meeting girls' needs.

Girls in this study preferred WASH facilities, such as household and school latrines, to be clean, private, and designed with clean water storage options and trash receptacles inside the facilities. Both household and school latrines failed to meet girls' standards in these areas, and girls' dissatisfaction with latrines resulted in increased FSD and greater difficulty navigating MHM. Several studies have found WASH-related challenges for girls in the school environment, but few studies have assessed WASH-related needs and challenges in the home environment. A formative study in Timor-Leste found barriers to MHM in the home environment due to a lack of privacy, water, and disposal options [16]. Several parents and girls said a primary challenge at home was lack of a household latrine, closely followed by a lack of a reliable source of clean water. In the absence of these WASH facilities and amenities, mothers and girls had challenges maintaining hygienic practices for MHM. This proved particularly problematic for girls, who found it very important to wash and clean before school to avoid odors. Rural households often face significant barriers to improving their WASH facilities. A study from India examining sanitation needs of women during their life course found that, although household latrines were favorable compared to public options, difficulties associated with space, landownership, and the costs of construction and maintenance could limit investing in a household latrine [17]. In order to comprehensively meet the needs of girls in regards to WASH and MHM, investing in household WASH improvements will be a necessary target for WASH interventions.

At school, girls described challenges associated with dirty latrines, not having access to clean water, lack of soap, and inadequate disposal options. Connolly and Sommer found similar concerns among Cambodian schoolgirls in both urban and rural school environments [20]. Consistent with the findings of our study, Cambodian schoolgirls in the prior study identified that latrines were not cleaned regularly or private enough to encourage use by girls, and a lack of clean water and trash bins inside the latrines were challenges to discrete practice of MHM [20]. In both prior findings [20], and this study, teachers recognized several of the challenges girls faced and often made suggestions on ways to improve privacy and access to better resources for

girls at school. However, it was captured in this study that limited school budgets were a primary concern for teachers, despite a desire to make changes. Boys also had thoughtful suggestions on how to improve school resources for girls, often in agreement with girls' personal recommendations (e.g. having jars in the latrines for clean water storage). Although girls rarely considered boys as being comforting during menstruation, it was apparent from our discussions that boys were at least considering girls' needs and that there may have been more affirmation from male students than girls realized.

When girls felt unable to use the school latrines, girls sometimes used lower MHM standards for hygiene. Examples of this included girls keeping their used sanitary materials with them in plastic bags throughout the school day, which resulted in odors, despite alleviating the need to publicly dispose of them in outdoor trash receptacles. Some girls also reported not changing their sanitary pads at school, which may have contributed to the itching girls described associated with wearing pads. Other studies have found similar behaviors among girls in school environments with inadequate latrines [33, 35]. In Kenya, it was found that girls' reluctance to change in dirty school latrines led to girls wearing the same pad long past the time to change it, which would sometimes cause chafing [35]. The difficulties of inadequate latrines, coupled with other concerns of staining and odors that increase FSD, clearly point out the need for improved school latrines that girls will find acceptable during menstruation.

The third component of MHM discussed by girls and parents was pain and discomfort management (PDM), which concerned access to medicine or pain-relief supplies and areas of rest during times of menstrual discomfort. Connolly and Sommer found previously that although some girls knew that exercise could help PDM, they observed that very few rural girls used the school resources to exercise during recess [20]. Girls in this study recommended that schools have medicine available for girls experiencing menstrual pain or discomfort. Additionally, girls said that teachers would sometimes let girls rest, but there was no indication that a private place was designated for that purpose on school grounds. Cambodian schoolgirls in the prior study suggested that a private area be designated for girls to rest for PDM [20]. Taken together, if schools cannot meet girls' needs in this area, girls will continue to prefer returning home rather than staying at school, thus contributing to absenteeism.

Girls in this study indicated that experiencing menstruation would at times impact their ability to do housework, travel, participate at school, or attend school. Although 50% of girls interviewed said they missed participating in some activities at home or in the community, it is interesting to note that some of the missed activities were in part due to menstrual management techniques, such as not working hard in order to rest. Likewise, parents sometimes required that their daughters take rest during times of menstruation, as they felt this was better for girls than continuing to participate in routine household activities. Therefore, it should be recognized that not all changes in participation due to menstruation signify a negative impact on girls. In the school environment, nearly one-third of girls interviewed said that menstrual challenges impacted their attendance at school or participation in class. Teachers verified this and generally said that girls did not usually miss more than two to three days, at most. Class attendance has

been used as a proxy to detect how challenges to MHM disrupt school participation, and other studies have similarly found that barriers to MHM can contribute to school absenteeism [20, 36, 37]. It was interesting to note, however, that the vast majority of girls in our study said that they were not willing to miss exams that coincided with times of menstruation. Girls were concerned about their academic progress, both personally and compared to other students, and this spurred their resilience to take exams despite menstrual challenges. However, it was not clear as to whether the girls performed equally well on those exams during menstruation compared to when they were not experiencing menstruation. Teachers at times felt girls did perform less well on exams or assignments due to menstrual challenges. Given the impact of MHM challenges on girls' participation and engagement at school, it is critical to address girls' needs for MHM to eliminate the additional layers of FSD that compromise a girl's ability to engage and participate to her full potential.

Limitations

Through this study, many dynamic and important nuances related to rural Cambodians' experiences of menstruation and MHM were identified in both the home and school environments. However, there were certain limitations that are important to consider. The study design involved using five SI guides tailored to each of the participant groups and five SFG guides tailored to respective participant groups. The structural nature of the guides were designed so that each participant was asked the same set of questions depending on the guide being used. Structured guides were chosen to ensure that the focus of the information gathered was in keeping with our original study intent. Although a wealth of information was gained, having a more semi-structured interview approach may have allowed the interviewers to probe more deeply and perhaps gain additional insight into topics that were discussed.

