


Research Paper

Engaging boys in menstrual hygiene management (MHM) interventions in Bangladeshi schools: a pilot study to assess acceptability and feasibility

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ABSTRACT

Educating boys about puberty and menstruation has been hypothesized to aid in reducing menstrual stigma and negative attitudes about menstruation. We developed and piloted a school-based intervention for girls and boys to increase knowledge about puberty and foster a more supportive environment for menstruating schoolgirls. In this sub-study, we conducted 24 formative in-depth interviews and four group vignette exercises for schoolboys to develop the intervention package. We then carried out pre- and postintervention surveys and conducted four follow-up focus group discussions to determine the feasibility, acceptability, and effects of the intervention package among schoolboys and to develop recommendations for scale up. During the formative phase, boys reported minimal knowledge concerning puberty but felt puberty education was vital for all. Following the intervention, boys' awareness of menstruation increased compared to baseline [PD: 15%; 95% confidence interval (CI): 2, 29]. The reported comfort level of discussing puberty-related issues in a school club or with friends also increased [PD: 13%; 95% CI: 2, 24]. In focus groups, boys reported finding the sessions helpful and informative. Engagement of schoolboys, combined with well-delivered intervention materials and social and behavior change communication interventions is feasible and can contribute to a more supportive and girl-friendly environment in schools.

Key words: adolescent boys, Bangladesh, in-depth interview, menstrual hygiene management, puberty curriculum, social and behavior change communication

HIGHLIGHTS

- Establishing a common pool of accurate information about puberty and menstruation creates room for open discussion and destigmatization of menstruation.
- Engagement of schoolboys, combined with well-delivered intervention materials and social and behavior change communication interventions can contribute to more supportive and girl-friendly environments in schools. This in turn may contribute to lower school dropout rates.

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GRAPHICAL ABSTRACT



From: **Engaging boys in menstrual hygiene management interventions in Bangladeshi schools: A pilot study to assess acceptability and feasibility**



Fig: Puberty intervention: Know yourself and grow. We can overcome stigma and help our peers. Mocking or embarrassing others is not an acceptable behavior

INTRODUCTION

Social and physical constraints on optimal menstrual hygiene management (MHM) are major contributors to gender inequity in education and subsequent long-term outcomes among adolescent girls (Rossouw & Ross 2021).

Many schoolgirls in South Asia lack access to a clean and private space, water, and sanitation facilities to wash or change menstrual absorbents which cause girls to either miss school time in order to go home to change absorbents or miss entire days of school, putting them at risk of falling behind academically or dropping out before they attain primary or secondary level education (Seymour 2008; House *et al.* 2013; Alam *et al.* 2017; Sivakami *et al.* 2019). Studies in South Asia, including Bangladesh, and in Africa have documented that leaking from menstrual absorbents and fear of being teased by male classmates make girls uncomfortable, leading to 30% or more of girls missing school during menstruation (WaterAid -Kathmandu 2009; Mahon & Fernandes 2010; Dambhare *et al.* 2012; Chinyama *et al.* 2019; Bangladesh Bureau of Statistics 2020). Girls in Delhi, India reported that they kept their menstrual status secret to avoid rumors about them and their sexuality (Rastogi *et al.* 2019). Group discussions conducted in co-educational schools in Taiwan and Mexico found that concern about poor acceptance of menstruation educational material by boys can result in the provision of MHM education to female students only (Luisa Marván & Bejarano 2005; Chang *et al.* 2012). In lower-middle-income countries (LMICs), women and girls face many difficulties at the onset of puberty due to inaccurate and incomplete knowledge about personal hygiene management and cultural and religious proscriptions (Thakur *et al.* 2014). In some cultures, girls are forbidden to talk about this issue and seek help from male family members to gain access to sanitary products (Kaur *et al.* 2018). Negative attitudes and teasing about periods by male classmates may contribute to mental health problems among girls and impair their participation in activities including school attendance (Hennegan *et al.* 2019).

Teachers often lack the confidence to engage in puberty-related topics in the classrooms (Mahfuz *et al.* 2021). In 2017–2018, the Ministry of Health and Family Welfare in Bangladesh reported that across many settings, boys were discouraged from discussing menstruation, impeding receipt of accurate information (NIPORT *et al.* 2020). Despite multiple social and behavioral change communication initiatives taken by the Government of Bangladesh for both male and female members in the community and schools, social norms and perceptions of menstruation continue to prevent the dissemination of

accurate information (Mahon *et al.* 2015). Furthermore, ensuring the necessary requirements to achieve menstrual health is a fundamental human rights issue that has yet to be prioritized and requires an evidence-based approach (Hennegan 2017; Babbar *et al.* 2022).

