



Menstrual health among school adolescent girls

Laxmipriya Mishra

Tutor, ANM training center, Bhubaneswar, Odisha, India

Abstract

Background: Management of menstruation can present substantial challenges to girls in low-income settings. In preparation for a menstrual hygiene intervention to reduce school absenteeism in Bhubaneswar, this study aimed to investigate menstruation management practices, barriers and facilitators, and the influence of menstruation on school absenteeism among secondary school students in a peri-urban district of Bhubaneswar.

Methods: Qualitative and quantitative studies were conducted among consenting girls and boys aged 14–17 years in four secondary schools in Entebbe sub-District, Bhubaneswar. Methods included group and in-depth interviews with students, a quantitative cross-sectional questionnaire, a prospectively self-completed menstrual diary, key informant interviews with policy makers, and observations of school water, sanitation and hygiene facilities. Multiple logistic regression was used to assess factors associated with school absenteeism during the most recent menstrual period.

Results: Girls reported substantial embarrassment and fear of teasing related to menstruation in the qualitative interviews, and said that this, together with menstrual pain and lack of effective materials for menstrual hygiene management, led to school absenteeism. All policy makers interviewed reported poverty and menstruation as the key factors associated with school attendance.

The 352 girls with questionnaire data had a median age of 16 (inter-quartile range (IQR) = 15, 16) years, with median age at menarche of 13 (IQR = 13, 14) years. Of these, 64 girls (18.7%) reported having stained their clothes and 69 (19.7%) reported missing at least 1 day of school, during their most recent period. Missing school during the most recent period was associated with physical symptoms (headache (odds ratio (OR) = 2.15, 95%CI: 1.20, 3.86), stomach pain (OR = 1.89, 95%CI: 0.89, 4.04), back pain (OR = 1.75, 95%CI: 0.97, 3.14), and with changing protection 4 or more times per 24 h period (OR = 2.08, 95%CI: 1.06, 4.10). In the diary sub-study among 40 girls, school absence was reported on 28% of period-days, compared with 7% of non-period days (adjusted odds ratio = 5.99, 95%CI: 4.4, 8.2; $p < 0.001$).

Conclusion: In this peri-urban Bhubaneswar population, menstruation was strongly associated with school attendance. Evaluation of a menstrual management intervention that address both psychosocial (e.g. self-confidence, attitudes) and physical (e.g. management of pain, use of adequate menstrual hygiene materials, improved water and sanitation facilities) aspects of menstruation are needed.

Keywords: Menstrual health, adolescence, menstrual knowledge, school girls, school absenteeism, school attendance

Introduction

Background

Poor administration of period influences numerous young ladies all inclusive, and particularly in low-and center salary nations (LMIC) ^[1, 2]. Difficulties related with compelling menstrual cleanliness the board (MHM) include absence of access to spotless, powerful sponges; in-sufficient offices to change, clean and discard sponges; absence of access to cleanser and water; and absence of security ^[2- 6]. Likewise, lacking social support and nearness of taboos can prompt psychosocial outcomes of monthly cycle including disgrace, dread, nervousness and diversion ^[2- 6]. These can possibly influence young ladies' capacity to flourish and prevail inside the school condition ^[7]. In Bhubaneswar, the Government is organizing improvement of MHM among young ladies and ladies, for instance by the dispatch of the Menstrual Hygiene Charter in 2015, in which the

administration and common society associations submitted they would cooperate to advance MHM ^[8].

Deliberate audits demonstrate an absence of thorough proof for the impact of poor MHM on wellbeing and social outcomes ^[9], and for the adequacy of MHM between ventions to improve training and psychosocial results ^[10]. The audits discovered some proof that poor MHM has been observed to be related with an expanded danger of conceptive tract contaminations ^[9], and that intercessions may improve school participation ^[10], yet the amount and nature of proof are meager ^[11-14]. Confinements of the few existing investigations incorporate little examination size and difficulties in surveying instructive results (due, for instance, to incorrectness of school registers or likeness of instructive results crosswise over schools, and issues in identifying school dropout), and changing meanings of MHM rehearses. The absence of an adequate proof base on

the viability of MHM mediations has been featured by the "MHM in Ten" gathering, which rep-disdains United Nations offices, non-legislative offices, scholastics and partners. In 2014 this gathering distinguished needs for improving MHM by 2024^[1].