By using enumerators instead of voice-recording and transcribing, the loss of the participant 'voice' was recognized as a potential limitation in the responses gathered. However, given the similarities in described experiences across participant groups, having used multiple data collection methods (SI and SFGs), and with a relatively large sample size in two separate provinces, we consider our data set to be robust and consistently reflective of our participants' described experiences.

Similar to other contexts, in which menstruation is a sensitive topic to discuss openly, social desirability bias and discomfort in discussing menstruation may have influenced what information was shared by participants. In an effort to mitigate this challenge, an all-female team was assembled to help minimize discomfort for female participants. Although a pilot test was conducted to test the experience for boys prior to the start of data collection, some boys and fathers felt challenged to discuss menstruation, as this was commonly viewed as a woman's issue. Nevertheless, interviewers were sensitive to this challenge and remained encouraging to participants. This is reflected in the wealth of information that participants were willing to share. The use of some quantitative, closed-ended questions may have also helped reduce the

discomfort of having to go into detail about a particular topic if a participant did not feel comfortable doing so.

Overarching Recommendations

Despite these potential limitations, the recommendations offered by participants regarding stain prevention, relational support, access to supplies, discomfort management, improved facilities, and knowledge of menstruation and MHM are robust and timely. The multifaceted description of menstrual experiences, both within and between the home and school environment, provided through this study should be considered by relevant stakeholders. MHM needs and challenges extend across environments. Therefore, addressing both home- and school-based needs for behavior change interventions, improved material supplies and WASH facilities, and educational outreach may work synergistically to improve girls' health and educational outcomes. Stakeholders from all sectors, including government agencies, NGOs, and industry, should prioritize identifying common underlying factors for FSD (e.g. unreliable sanitary pads) that contribute to aversion to the school environment during menstruation. By targeting these factors specifically, programs and interventions will be better positioned to result in a ripple effect for impact and change. Addressing the needs of girls, boys, parents, and teachers in rural Cambodia regarding MHM and improving the home and school environments will require an inter-disciplinary effort that supports and encourages the Cambodian Ministry of Youth, Sport, and Education, Health, the Ministry of Health, and the Ministry of Rural Development to ensure that behavioral, WASH, and educational goals related to MHM are incorporated into their upcoming plans of action.

Conclusions

The findings of this study have served to validate prior evidence on the challenges faced by rural Cambodian adolescent girls in relation to menstruation and MHM, with an expanded scope inclusive of both the home and school environments. Based on girls' descriptions of their menstrual experiences across environments, it was clear that FSD had a significant impact on girls' behavior, confidence, and decision-making. FSD was associated with relational discomfort, lack of access to key MHM facilities and resources, and gaps in knowledge that impacted the pragmatic aspects of MHM. Often underlying MHM pragmatism was the need for reliable, high-quality sanitary pads that would adequately meet girls' needs across environments and in transit. Without better quality resources, girls will continue to face ongoing challenges with FSD. Affirming and resourceful relationships, comprehensive and timely knowledge of menstruation and MHM, and access to MHM-optimized WASH facilities helped to alleviate FSD, as girls emphasized needing these aspects to overcome FSD and associated barriers. The authors hypothesize that given the appropriate supports, girls will experience less FSD, which will reduce the critical tensions girls face relationally, educationally, and contextually during

menstruation. Since FSD also contributed to lower hygienic standards for MHM, alleviating FSD may promote better menstrual decision-making, thus leading to improved menstrual, relational, educational, and health-related outcomes among adolescent girls. Supporting the dignity of adolescent girls must include efforts to eliminate FSD associated with menstruation. Reductions in FSD should be a key indicator as to the success of future interventions. Future research should continue to explore MHM in multiple environments (e.g. home, workplace) to determine underlying factors that contribute to FSD. Further evidence regarding the specific challenges that caregivers face in supporting girls during menstruation across environments will also provide valuable knowledge on how to design interventions towards having a generational impact on reducing FSD. Although MHM is often framed as a women's and girls' issue, it is important to consider the impact FSD has on family cohesion between parents and daughters, school experiences between teachers and female students, as well as in the social dynamic between boys and girls. As such, addressing the commonly unserved needs of women and girls in regards to MHM and FSD will serve to promote the confidence and comfort for everyone involved.

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Appendices

Appendix A. Thematic Area Quantitative Data Summary

In this appendix, the quantitative data from the “Relational Impacts on FSD” and “Managerial Impacts on FSD” sections are summarized in aggregate and by province.

	All	BMC Only	KT Only
Relational Impacts on FSD			
Girls felt supported at the onset of menarche (%) ¹	93.3 (n=75/75)	98.0 (n=51/51)	83.3 (n=24/24)
Girls felt mother was a trusted person to discuss personal health issues with (%) ²	30.7 (n=71/75)	91.7 (n=48/51)	91.3 (n=23/24)
Fathers felt comfortable assisting wife and daughter during menstruation (%) ³	86.7 (n=15/15)	80.0 (n=10/10)	100.0 (n=5/5)
Managerial Impacts on FSD			
Type of absorbent material used ⁴	(n=75/75)	(n=51/51)	(n=24/24)
Disposable pads (%)	100.0	100.0	100.0
How girls accessed supplies ⁵	(n=72/75)	(n=51/51)	(n=21/24)
Receive from family member (%)	33.3	33.3	33.3
Receive from friend (%)	1.4	2.0	0.0
Receive money from home to purchase (%)	70.8	66.7	81.0
Supplies provided at school (%)	2.8	0.0	9.52
Make them at home (%)	5.56	7.8	0.0
Has not experienced a time when a girl did not have enough supplies (%)	73.2 (n=71/75)	66.7 (n=51/51)	90.0 (n=20/24)
Not able to access supplies at school (%) ⁶	100.0 (n=75/75)	100.0 (n=51/51)	100.0 (n=24/24)
How many times girls changed sanitary pad or cloth per day	(n=75/75)	(n=51/51)	(n=21/24)
One time (%)	0.0	0.0	0.0
Two to three times (%)	33.3	33.3	33.3
Three or more times (%)	66.7	66.7	66.7
Household latrine conditions	(n=75/75)	(n=51/51)	(n=24/24)
Does not have access to clean water for washing hands (%)	33.3	35.3	29.2
Does not have access to a private place for disposal of sanitary materials (%)	28.0	33.3	16.7
School latrine conditions	(n=75/75)	(n=51/51)	(n=24/24)
Girls report having no access to a place to dispose of used sanitary materials (%)	81.3	78.4	87.5
How often experiencing pain or discomfort during menstruation	(n=71/75)	(n=50/51)	(n=21/24)
Always (%)	14.1	10.0	23.1
Often (%)	25.4	28.0	19.1
Sometimes (%)	43.7	44.0	42.9
Rarely (%)	8.5	8.0	9.5
Never (%)	8.5	10.0	4.8