If implemented effectively, involving and sensitizing men and boys about MHM can lead to a more supportive environment for female students (Benshaul-Tolonen *et al.* 2020). Schools are an excellent setting for engagement and health promotion with young people where reproductive education can contribute to changes in boys' attitudes and reduce the social anxiety experienced by girls regarding menstruation (Chang *et al.* 2012). Male students and family members can play a role and become advocates for MHM (Mason *et al.* 2017).

icddr,b conducted a study (henceforth referred to as the 'parent study') aimed to develop and pilot a package of interventions with schoolgirls and boys that sought to create a more supportive environment for MHM in schools (Alam *et al.* 2022).

In this paper, we report the results of research on puberty education intervention for boys in schools in Bangladesh with the following objectives: (1) Develop intervention content for delivery to schoolboys to increase accurate information about puberty and menstruation, decrease teasing and marginalization, and promote a supportive environment, for schoolgirls during menstruation. (2) Assess the feasibility and quality of implementation of the intervention package. (3) Measure the effect of the intervention package on knowledge, attitudes, and perceptions regarding menstruation among schoolboys. (4) Assess the acceptability and potential for sustainability of the intervention package.

METHODS

Study design and participants

The parent study was conducted from September 2016 to June 2018 (Alam *et al.* 2022).

This parent study, including the activities aimed at boys discussed in this paper, was conducted in three phases: formative, intervention pilot, and a follow-up qualitative assessment after the piloting (Supplementary material, Table S1). For this study, we selected four schools from urban Dhaka, and four from rural Manikganj. The schools that were located in Dhaka city were considered to be urban schools and those in Manikganj were considered to be rural schools. We selected two urban and two rural schools for the formative phase and the other two urban and two rural schools for the pilot and qualitative assessment phases. We employed a quota sampling method to select 47 boys (24 for in-depth interviews and 23 for the Vignettes exercise) for participation in the formative phase. We applied random sampling to select 201 boys during the piloting phase. In the sampling frame, we included students from grades 5 to 10, aged between 11 and 19 years (as the average age of menarche is between 10 and 14 years in Bangladesh). The intervention was implemented over a 6-month period (October 2017–March 2018). For the follow-up qualitative assessment, we purposively selected 32 boys from grades 6 to 10 to participate in four focus group discussions (FGDs) after the intervention endline survey. A companion paper presents the outcomes for schoolgirls in this integrated intervention (Alam *et al.* 2022).

Phase 1: Exploratory formative research to inform intervention content

We conducted exploratory formative research in September–December 2016 to explore boys' knowledge, perceptions, and attitudes regarding puberty and menstruation to inform the development of intervention content. We selected 24 boys (six from each school) from grades 6 to 10 (at least one from each grade) based on class teachers' recommendations regarding their performance and engagement in the classroom for participation in in-depth interviews. Researchers conducted in-depth interviews (IDIs) with each male student separately to identify factors to address through intervention.

Vignette exercises

We then purposively selected 23 boys from grades 7 to 10 to conduct four vignette exercises (Mayor & Frydman 2021) because from in-depth interviews we found that male students in grade 6 did not have enough experience of adolescence and hence were not appropriate respondents for the vignette exercises. We aimed to explore stigma, knowledge, and perceptions related to menstruation and MHM-friendly environments and available facilities in the school. Vignettes presented different stories that described real scenarios regarding puberty and menstruation to the participating students and asked them to express their views and reactions to the stories.

Intervention design and development workshop

We conducted a day-long workshop at the icddr, Dhaka office with stakeholders relevant to intervention development that included participants from the Ministry of Health and Family Welfare, Ministry of Education, Department of Public Health Engineering (lead government agency for water, sanitation, and hygiene), non-governmental organizations, and Johns Hopkins University. We shared our findings from the formative phase and sought recommendations for improving MHM in schools during the workshop (Alam *et al.* 2022).

Phase 2: Piloting the intervention

Intervention design and rollout

The investigators introduced the study interventions to the teachers, school management committee, and parent-teacher association members at each participating school and addressed their questions before implementation began. Students in grades 5–10 of the participating schools were included in the intervention, totaling approximately 1,400 male students.

1. *Puberty education*: The head-teachers nominated one male and one female teacher from each school to implement a curriculum of puberty education comprising four modules: (1) growing up, (2) reproductive systems, (3) menstruation, and (4) nutrition. The curriculum included pictorial flipcharts for sharing information and allotted time for discussion, question and answer, and participatory activities. Students were also provided government-approved puberty booklets. For boys, the booklets were called *Showpner jadukor* (Wizard of Nightmare) and consisted of their first experiences of nocturnal emission; for girls, *Circus-er Meye* (Circus girl) presented girls' puberty and menstruation; and for both, *Nijeke Jano* (Know yourself) contained puberty experiences of both girls and boys (BCCP 2018).