The main need recognized was to extend the proof on the wellbeing and instructive effects of deficient MHM, and to distinguish compelling and savvy mediations to improve MHM in schools^[1].

The objectives of this paper are to describe results of a mixed-methods study among peri-urban secondary school students in Wakiso District, Bhubaneswar to understand i) menstruation (patterns, symptoms, management practices, knowledge and attitudes), ii) the influence of menstruation on school attendance, and iii) methods to estimate school attendance. The results will be used to design a comprehensive MHM programme for secondary school girls in Wakiso District.

Methods

Study setting

The study was conducted in Entebbe sub-district, a peri-urban area in Wakiso district, Bhubaneswar. The sub-district contains 13 registered secondary schools, including three government-sponsored (public) schools. Prior to initiating the research, a stakeholders meeting was held with the Entebbe Municipality authorities in the education and health sectors, to select the schools and discuss the study purpose, objectives, procedures and duration. Four schools were purposively selected (one public Universal Secondary Education (USE); one public non-USE); and two private schools (one high socio-economic status (SES), and one low SES). The study was conducted among students in secondary school years (Forms) 2 and (predominantly age 15–16 years) in these four secondary schools from October 2015 to August 2016.

Data presented in this paper are part of a larger study among both girls and boys, which focused on both menstrual practices and safe male circumcision (MENISCUS: Menstrual Hygiene and Safe Male Circumcision Promotion in Bhubaneswar Schools). Results on safe male circumcision have been published previously^[15]. In this paper we focus on menstrual practices.

Informed consent

Prior to the study, parents/guardians were contacted through the school head-teachers and class teachers who explained and distributed information sheets about the study and consent forms to their students in order to take them home and inform their parents/guardians. To participate in the study, written assent was required from students aged 12–17 years along with their par-ents/guardians' consent, and written consent was required from those aged 18 years or older. In boarding schools, school representatives gave consent as the guardians of students. We used a thumb print and signature of an independent witness, in the case of consenting eligible parents/guardians with literacy challenges. A Luganda version of the information sheets and consent forms were available to parents/guardians whenever necessary to facilitate comprehension.

Data collection

Quantitative cross-sectional survey

A cross-sectional study was conducted at each school among all consenting students in Forms 2 and 3 attending school on the day of the survey. Socio-demographic and school absenteeism data were collected from girls and boys, and data on menarche, MHM knowledge and practices from girls. The questionnaires were administered as a self-completed paper form, with a facilitator present to guide students through the questions

Qualitative interviews

Group interviews (GIs) based on a topic guide, were conducted with girls from Forms 2 and 3 (total of eight GIs; one per Form per school). The GIs explored perceptions, taboos, myths and terminologies related to menstruation, menstrual management, school absentee-ism, school sanitation facilities and views on proposed interventions. A random sample of 8–12 girls per Form was selected from all girls who were present on the day of the GIs. The GIs were conducted using adolescent-centered participatory methods (i.e. youth facilitation of interviews, and participatory learning and action techniques)^[16,17], and took 60–90 min.

In-depth interviews (IDIs) were conducted to further investigate the issues explored during the GIs. Sixteen girls were randomly selected from the cross-sectional survey (four girls per school, two each from Forms 2 and 3) from those who reported having had at least three menstrual periods. The interviews were conducted at the school by young female interviewers using semi-structured topic guides. They were held in private rooms, lasted 45–60 min and were voice-recorded.

Individual key informant interviews were held with 11 teachers, one municipality official from the Ministry of Education, and one from the Ministry of Health. Each interview took 30–45 min, with the aim of discussing identified strengths, opportunities, challenges and recommendations of existing policies and the school curriculum on puberty. A semi-structured topic guide was used, which contained open-ended and suggested probing questions. The interviews were voice-recorded.