¹Specifically asked: “Did you feel like you were supported when you experienced menstruation for the first time?”

²Specifically asked: “Is there a trusted person that you feel comfortable talking to about personal health issues? If so, who is that person?” Choices included mother, father, other female relative, friend, teacher, and community leader. Girls could choose more than one option.

³Specifically asked: “Do you feel confident/comfortable assisting your wife or daughter(s) with menstruation issues?”

⁴Specifically asked: “What do you use during menstruation?” Choices included disposable pads, reusable pads/cloth material, tissue, and other. Girls could choose more than one option.

⁵Options will sum >100.0% because girls could choose more than one option.

⁶Specifically asked: “When you are at school, are you able to access supplies (menstrual pads/napkins, cloths) to help you manage your menstrual cycle?”

Appendix B. Latrine Survey Results

At each school (n=8), the primary investigator and a research team member would observe the latrines on the campus grounds. Notes were taken qualitatively to document the condition of the latrine. Those notes have been converted into count data and are tabulated below. Numbers of latrines observed do not always represent total number of latrines on school campus. Often, latrines were locked and were not opened during our visit. *Percentages based on n=28.

School	BMC 1	BMC 2	BMC 3	BMC 4	BMC 5	KT 1	KT 2	KT 3	Summary
Total number of functional latrines observed (n)	3	3	5	4	3	3	3	4	28
No. of nonfunctional/broken latrines not observed	0	1	0	2, still observed	0	1	0	2	6
Are stalls separate for girls and boys?	Yes, nominally	Yes, nominally	Yes, nominally	Yes	No	No	-	No	No: 3/8 schools
Are latrines separate for teachers and students?	No	Yes, nominally	Yes	No	No	No	Yes, nominally	Yes	No: 4/8 schools
No. of clean latrines	1	3	5	0	0	0	0	1	35.7%*
No. of latrines with water in basin	1	3	5	4	3	3	3	4	92.9%*
Source of water for latrine	Well	Pond	Pond	Purchases	Pond	Purchases	Purchase	Piping (?)	Onsite: 5/8 schools; 3 purchase
Water is available all year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes: 8/8 schools
No. of latrines with odor	0	0	2	0	2	NN	NN	NN	14.3%*
No. of latrines with soap inside or nearby	0	2	3	2	0	0	0	0	25.0%*
No. of latrines with sufficient light	3	3	5	4	3	3, minimal	3, minimal	4	100.0%*
No. of latrines with private trash bin or location to privately dispose of trash	0	0	0	0	0	0	0	0	21.4%*
No. of latrines with door that locks from the inside	3	3	3	3	3	3	3	4	89.3%*
No. of latrine with door that allows “peaking” (e.g. holes)	0	0	0	4	3	3	3	2	53.6%*
Walkway to latrine is inundated with water in the rainy season	No	Yes	No	Yes	Not regularly	No	No	No	No: 5/8 schools

Appendix C. Information on Sanitary Pads

A subset of information was collected specifically on sanitary pad options that rural Cambodian girls commonly used. Speaking in more detail with six BMC girls, we were able to gain more information, to saturation, about what made sanitary pads either useful or unreliable, thereby contributing to stains and FSD. Brands were also explored in the local markets and stores.

Types of Brands of Pads Used:

Girls were asked what brand(s) of sanitary pads they used and why they chose those brands. Girls indicated that they often used multiple brands.

Type/brand	Percent of use	Reason	Others
mimi	100%	Available in local area, ultra-thin	Price: 0.625 USD (2500 Riels) per package/ 10 pads
77777	87.5 %	Available in local area, thick	Price: 0.375 USD (1500 Riels) per package/ 5 pads
SOFY (multiple types)	20 %	Unavailable in local area, available only in Mart or supermarket, sometimes their relatives buy from Thailand	Price: 0.60 USD/12 pads to 2.00 USD/12 pads, depending on type
Libresse (multiple types)	20 %	Unavailable in local area, available only in Mart or supermarket, sometimes their relatives buy from Thailand	Price: 0.90 USD/6 pads to 1.58 USD/32 pads

Question A: What do you like or don't like about wearing the pads? What is difficult about them? Or, what would you like to change?

Like: Prevents accidents; comfortable; have grown used to them

Dislike: Difficult to move or do actions; bad smell from used pads; some brands are too thick; pads turn over; pads contribute to itching; adhesive is not good; pads turn over while sleeping or when a girl gets wet; feel heavy after use

Would change: Make 7777 longer than it currently is; improve the adhesive on 7777 and mimi

Question B: Where do you buy the pads?

Can purchase 7777 and mimi in the local area markets. Libresse and SOFY are often in stores and supermarkets, or will receive them from relatives, who purchase them from Thailand.