2. *Gender Committee*: The investigators worked with teachers and students to form a gender committee at each pilot school, consisting of a boy and a girl representative from every grade and selected teachers, including head teachers, janitors, school management committee members, and an *Upazila Nirbahi* officer (an administrative official responsible for schools in the sub-district) and education officer. Once a month, the club members gathered to discuss puberty and the management of menstrual hygiene.

Teachers' training

The study investigators conducted five days of training sessions with a total of 18 teachers, including head-teachers from pilot schools to deliver the puberty education sessions and serve as a focal person with puberty, adolescent health, and MHM knowledge. Each school had at least one male and one female teacher, but some had more. There was an initial 3-day training on how to deliver the puberty education curriculum and a 2-day refresher training at the mid-point of the pilot phase. We provided teachers' manuals, pictorial flip charts and multimedia, and all materials needed for the participatory classroom activities. After initial training, the investigators also conducted a day-long orientation at each school for all the teachers and students to introduce them to the intervention plan.

Surveys

The study staff conducted pre (1–15 August 2017) and post (10–25 April 2018) surveys to evaluate the pilot intervention. We used a tablet-based structured questionnaire for data collection. We interviewed them during lunch time (break time) or after the end of the school day. We randomly selected 100 male students from class rosters in grades 5–10 (25 in each school) for the baseline survey. After six months of intervention, we conducted an endline survey among randomly selected 101 students (not from the same cohort) and followed the same procedure as the baseline.

Phase 3: Qualitative assessment

After the endline survey, four FGDs conducted with 32 schoolboys explored the acceptability, feasibility, and potential for sustainability of the intervention package. Each FGD comprised the following components: (1) introductory session (introduction of researchers and objective of the discussion), (2) perceptions regarding the education sessions, (3) perceptions about the gender committee, (4) boys' perceptions about the MHM-specific components of the intervention for girls, and (5) recommendations for further modification/improvement.

Outcome measures

We assessed the intervention package's acceptability and feasibility by reporting intervention uptake measures. This includes (1) boys' knowledge and perceptions regarding puberty in males, (2) perceptions, barriers, and recommendations for the sustainability of puberty education sessions, and (3) boys' perceptions and attitudes towards menstruation.

Data management and analysis

Six experienced researchers with academic backgrounds either in anthropology or public health conducted the data collection in Bengali, the native language of the school communities. Researchers conducted all the interviews and participatory exercises in classrooms during school hours and lunch breaks.

Formative data

We followed an inductive process to analyze the qualitative data. First, researchers recorded in-depth interviews, and vignette exercises using digital audio recorders and then transcribed them verbatim into Bengali, and then coded in Atlas.ti (version 5.2). We conducted open coding on the text and then identified emergent themes. Then, we summarized the coded data in English.

Pilot data

For the baseline and endline surveys, we captured data electronically with tablets, and performed descriptive statistics using STATA software. Comparing baseline and endline measures we estimated the intervention effect on binary outcomes using prevalence differences and 95% confidence intervals (CIs) estimated using logistic regression (smaller sample size). Effects on continuous outcomes were similarly assessed with linear regression to estimate the adjusted mean difference and 95% CIs. We adjusted for clustering (schools) effect using a sandwich estimator. Finally, we calculated χ^2 test for linear trend for data captured using Likert-type scales (for respondents' opinion) to measure the ordinal association between baseline and endline responses and the bootstrap method to estimate the odds ratio.

Qualitative assessment

We audio-recorded focus group discussions and later transcribed them verbatim into Bengali. We coded the data in Atlas.ti using a list of a priori codes developed according to the focus group topic guide. We then charted the data against each code and summarized the findings for reporting.

Ethical approval

All participants were approached for written informed consent, and students assented to participate as per the ethics regulations of icddr,b. The students' assent was provided by the schoolteachers and headmasters. Within Bangladesh school teachers are considered as students guardians, and therefore, teachers consented for data collection held at school premises and during school hours. Students provided assent before participating and could freely refuse to participate. We asked the teachers, school management committee and parent-teacher associations to conduct a parent gathering to inform about the study activities, where the investigators presented the study objectives and activities among the parents. Before obtaining signatures, field researchers also obtained participants' oral consent to record the conversations and provided copies of the forms.

The study protocol including consent and process was reviewed and approved by the Ethical Review Committee (PR-15115) of icddr,b.

RESULTS

Sixty-four percent of participants in the exploratory formative research phase were in grades 8–10, while this figure was 52% for the pilot (Table 1). The mean age of participants in in-depth interviews was 15.9 (SD 1.3) and 15.4 (SD 1.2) years for vignette exercises. A total of 201 male students took part in the baseline and endline surveys, a different random sample at each time point; their mean age was 13.5 years (SD 2.0). The mean age of FGD participants was 12.9 (SD 1.8) years.