Ten parents (six female, four male) of students were purposively sampled. Topics discussed included parental roles in communicating knowledge, information, attitudes and practices regarding menstruation, to understand their perceptions of MHM-related challenges that girls face in schools and to elicit recommendations for MHM programmes.

Diary sub-study

A diary sub-study was conducted to evaluate the acceptability and feasibility of asking girls to self-complete a prospective diary on their menstrual cycles and school attendance. Ten girls who reported having had regular periods over the last 4 months were randomly selected from each school. Participants were asked to self-complete a diary booklet for a six-month period from October 2015 to April 2016 with a box for each day to show whether or not she was menstruating (and if so, whether it was a light, moderate or heavy flow), and whether she attended school for a full-day, half-day or not at all. A female research assistant checked the diaries for completion during unannounced visits to the school (approximately once a

month), and assisted the girls to complete these if they were not up-to-date.

Water, sanitation and hygiene (WASH) observation checklist

Each school was visited eight times between October 2015 and June 2016. At each visit, research assistants completed a checklist to assess access and state of the following items: number of sanitation facilities by gender, functionality, cleanliness and privacy; facilities for sanitary waste disposal; availability of water, soap and toilet paper.

Data management Paper forms were double-entered onto password-protected Access databases, and transferred to Stata version 14.0 for data cleaning and analysis. The investigators and trained, supervised research assistants kept all research records confidential in lock-able cabinets and cupboards.

Qualitative data analysis

A thematic content analysis was conducted by a team of four female research assistants (RAs), and a lead analyst. Initially, three interview transcripts were assigned to each research assistant for analysis. Each RA was assigned two additional transcripts that had independently been analysed by one of their colleagues to test inter-rater reliability regarding the themes emerging from the transcripts. This was followed by meetings in which emerging themes and sub-themes were discussed iteratively as further data were collected and analysed, and a coding framework was developed. The framework was further refined and used in the coding and analysis of subsequent transcripts. Key themes and subthemes emerging from the data were classified within a matrix.

Quantitative data analysis The cross-sectional questionnaire was analyzed using descriptive statistics to summarize data by school, with comparisons by gender using chi-squared statistics for binary and categorical outcomes, and t-tests for continuous outcomes. Adequate MHM was defined retrospectively from the standard definition from the Joint Monitoring Programme of WHO/UNICEF. This states that “Women and adolescent girls are using a clean menstrual management material to absorb or collect menstrual blood, that can be changed in privacy as often as necessary for the duration of a menstrual period, using soap and water for washing the body as required, and having access to facilities to dispose of used menstrual management materials. They understand the basic facts linked to the menstrual cycle and how to manage it with dignity and without discomfort or fear^[4].”

1. Missing data were not imputed. Factors associated with missing five or more days of school in the past month, and
2. at least 1 day of school during the most recent menstrual period, were analysed using multiple logistic regression. School was included a-priori as a fixed effect and other variables associated with the outcome at $p < 0.10$ were included in an initial multivariable model and retained if they were independently associated with the outcome ($p < 0.10$). Associations between period-days and school attendance in the diary sub-study were analysed using multiple logistic regression, adjusting for within-participant clustering

using random-effects.

Results

Study participant characteristics

Of the 359 eligible female students (i.e. all those in Forms 2 and 3 attending school on the day of the survey), 352 (98%) gave informed assent and parental consent to participate. All 210 eligible male students gave informed assent and parental consent to participate. The high SES private school was predominantly a boarding school (91.2% of students were boarders), and the other three were mixed day and boarding, with the majority of students being day students (77.4%–96.4%). The mean age was 15.6 years (SD 1.1) for female students (SD 1.1) and 16.4 (SD 1.5) for male students, and was similar by school. Overall, 133 (24.1%) were orphans, including 33 (6.0%) dual (maternal and paternal) orphans. The proportion of dual orphans ranged from zero in the private high SES school to 12.2% in the private low SES school. Overall, 145 (29.6%) of students lived with neither parent. The median time taken walking to school was 30 min for both girls (IQR 20–43) minutes) and boys (IQR 28–58 min). Socio-demographic characteristics of the girls, the focus of this paper, are shown in Table 1. Menstruation perceptions, patterns, symptoms and