Question C. Are there more expensive pads you don't usually buy? If so, what makes these ones better?

100% (n=6) said yes. Generally do not purchase them because they are not available in the local area, and sometimes the girls do not have enough money.

Tables and Figures Section

Table 1. Participant characteristics

Characteristic	All¹ (% Responded)	BMC Only¹ (% Responded)	KT Only¹ (% Responded)
Adolescent Girls (Grades 8-12)	(n=75)	(n=51)	(n=24)
Median age (yrs)	16 (100.0)	16 (100.0)	16 (100.0)
Range (yrs)	14-20 (100.0)	14-20 (100.0)	14-18 (100.0)
Average household size ²	5.1 ± 1.6 (100.0)	5.0 ± 1.7 (100.0)	5.5 ± 1.6 (100.0)
Average age of menarche (yrs)	14.2 ± 1.0 (100.0)	14.2 ± 1.0 (100.0)	14.3 ± 0.9 (100.0)
Average length of menstruation (days)	4.4 ± 1.4 (100.0)	4.6 ± 1.3 (100.0)	3.9 ± 1.4 (100.0)
Adolescent Boys (Grades 8-12)	(n=38)	(n=25)	(n=13)
Median age (yrs)	17 (100.0)	17 (100.0)	17 (100.0)
Range (yrs)	14-20 (100.0)	14-20 (100.0)	14-20 (100.0)
Average household size ²	5.2 ± 1.5 (97.4)	5.3 ± 1.5 (100.0)	5.0 ± 1.6 (92.3)
Parents (Mothers and Fathers)	(n=46)	(n=30)	(n=16)
Sex			
Male (%)	32.6 (n=15)	33.3 (n=10)	31.2 (n=5)
Female (%)	67.4 (n=31)	66.7 (n=20)	68.8 (n=11)
Median number of daughters	2 (100.0)	3 (100.0)	2 (100.0)
Range	1-5	1-5	1-5
Median number of daughters who have begun menstruating	2 (97.8)	2 (100.0)	1 (93.8)
Range	1-5	1-5	1-3
Daughters still in school (%)	26.1 (100.0)	30.0 (100.0)	18.8 (100.0)
Mothers only: Still personally experiencing menstruation (%)	55.2 (93.5)	55.0 (100.0)	55.6 (81.8)
Teachers (Male and Female)	(total n=37; SFG: n=31)	(total n=25; SFG: n=25)	(total n=12; SFG: n=6)
Sex			
Male (% total)	45.9 (n=17)	44.0 (n=11)	50.0 (n=6)
Female (% total)	54.1 (n=20)	56.0 (n=14)	50.0 (n=6)
SFGs only: No. of teachers with a daughter who's begun menstruating	1 (100.0)	1 (100.0)	0 (100.0)
SFGs only: Average number of years working as a teacher	6.3 ± 4.2 (100.0)	6.2 ± 4.5 (100.0)	6.8 ± 3.1 (100.0)

¹All numbers reported are for structured interview responses, unless otherwise noted. Teachers are the only exception due to errors in reporting demographic information for teachers who were interviewed. Full demographic data was collected for teachers in SFGs. Averages are presented with ± standard deviation.

²Household size defined as number of members in household.

Table 2. Girls' reports of self-efficacy and feelings about experiencing menstruation

Response	All¹	BMC Only¹	KT Only¹
Self-Efficacy²	(n=74)	(n=50)	(n=24)
Feels capable of managing menses each month (%)	94.6	94.0	95.8
Feelings about Menstruation³	(n=75)	(n=51)	(n=24)
Normal (%)	12.0	7.8	20.8
Grown Up (%)	8.0	7.8	8.3
Scared and/or Shy (%)	65.3	78.4	37.5
Burdened, Uncomfortable, Bored (%)	17.3	9.8	37.5
Happy and/or Excited (%)	4.0	2.0	4.2

¹All numbers reported are for structured interview responses (n=75 total).

²Specifically asked: "Do you believe that you have the ability to manage your menstruation each month?" Response rate: 98.7%.

³Specifically asked: "How do you feel about experiencing menstruation and why?" The question was purposefully open to capture general feelings about experiencing menstruation, regardless of the timing or environment. Response % may add to > 100.0% because girls could give multiple responses. Response rate: 100.0%.

Table 3. Girls' preferred approach to learning about menstruation and MHM

	All¹	BMC Only¹	KT Only¹
Prefers to Learn From^{2,3}	(n=75)	(n=51)	(n=24)
Booklet (%)	45.3	54.9	25.0
Teacher (%)	30.7	23.5	45.8
Mother or female relative (%)	40.0	33.3	54.2
Nurse or health worker (%)	8.0	6.0	13.0
Want to Learn More?⁴	(n=75)	(n=51)	(n=24)
Yes (%)	98.7	98.0	100.0
Would Like to Learn More About⁵	(n=75)	(n=51)	(n=24)
Basic biology of menstruation (%)	24.0	21.6	29.2
How to improve hygiene (%)	44.0	35.3	62.5
Proper disposal methods (%)	29.3	27.5	33.3
Infections related to poor MHM (%)	48.0	54.9	33.3
How to teach others about MHM (%)	21.3	17.7	29.2

¹All numbers reported are for structured interview responses (n=75 total).

²Specifically asked: "How do you prefer to learn about menstruation and MHM, and why?" Response rate: 100.0%.

³An additional option for "drama" was asked, but no girl chosen drama as a preferred learning method.

⁴Specifically asked: "Would you like to learn more information about MHM?" Response % may add to > 100.0% because girls could give multiple responses. Response rate: 100.0%.

⁵Specifically asked: "If yes, what type of information?" The options were as listed in the table, plus an additional option for other. Response % may add to > 100.0% because girls could give multiple responses. Response rate: 100.0%.