Table 1 | Demographic characteristics of adolescent schoolboys, from four urban and rural schools in Bangladesh, 2018

Indicators	Formative N (%)	Piloting N (%)	Assessment N (%)
Description of respondents	N= 47	N= 201	N= (27)
Students	24 (43)	201(100)	27 (100)
Vignette students who participated in 4 group vignette exercises)	23 (41)	–	–
Age of respondent (mean, SD)			
Students	15.9 (1.3)	13.5 (2.0)	12.9 (1.8)
Vignette	15.4 (1.2)	–	–
Respondents from			
Grades 5–7	11 (20)	97 (48)	
Grades 8–10	36 (64)	104 (52)	
Education of the respondent's mother	N= 47	N= 201	N= 27
No education	11 (20)	20 (10)	1 (4)
Grades 1–5	12 (21)	36 (18)	7 (26)
Grades 6–10	17 (30)	71 (35)	8 (30)
Above grade 10	6 (11)	24 (12)	4 (15)
Don't know	0	50 (25)	7 (26)
Main occupation of the father of the respondent (students and vignette)			
Salaried job/Teacher/	13 (28)	65 (32)	9 (33)
Business/shopkeeper/ambulant vendor	18 (39)	49 (29)	10 (37)
Farmer/Cultivator	3 (6)	23 (11)	3 (11)
Mason/carpenter/Driver/Electrician/Plumber/Tailor/Garments worker	1 (43)	21 (10)	1 (4)
Staying abroad	6 (13)	11 (6)	2 (7)
Van/Rickshaw puller/battery driven auto/Cobbler/maker/fisherman	3 (6)	15 (8)	1 (4)
Died/Untraced	1 (43)	5 (43)	1 (4)
Unemployed/Disabled	2 (4)	2 (44)	0
Respondents have older brothers/sister	30 (64)	119 (59)	–

Phase 1: Exploratory formative research to inform intervention content

The boys reported that they were not informed about puberty or menstruation before they reached puberty.

Most of the boys mentioned they were surprised and frightened when they first experienced ejaculations and thought it was a disease. Half of the boys stated that they experienced mental stress as they were curious about the opposite sex. A boy aged 16 years in grade 8 in an urban school said:

One of my friends shared his experience about the wet dream, though I did not understand or believe him! While I experienced mine, I was scared and frustrated.

Most of the boys mentioned that their family members, relatives, and neighbors were reluctant to discuss puberty and menstruation-related issues and reported that it is related to the secret organs of the human body so the social norm is to keep it private. Both the boys and girls are considered too young to discuss such topics, such discussion would increase their curiosity about the opposite sex, and menstruation is a matter of shame.

Most students reported that their school curriculum lacked sufficient information about puberty to develop a clear idea about the physiology and purpose of male ejaculations or about menstruation. The teachers avoided providing puberty and menstruation-related classes and advised students to study the relevant textbook chapters at home.

A boy aged 17 years in grade 10 in a rural school said:

Consider menstruation, we don't know much about this! There is just the term ejaculation (birjopat) which creates curiosity that "what does it mean?" But the teacher doesn't discuss in detail to make us understand. We also do not know why such

erections and ejaculations occur, what to do if something like this happens, or if this is an illness! Such issues could have been better explained.

Some boys thought that discussing puberty or menstruation is somewhat prohibited and this stigmatization and prohibition were socially constructed. Nearly half of the boys mentioned that they were familiar with menstruation as a term that causes blood secretion and girls' use of products during their menstruation. One boy aged 15 years in grade 9 said:

Puberty-related topics are personal, and a shame to share and discuss as it is related to the secret organs of human body.

Another boy aged 16 years in grade 10 in a rural school, said:

Our social environment is constructed in a way that prohibits us from talking about puberty and menstruation. That is how we learned from childhood [to not talk about these topics]. Thus, we keep these issues secret.

Boys mentioned that they perceived menstruation as a hidden issue and potentially a negative sign indicating illicit sexual relationships. Half of the boys mentioned that other boys perceive puberty signs and menstruation as a subject to make fun of. They had often written offensive statements on the walls of female toilets and school walls that indicate sexual innuendo. Some boys mentioned that their fellow friends confessed observing girls being teased by other students in the school with offensive remarks, such as 'marry me,' 'your figure is so good,' 'let's have sex.' One boy aged 15 years in grade 9 at an urban school said:

Once some boys found the school bench was stained with blood and started joking and laughing, saying that a girl might have menstruated, ha ha ha.