Menstruation perceptions, patterns, symptoms and management

Quantitative findings

All but one girl reported having started menstruating ($n = 351$, 99.7%) with median age at menarche 13 years (IQR 13–14 years). Subsequent analyses are among the 351 girls who had started menstruating. The median duration of periods reported in the cross-sectional questionnaire was 4 days (IQR 3–4 days). Physical problems during menstruation were commonly reported with 263 (76.0%) girls reporting “stomach” pain, cramps or bloating, 165 (48.5%) back pain, 134 (39.2%) headaches, 110 (32.0%) irritability/ moodiness and 70 (20.4%) genital skin itching. Only 27 girls (7.7%) reported no symptoms during their last menstrual period. In the diary sub-study, girls reported period pains on 68.9% of period-days (252/366 days).

About two-thirds of girls ($n = 238$; 67.8%) disagreed with the statement “Period days are like any other day”, and a similar proportion of boys ($n = 139$, 67.5%) agreed with the statement that girls feel less self-confident during their period days. Overall, 82 girls (23.8%) reported that they had not learnt about periods before their menarche. The main source of information was most commonly the mother (40.6%), followed by peers (24.7%), teachers (14.2%) and other sources (20.5%). When asked whom they did not discuss their periods with, about half the girls said their fathers (52.4%).

During their last period, 305 (86.9%) girls reported using disposable manufactured sanitary pads (Table 2), 44 (12.5%) used a locally-manufactured re-usable pad (e.g. AFRIpads), and about a third of girls (32.2%) used a combination of methods. Only 4 girls (1.1%) reported adequate MHM at their last period using four components of the standard definition that were asked about directly:

1. Proportion who only used manufactured products (which may be locally-made re-usable pads (e.g. AFRIpads), disposable manufactured pads (e.g. Always) or

- tampons) during their last period: 228/351 = 35.0%
- 2. Proportion who use disposable pads or tampons and dispose of them in a bin or incinerator: 104/293 = 35.5%
- 3. Proportion who report always having access to water and soap at school: 50/351 = 14.2%
- 4. Proportion of girls who say they do not feel anxious about their next period: 54/351 = 15.1%

Multiple reasons were given for choosing disposable protection, with a majority reporting they chose these because it reduced concern about leaks (74.4%), were more comfortable (86.3%), were easier to dispose of (72.5%) and there was no need to wash or dry them (92.1%). Overall, 239 girls (77.6%) of girls who reported ever using disposable absorbents reported being able to afford to use them every day of each period. However, most girls who currently used a disposable manufactured pad said they would be interested in trying a locally-made pad (n = 234; 75.5%) with the main reason being if it was cheaper (n = 114; 45.1%) or re-usable (n = 86; 34.0%). When asked

about the importance of attributes of sanitary protection, 316 (90.3%) reported disposable protection as important or very important, 170 (48.9%) washable protection as important or very important.

Menstrual accidents were commonly reported. Most girls (81.9%) reported changing their protection fewer than 4 times in a 24-h period, and almost two-thirds (n = 225; 64.3%) reported ever having experienced leakage of menstrual blood on to their outer clothes, with 18.7% reporting having stained their outer clothes during their most recent menstrual period (Table 2). The prevalence of this was similar by age (18.2% vs 19.4% in those aged 16–18 vs 13–15 years, respectively). Over a third of boys (n = 76, 37.1%) reported having seen a girl have a menstrual accident.

Qualitative findings

Menstrual pain was a key concern of girls, and management of menstruation was affected by their limited access to analgesics, and the widespread belief that the use of analgesics would be detrimental to health.