Table 4. Impacts of FSD on girls’ participation and engagement across environments

Response	All¹	BMC Only¹	KT Only¹
Impacts in the Home Environment	(n=74)	(n=51)	(n=23)
Missed activities in the home or community due to menstruation ² (%)	50.0	52.9	43.5
Impacts in the School Environment	(n=75)	(n=51)	(n=24)
Missed days of school due to menstruation ³ (%)	36.0	41.2	25.0
Participation in class or activities in school was affected due to menstruation ⁴ (%)	37.3	45.1	20.8
Missed exams or assignments due to menstruation ⁵ (%)	16.0	21.6	4.17

¹All numbers reported are for structured interview responses (n=75 total).

²Specifically asked: “Do you miss any activities in your community or home because of menstruation?” Response rate: 98.7%.

³Specifically asked: “Do you miss any days of school because of menstruation each month?” Response rate: 100.0%.

⁴Specifically asked: “How does experiencing your menstrual cycle at school affect your participation in class or in other activities at school?” Quantitative response inferred as “yes” or “no” based on girls’ response. “Yes” = any description of a class or school activity being disrupted. Response rate: 100.0%.

⁵Specifically asked: “Do you miss exams or assignments because of menstruation each month?” Response rate: 100.0%.

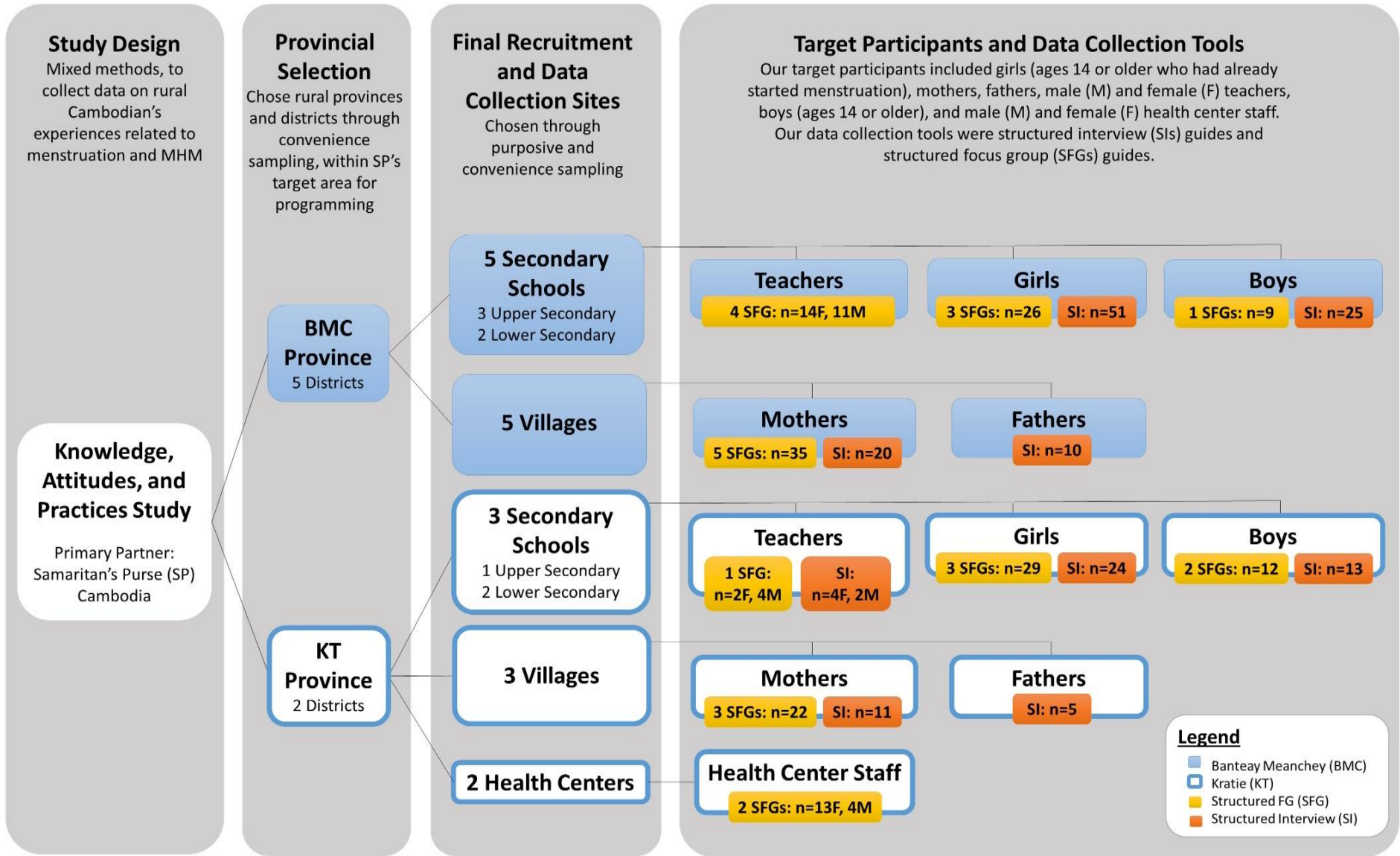


Figure 1. Study Design Overview

Schematic diagram describing the study design process and final selection of study locations, participants, and participant numbers. Total number of participants: n = 346.