Both girls and boys preferred separate sessions to provide a comfort zone to open up about puberty and menstruation-related discussions. They perceived this would also prevent teasing. One boy aged 16 years in grade 9 in a rural school said:

Boy students would feel excited as girls will be in the same session, and then they would make fun of girls or tease during the educational sessions. Suppose if we discuss menstruation in the same class, I might visualize that in my mind and relate to the girls sitting in the same class, which is awful.

Vignette exercise

In several vignette exercises, students stated when they came to know that their puberty-related class (according to the national curriculum textbooks) would start they left the class as they felt awkward discussing puberty-related topics delivered by the male teacher in the presence of their female peers in the same classroom.

During vignette exercises, participants mentioned that these topics were vital for all and suggested developing a gender committee including male and female teachers, who could teach with active participation from students. Students stated that:

It will be good to have a gender club, but we have to start from lower class (class six)

There should be both male and female teachers and if possible, guardian

Furthermore, boys confessed during the vignette exercise that the presence of both girl and boy students in the same class made them uncomfortable and would create a possibility of making laugh and fun by boys' could make an embarrassing situation for female students. Regarding reasons for their shyness, boys mentioned inadequate levels of knowledge as their family never shared any thoughts about puberty with them. They said:

Because of shame we do not even read our textbook regarding puberty and menstruation thoroughly at home.

Phase 2: Piloting of intervention to evaluate the feasibility and effectiveness of boys' engagement

Compared to baseline, boys' knowledge about puberty and menstruation considerably increased after intervention. Accurate knowledge regarding nocturnal emission (wet dreams) increased significantly [PD: 24%; 95% CI: 11, 38] among schoolboys

compared to baseline. Similarly, boys' awareness of menstruation increased at the endline [PD: 15%; 95% CI: 2, 29]. At the endline, boys' knowledge improved regarding the average length of the menstrual cycle (28 days) [PD: 9%; 95% CI: -12, 30], and also the typical duration of bleeding (3–7 days) [PD: 17%; 95% CI: -4, 38] (Table 2).

Reported comfort discussing puberty-related issues with doctors and their friends in school clubs increased modestly among the boys [PD: 18%; 95% CI: 8, 28] and [PD: 13%; 95% CI: 2, 24]. At the endline, obtained knowledge having learned about the importance of eating a balanced and nutritious diet, engaging in regular exercise, rest, and play during adolescence decreased compared to baseline. Receiving accurate information on physical and mental changes during adolescence increased significantly [PD: 19%; 95% CI: 10, 28] at the endline (Table 3).

Attitudes and perceptions about puberty and menstruation improved compared to the baseline, although many of the changes were not statistically significant. Boys agreed that they could support girls during menstruation at the endline (29% at baseline vs. 47% at endline, $p = 0.046$), the odds of being in agreement versus the neutral and disagree categories was 2.22 [95% CI: 1.14, 4.33] times greater at endline. The majority said that they felt confident to stop others teasing about menstruation (71% at baseline vs. 87% at endline, $p = 0.07$), and the odds of being in agreement versus the neutral and disagree categories was 2.69 [95% CI: 1.14, 6.28] times greater at endline. Boys in both baseline and endline surveys agreed that teasing girls was morally wrong. At the endline, boys agreed that menstruation is healthy for girls (55% at baseline vs. 75% at endline, $p = 0.12$). At baseline most boys (87%) disagreed with the notion that menstruation is the curse of God; after the intervention, nearly all-boys (98%) disagreed with this notion ($p = 0.028$), compared to baseline, the odds of being in agreement versus the neutral and disagree categories were 8.00 [95% CI: 1.79, 3.57] times greater at endline. Boys agreed it was reasonable for a family to spend money each month to buy sanitary products for female family members (82% at baseline vs. 89% at endline, $p = 0.17$) (Table 4).

Phase 3: Qualitative assessments

Schoolboys, both from urban and rural schools, found the education sessions helpful and informative. They mentioned that they had been unaware of physical and mental changes that occurred during puberty and the sessions made them better informed. They appreciated that the teachers were interactive and shared their own experiences.

One boy aged 15 years in grade 8 from an urban school said,

In adolescence, we go through several changes physical and mental. Many [boys] are not aware of these changes. When these sessions were conducted, they get to know about these. When these changes happen suddenly, many boys cannot accept it and get scared. After icddr,b started their activities, teachers provided classes on puberty, and everyone got to know.

Regarding wet dreams boys mentioned:

Table 2 | Adolescent boys' knowledge of puberty and menstruation before and after the intervention

Indicators	Baseline N (%) N = 101	Endline N (%) N = 100	Prevalence difference
'Semen comes out during sleep' as the meaning of wet dream	35 (35)	59 (59)	24 (11, 38)
Boys could identify the name of the body part			
Penis	78 (77)	95 (95)	18 (8, 27)
Scrotum	40 (40)	40 (40)	0 (-13, 14)
Testis	18 (18)	9 (9)	-9 (-18, 1)
Seminal vesicle	1 (1)	4 (4)	3 (-1, 7)
	N = 38 ^a	N = 53 ^b	
Average length of the menstrual cycle 28 days	16 (42)	27 (51)	9 (-12, 30)
Typical duration of each period of bleeding 3–7 days	13 (34)	27 (51)	17 (-4, 38)
'Wash with water and soap and dried under sunlight' as recommended method	8 (21)	19 (36)	15 (-5, 34)

^aThere was a skip note at the question 'Have you heard about menstruation?', only those answering 'yes' to that question (N = 38) were asked the subsequent knowledge items about menstruation.

^bThere was a skip note at the question 'Have you heard about menstruation?', only those answering 'yes' to that question (N = 53) were asked the subsequent knowledge items about menstruation.

Table 3 | Boys' perceptions of their environment, practices, comfort, and intervention uptake

Indicators	Baseline <i>N</i> (%)	Endline <i>N</i> (%)	Prevalence difference
Obtained information on biological or mental changes in early adolescent period from (multiple responses)	<i>N</i> = 101	<i>N</i> = 100	
National curriculum	77 (76)	43 (43)	-31 (-41, -20)
Other female family members	26 (26)	30 (30)	4 (-14, 23)
Friend	25 (25)	29 (29)	4 (-17, 26)
Teacher	21 (21)	25 (25)	4 (-20, 28)
Other male family members	19 (19)	14 (14)	-5 (-13, 3)
Mother	17 (17)	10 (10)	-7 (-14, 0)
Father	11 (11)	11 (11)	0 (-6, 6)
icddr,b book	-	31 (31)	-
Obtained information (multiple responses)	<i>N</i> = 96	<i>N</i> = 91	
Wet dream, erections, and ejaculation	36 (38)	33 (36)	-1 (-14, 11)
Need to eat balanced and nutritious diet, exercise, rest, and play regularly	25 (26)	3 (3)	-27 (-32, -21)
Don't worry about biological and mental changes	20 (21)	2 (2)	-23 (-35, -12)
Personal hygiene	14 (15)	5 (6)	-10 (-24, 5)
Boys who had experienced with wet dream (yes/no)	48 (48)	47 (47)	-1 (-13, 12)
Comfortable to discuss puberty, menarche, and menstruation with	<i>N</i> = 101	<i>N</i> = 100	
School clubs/Friend	74 (74)	86 (86)	13 (0, 25)
Other male family members	63 (63)	61 (61)	-1 (-10, 7)
Doctor/gynecologists/Nurse	48 (48)	66 (66)	18 (8, 28)
Other female family members	44 (44)	43 (43)	-1 (-18, 16)
Mother	41 (41)	50 (50)	9 (-3, 22)
Teacher at school	35 (35)	45 (45)	10 (-10, 31)
Content of sessions provided for boys		<i>N</i> = 100	
Promoting the importance of personal hygiene	-	9 (9)	
Regarding wet dreams or other physical changes	-	60 (60)	-
Topics covered in gender committee meetings		<i>N</i> = 15	
Promoting the importance of personal hygiene management	-	4 (27)	-
Regarding wet dream	-	1 (7)	-

Yes, these books were very helpful to increase our knowledge. Earlier, we used to think that wet dream is a wrong thing, a blunder. Now we know it is a natural physiological process.

They also mentioned learning about personal hygiene, nutrition, and menstruation will help them understand the problems girls face and support them. Some of the boys described what they had learned concerning menstruation:

Every month, menstruation happens for girls, if the monthly cycle continues well; later on, in adult life, she will not face any problem. Girls get to know about these during the classes. If any [physical] problems happen [during menstruation], girl will be able to identify the irregularity. She will be able to teach younger family members. If one is aware of these facts, she can disseminate this information to others, sisters, cousins, friends. In this way, everyone will be aware! In many families, girls get reserved after menstruation. Family members do not allow them to talk to boys.