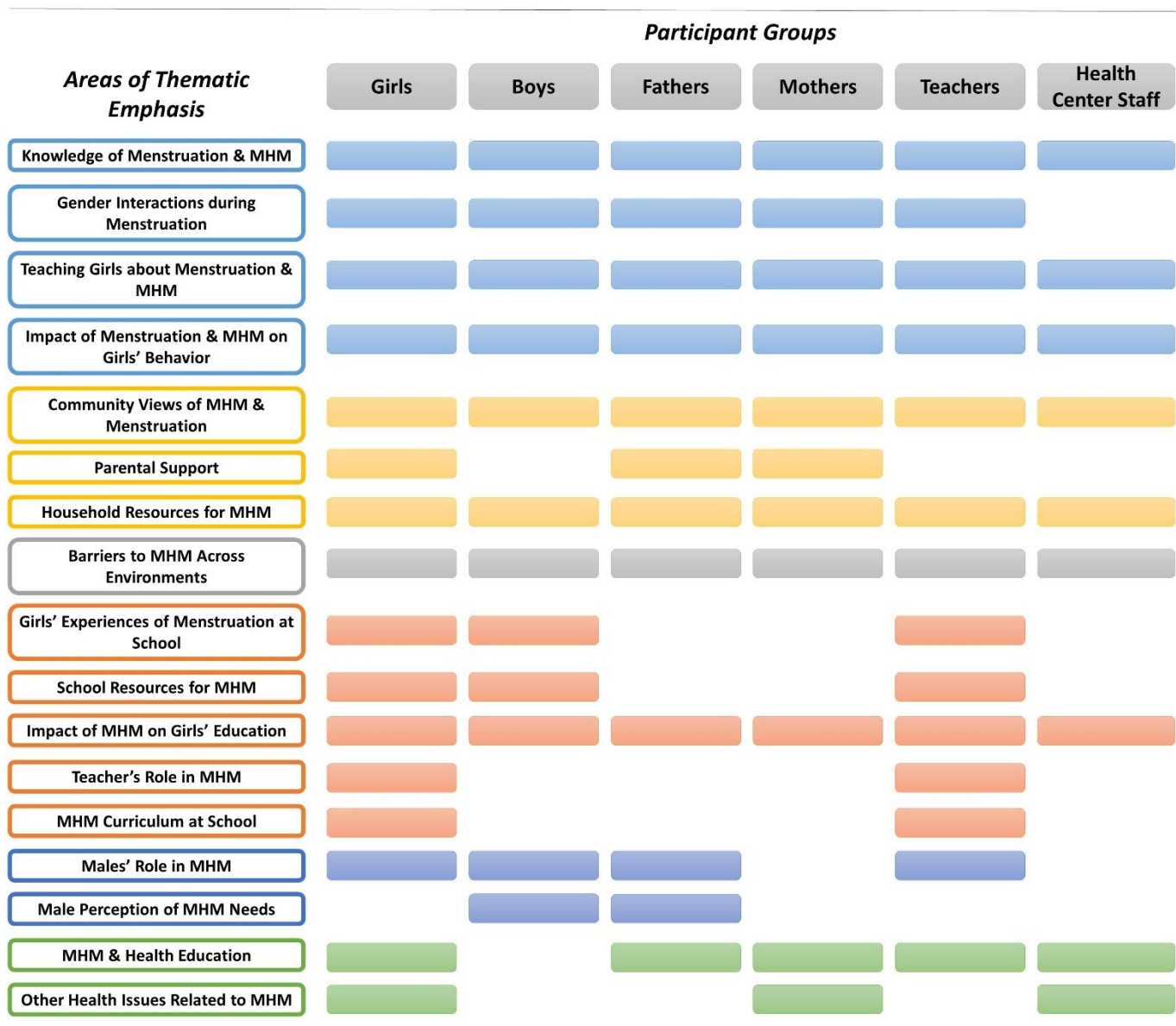


Figure 2. Questionnaire Design: Thematic Focus based on Participant Group

Structured interview and structured focus group guides were developed to capture themes of menstrual related experiences (MRE) and MHM. Questions were tailored to each participant group. Visual display of areas of thematic focus per participant group. Blank spaces indicate that the thematic area was not emphasized in that participant group questionnaire design. Light blue – general knowledge, attitudes, and practices; yellow – community specific; grey – barriers to MHM ; red – school specific; dark blue – male perspectives ; green – health related.