The boys mentioned that they learned about girls' puberty, which will help them guide their younger sisters. They found the books enjoyable and informative and have helped them be more supportive of the girls. One boy said:

Table 4 | Boys' attitudes and perceptions regarding menstruation

Indicators	Baseline <i>N</i> (%)	Endline <i>N</i> (%)	Chi-square test for linear trend, <i>p</i> -value, and odds ratio ^a
I can be supportive to the needs of girls when they have their periods	<i>N</i> = 38 ^b	<i>N</i> = 53 ^c	
Agree	11 (29)	25 (47)	3.99, <i>p</i> = 0.046, 2.22 (1.14, 4.33)
Neutral	10 (26)	14 (26)	
Disagree	17 (45)	14 (26)	
It is common in our school for students to tease girls about menstruation			
Agree	6 (16)	10 (19)	0.76, ns ^d
Neutral	10 (26)	3 (6)	
Disagree	22 (58)	40 (75)	
I am confident that if someone is teasing a girl for menstruation I can say or do something to stop the teasing			
Agree	27 (71)	46 (87)	3.29, ns, 2.69 (1.14, 6.28)
Neutral	9 (24)	6 (11)	
Disagree	2 (5)	1 (2)	
It is morally wrong to tease others because of their physical changes during puberty	<i>N</i> = 101	<i>N</i> = 100	
Agree	89 (88)	87 (87)	38.18, ns
Neutral	10 (10)	9 (9)	
Disagree	2 (2)	4 (4)	
I tease girls in my class about their menstruation	<i>N</i> = 38	<i>N</i> = 53	
Agree	0 (0)	5 (9)	3.02, ns
Neutral	1 (3)	1 (2)	
Disagree	37 (97)	47 (89)	
Girls are unclean/polluted during their menstruation			
Agree	13 (34)	26 (49)	0.21, ns
Neutral	13 (34)	7 (13)	
Disagree	12 (32)	20 (38)	
Menstruation is a healthy thing for a girl			
Agree	21 (55)	40 (75)	2.46, ns
Neutral	8 (21)	4 (8)	
Disagree	9 (24)	9 (17)	
Menstruation is a curse of God			
Agree	2 (5)	0 (0)	4.82, <i>p</i> = 0.028, 8.00 (1.79, 3.57)
Neutral	3 (7)	1 (2)	
Disagree	33 (87)	52 (98)	
It is reasonable for a family to spend money each month to purchase sanitary products for the girls/women to manage their menstrual hygiene			
Agree	31 (82)	47 (89)	1.84, ns
Neutral	5 (13)	6 (11)	
Disagree	2 (5)	0 (0)	

^aApplied the bootstrap method to find out odds ratio.

^bThere was a skip note at the question 'Have you heard about menstruation?', only those answering 'yes' to that question (*N* = 38) were asked the subsequent knowledge items about menstruation.

^cThere was a skip note at the question 'Have you heard about menstruation?', only those answering 'yes' to that question (*N* = 53) were asked the subsequent knowledge items about menstruation.

^dNot significant.

Sometimes, out on the street, boys tease girls for their changes during puberty. So, from this book, we came to know, this [menstruation] is a normal physical change of girls, we will not make fun of it. We will support them; we will not tease them.

Another boy aged 15 years from grade 9 from a rural school mentioned:

This book talks about the issues regarding the girls. If we just confine our knowledge just about us and exclude theirs, then problems may arise. For instance, I have a younger sister. During her troubles I can give her advice.

The boys unanimously agreed that the classes are helpful but suggested more regular (ongoing) classes to ensure no one misses out on the sessions, and the information can be refreshed:

Of course, it's nicer if the classes do not come to an end. Everyone changes with time. Say, we remember everything but still, we are neglecting what we learned. Or maybe we can forget things later due to reduced practice. Regular classes will remind us about our learning.

All the boys supported the idea of a gender committee and agreed that it is necessary, though some boys said that the committee was not active in their school during the intervention. They mentioned that this committee could establish communication between teachers and students to bring a positive change in the school environment. The boys all agreed that these interventions should be introduced in other schools.

Forming such gender committee in other schools, will bring a positive change in those schools, this is happened in our school. When we discussed, many misconceptions and negative perceptions were unaddressed!

The lack of knowledge about puberty and menstruation caused fear, shame, and misperceptions among boys. Delayed introduction and lack of detailed explanations about puberty and MHM in the curriculum were also found to be a barrier. Acceptable and creative intervention components provided evidence-based learning and gain knowledge that promotes gender equity.

DISCUSSION

The improvement of boys' knowledge, attitudes, and perceptions about puberty and menstruation, including reported confidence in their ability to be supportive of menstruating girls' needs, suggests that engaging boys in puberty and MHM intervention in Bangladeshi schools was acceptable and feasible. Prior to intervention, we found that boys poorly understood the physiological aspects of menstruation. They had gathered that since it was a topic of joking and teasing and was related to the secret organs of the body, that menstruation should not be openly discussed. Boys reported being eager to learn from puberty education within the school curriculum but described how their teachers did not fully cooperate with this demand prior to our intervention out of discomfort with teaching the material. This has also similarly been described in studies in another context, such as Philippines and Kenya, where teachers make efforts to avoid such topics (McMahon *et al.* 2011; Haver *et al.* 2013). The intervention piloted in our study addressed boys' misconceptions about menstruation and menstrual hygiene management through effective puberty education materials and participatory approaches that had been developed with the engagement of schoolboys from the outset – thereby contributing to a more supportive school environment for menstruating schoolgirls.