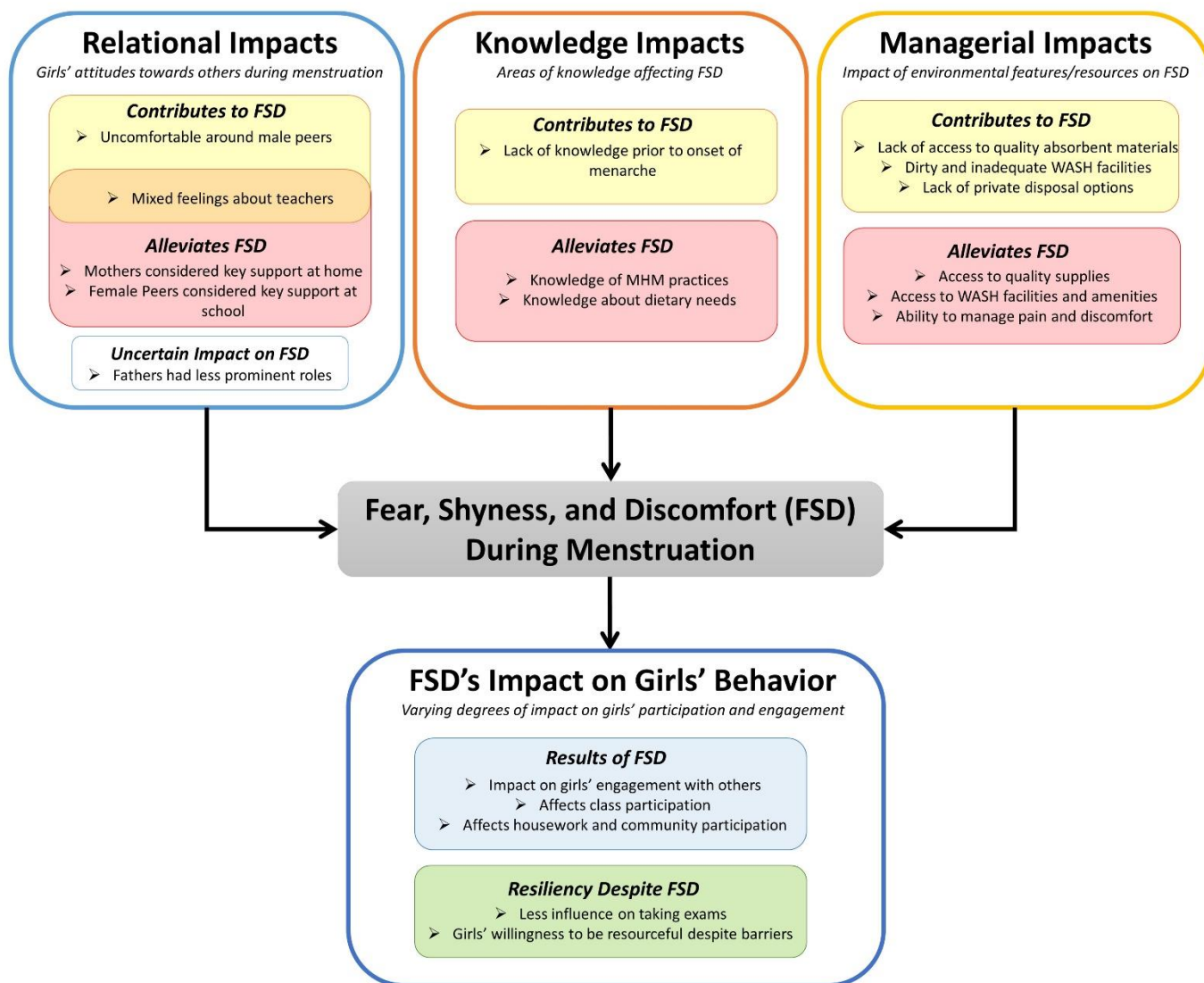


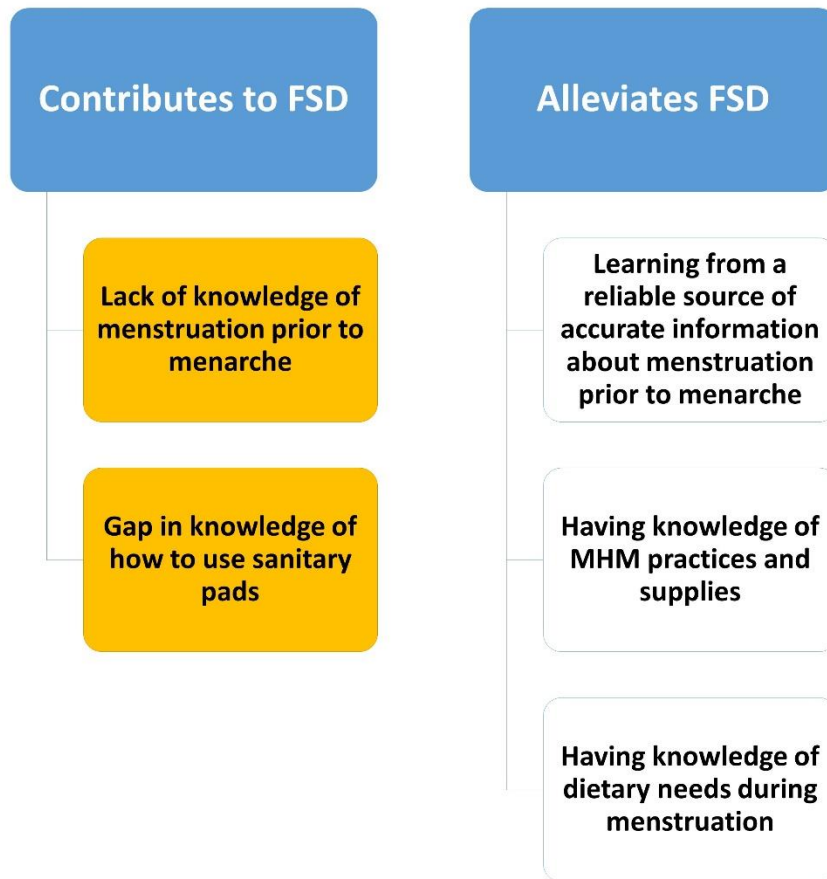
Figure3. Framework for Emerging Themes Related to Fear, Shyness, and Discomfort (FSD) during Menstruation

Three main thematic areas emerged from the girls' responses describing factors that influenced the experience of FSD: relational impacts on FSD, concerning girls' attitudes towards other people during menstruation; knowledge-related impacts on FSD, indicating areas of knowledge that influenced MHM and FSD; managerial impacts on FSD, dealing with the environmental features and resources that were pragmatic for girls' MHM; and the impact of FSD on girls' behavior.

	Mothers	Fathers	Teachers	Female Peers	Male Peers (Boys)
Quantitative Highlights ¹	<ul style="list-style-type: none"> • 91.5% (n=71) of girls said they felt comfortable talking with their mothers about personal health issues 	<ul style="list-style-type: none"> • 86.7% (n=15) of fathers said they felt comfortable assisting their wives or daughters during menstruation 			
Qualitative Highlights from Girls' Perspective	<p><i>Girls said:</i></p> <ul style="list-style-type: none"> • Mothers were a key support for access to knowledge and resources – alleviated FSD • Preferred maternal closeness and prior experience with MHM • Some hid first menstruation from mothers because of FSD • A few experienced maternal confusion at onset of menarche; had difficulty asking mother for supplies post-menarche – contributes to FSD 	<p><i>Girls said:</i></p> <ul style="list-style-type: none"> • Implied paternal support in helping provide money for supplies – alleviated FSD • Some expressed still having positive relationship with father during menstruation • Some noticed changes in fathers' behavior (e.g. less playful) post-menarche – uncertain effect on FSD 	<p><i>Girls said:</i></p> <ul style="list-style-type: none"> • Both male and female teachers could help, but more often preferred female teachers • Teachers could be supportive by helping provide supplies, allowing rest, and giving permission to go home – alleviated FSD • Teachers were sometimes unsupportive because they were too busy or did not have supplies • Several said they would not tell teachers about menstrual needs due to FSD 	<p><i>Girls said:</i></p> <ul style="list-style-type: none"> • Female peers key support in the school environment • Female peers seen as trustworthy and confidants • Girls helped each other find supplies, hide accidents, accompany each other home, and share knowledge about menstruation and MHM • Some girls said female peers couldn't help sometimes due to limited supply or personal lack of knowledge 	<p><i>Girls said:</i></p> <ul style="list-style-type: none"> • Generally felt uncomfortable around boys during menstruation • Were afraid of boys knowing they were experiencing menstruation • FSD around boys predominantly associated with fear of stains; concerns about teasing, as well • Some felt boys were not bothersome to girls during menstruation; agreed many boys were unaware
Qualitative Highlights from Other Perspective	<p><i>Mothers said:</i></p> <ul style="list-style-type: none"> • Felt confident and comfortable assisting their daughters with menstruation issues • Affirmed role in access to supplies/knowledge and daughters' decision-making about rest and diet • Confirmed paternal role in access to supplies 	<p><i>Fathers said:</i></p> <ul style="list-style-type: none"> • Made efforts to support wife and daughter during menstruation by helping with housework and activities • Some said daughter's attitudes towards them changed during menstruation • Wanted to alleviate daughter's FSD 	<p><i>Teachers said:</i></p> <ul style="list-style-type: none"> • Recognized girls' FSD associated with approaching teachers for help • Discussed their role in girls' menstrual needs as primarily instructive • Expressed providing limited support to girls 		<p><i>Boys said:</i></p> <ul style="list-style-type: none"> • Also experienced FSD about approaching girls during menstruation • Many had ideas about how to help girls during menstruation, such as providing supplies or helping with schoolwork or chores • Some felt they should not help or did not know how to help

Figure 4. Relational Impacts on FSD: Thematic Highlights

Highlighting main findings related to relational impacts on FSD. ¹Quantitative highlights summarized by province in Appendix A.



**Figure 5. Knowledge-related Impacts on FSD:
Thematic Highlights**

Highlighting main findings related to knowledge-related impacts on FSD.

	Access to Absorbent Materials and Clothes	Acceptable Latrines	Clean Water	Private Disposal Options	Pain and Discomfort Management
Described Needs	<ul style="list-style-type: none"> • Access to quality sanitary pads • Access to extra clothing (e.g. skirts and underwear) 	<ul style="list-style-type: none"> • Facilities that enable girls to shower, clean, and wash stains • Access to clean and secure latrines 	<ul style="list-style-type: none"> • Access to a reliable source of clean water • Clean water stored inside the latrine 	<ul style="list-style-type: none"> • Private and discrete disposal options across environments 	<ul style="list-style-type: none"> • Options are needed to help manage pain and discomfort across environments, particularly in schools
Quantitative Highlights ¹	<ul style="list-style-type: none"> • 100.0% (N=75) of girls use disposable pads • 70.8% (n=72) of girls receive money from home to purchase supplies • 100.0% (n=75) of girls have difficulty accessing supplies at school 	<ul style="list-style-type: none"> • 66.7% (n=72) of girls preferred to change their sanitary pads 3+ times/day 	<ul style="list-style-type: none"> • 33.3% (n=75) of girls lack clean water in their homes 	<ul style="list-style-type: none"> • 28.0% (n=75) of girls said they did not have access to a private place of disposal at home • 81.3% (n=75) of girls felt they did not have access to a private place of disposal at school 	<ul style="list-style-type: none"> • 43.7% (n=71) of girls said they experienced pain or discomfort “sometimes” • 14.1% (n=71) of girls said they experienced pain or discomfort “always”, for each menses
Current Challenges	<ul style="list-style-type: none"> • No emergency supplies at school • Poor quality sanitary pads cause leakage and staining • Schools and households lack budget for more supplies 	<ul style="list-style-type: none"> • Several households lack latrines • Across environments, latrines are dirty, no soap • Doors and/or locks to latrines were sometimes broken 	<ul style="list-style-type: none"> • Across environments, there is a lack of clean water • At school, there is no source of clean water in the latrines for handwashing or cleaning for MHM 	<ul style="list-style-type: none"> • Across environments, there are limited disposal options • Burying or burning sanitary materials is susceptible to the weather • At school, there are no trash cans inside the latrine for private disposal 	<ul style="list-style-type: none"> • In schools, there are no resources to help girls with pain management (e.g. no medicine available) • Hard to find private places to rest at school
Participant Recommendations	<ul style="list-style-type: none"> • School and home should prioritize helping girls access quality supplies • Have emergency supplies at school, including clothing • Improve pad design, especially the adhesive 	<ul style="list-style-type: none"> • Have soap and cleaning supplies in the latrine • Better secure existing latrines - fix holes in doors, secure locking mechanism • Across environments, increase number of latrines available 	<ul style="list-style-type: none"> • Across environments, improve access to clean water • Keep jars in latrines and regularly refill with clean water for cleaning purposes 	<ul style="list-style-type: none"> • Put trash cans inside latrines that are still discrete 	<ul style="list-style-type: none"> • Improve access to medicines that can help relieve stomach pain and/or headaches • Have a designated private place for girls to go rest when experiencing menstrual pain and discomfort

Figure 6. Managerial Impacts on FSD: Thematic Highlights

Highlighting main findings related to managerial impacts on FSD. ¹Quantitative highlights summarized by province in Appendix A.