Our findings suggest that schoolboys in this context can adopt positive attitudes and supportive behaviors regarding MHM. They expressed interest in becoming better informed. They were in favor of teachers conducting classes on the topic, and expressed support for the inclusion of these modules into their regular school curriculum, as reported for a similar setting in India (Das & Ray 2007). The involvement of male teachers and boys through the classroom sessions, activities and formation of gender clubs enabled them and the school community to better understand and destigmatize MHM issues in the school. A variety of compelling intervention materials including comic books, as well as role-playing, served to communicate the information effectively. Though it was an enjoyable activity for them, participating in the intervention created a

space to speak about menstruation openly which is the first step to breaking the silence and taboo (Rajagopal & Mathur 2017).

An unintended consequence of the intervention is that there was an increase in the proportion of boys agreeing that girls are unclean or in a state of ritual pollution during menstruation (Table 4), although the difference was not statistically significant. The intervention material emphasized that menstruation was natural and healthy for girls but did not specifically address issues of ritual impurity. The belief that girls are ritually impure during menstruation is widespread in Bangladesh (Czura *et al.* 2019).

The possible impacts of this belief on the experiences of menstruating girls warrants further investigation, and development and testing of ways to appropriately address this topic in the intervention materials. Although this tenet is often cited as a cause for concern in the menstrual health research literature (Benshaul-Tolonen *et al.* 2020), research outside of Bangladesh has shown that women who are members of a religion that designates a menstruating body as ritually impure may 'mentally separate how religion views menstruation from how they themselves feel about their menstruating bodies' and may be accepting of religious proscriptions regarding menstruation (Maharaj & Winkler 2022).

The endline survey of our study indicated that reported teasing of girls about menstruation increased, although not significantly. This may be due to the increased emphasis on this topic providing more material to boys on which to base their teasing of the girls. This requires further follow-up, through better identification of the particular content that stimulates teasing, and strengthening the components of the intervention that had been intended to address the problem of teasing. Our findings stand in contrast to a study with schoolboys in Uganda which found that it similarly was feasible and acceptable to deliver effective intervention content, but in their case the exposure to the intervention was associated with a reduction in teasing (Kansiime *et al.* 2020).

This study's approach of including a breadth of stakeholders including men, boys, and janitors to create MHM awareness set an example of inclusive program design along with materials that can be used when scaling the intervention for broader implementation. We aim to develop menstrual hygiene management interventions that are appropriate to recommend to the Ministry for integration into the national curriculum. The national Government of Bangladesh developed country's very first 'National MHM Strategy'. This strategy clearly emphasizes the engagement of men and boys in MHM. The lessons learned from this study can inform future programs in Bangladesh as well as in LMICs. One such program is the Generation Breakthrough program on adolescent health implemented in collaboration with UNFPA and several ministries of the Government of Bangladesh. The intervention model works directly with adolescents and role models who influence them and includes a radio campaign, social media activities, engagement of religious and community leaders, and committees in schools similar to the committees we established in this study (Ulziisuren 2020).

STRENGTHS AND LIMITATIONS

We developed the interventions based on formative research and designed education sessions to be interactive. The intervention uptake indicates an appropriate approach and intervention materials. However, due to the small number of schools and the limited sample size for this study, it might not represent the responses that such an intervention would receive in a larger study implemented in more schools. Furthermore, all of these outcomes were self-reported, which might result in an inaccurate assessment of knowledge. To enable a better understanding of why the intervention may have led to increased teasing and to develop an improved strategy, we need to conduct further qualitative work on menstrual teasing from the perspectives of both adolescent girls and boys. Further work should also consider a community component to the intervention to address knowledge and descriptive and injunctive social norms regarding MHM in the wider society.

CONCLUSION

This study demonstrated that an inclusive school-based intervention can be feasibly and acceptably implemented in Bangladesh to improve boys' perceptions about puberty and menstruation and contribute to creating more girl-friendly school environments through destigmatizing menstruation. Destigmatization of menstruation can promote gender equity in schools and may contribute to improved retention of girls in secondary schools in the long run. We consider that male participation is a desirable element of MHM interventions, and this study sheds light on such pathways and approaches to their inclusion. Education modules such as the ones we developed and tested should be integrated into comprehensive

school health programs, such as Generation Breakthrough, and further evaluated. Interventions should include guidance and adequate support for teachers with a focus on participatory learning and the mitigation of teasing.

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DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

CONFLICT OF INTEREST

The authors declare there is no conflict.

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