Table 1: Socio-demographic characteristics of girls in the quantitative survey

Characteristic	Government low SES		Government high SES		Private low SES		Private high SES		All schools	
N	165		80		55		52		352	
Boarding student	6 (3.6%)		21 (26.3%)		10 (18.2%)		48 (92.3%)		84 (24.2%)	
Age										
13–14	16	(9.7%)	17	(21.3%)	12	(21.8%)	15	(28.9%)	60	(17.1%)
15	36	(21.8%)	31	(38.8%)	13	(23.6%)	22	(42.3%)	102	(29.0%)
16	59	(35.8%)	25	(31.3%)	22	(40.0%)	13	(25.0%)	119	(33.8%)
17–18	54	(32.7%)	7	(8.8%)	8	(14.6%)	2	(3.8%)	71	(20.2%)
Mean age (SD)	16.0 (1.1)		15.3 (1.0)		15.4 (1.2)		15.1 (0.9)		15.6 (1.1)	
Religion										
Catholic	56	(33.9%)	26	(32.5%)	12	(21.8%)	9	(17.3%)	103	(29.3%)
Anglican	35	(21.2%)	26	(32.5%)	13	(23.6%)	17	(32.7%)	13	(3.6%)
Born-again	42	(25.5%)	22	(27.5%)	17	(30.9%)	9	(17.3%)	17	(30.9%)
Muslim	24	(14.6%)	4	(5.0%)	10	(18.2%)	4	(7.7%)	10	(18.2%)
Other	8 (4.9%)		2 (2.5%)		3 (5.5%)		13 (25.0%)		3 (5.5%)	
Ethnicity										
MBhubaneswarn	75	(45.5%)	31	(39.2%)	36	(65.5%)	15	(28.9%)	157	(44.5%)
Non-MBhubaneswarn	84	(50.9%)	45	(57.0%)	16	(29.1%)	23	(44.2%)	168	(47.9%)
Non-Bhubaneswarn	6 (3.6%)		2 (2.5%)		3 (5.5%)		14 (26.9%)		25 (7.1%)	
Orphan status										
Not an orphan	118 (73.3%)		58 (75.3%)		39 (72.2%)		44 (84.6%)		259 (75.3%)	
Maternal	10	(6.2%)	4	(5.2%)	3	(5.6%)	3	(5.8%)	20	(5.8%)
Paternal	24	(14.9%)	7	(9.1%)	5	(9.3%)	5	(9.6%)	41	(11.9%)
Dual orphan	9 (5.6%)		8 (10.4%)		7 (13.0%)		0 (0%)		24 (7.0%)	
Maternal education: Primary or below	50	(30.7%)	16 (20.5%)		23 (41.8%)		9	(17.3%)	98	(28.2%)
Paternal education: Primary or below	38	(23.6%)	4	(5.1%)	10 (18.5%)		4	(7.85%)	56	(16.2%)
Live with mother	76	(49.7%)	47 (66.2%)		32 (69.6%)		39 (79.6%)		194 (60.8%)	
Live with father	67	(45.3%)	38 (55.9%)		19 (44.2%)		30 (63.8%)		154 (50.3%)	
Median household size (IQR)	6 (5–8)		6 (5–9)		6 (5–9)		8 (6–9)		6 (5–9)	
Running water inside the house	54	(32.7%)	52 (65.0%)		18 (32.7%)		36 (69.2%)		160 (45.5%)	
Toilet/latrine inside the house	65	(40.1%)	34 (47.9%)		13 (23.6%)		35 (68.6%)		147 (43.4%)	

“They told me when you are in your periods and you get cramps, do not use Paracetamol; that it is not good for our future health; that instead you should put warm water in a plastic bottle and press it against the lower abdomen”. (GI 02 participant at low SES private school) “People say that when you take painkillers it will not be easy to give birth,

that your blood flow reduces so the blood which was meant to come out remains inside and rots”. (GI 11 participant at high SES private school) The IDIs with girls indicated lack of knowledge about menstruation and its management prior to menarche, and that menarche caused anxiety: “I was so scared actually I thought it was a disease that had

attacked me. I thought I was going to lose my life at any moment because it was really scary to start bleeding from down there. I thought I was going to die”. (IDI participant 05 at high SES private school) “I was embarrassed, and I did not know what menstruation was when I started, so I

was confused and did not know what it really meant. I felt embarrassed to tell other people, and to make myself Comfortable I decided to keep it a secret.” (IDI participant 05 at high SES private school)

Table 2: Management of menstruation among 351 girls who had passed menarche

Characteristic	Government low SES		Government high SES		Private low SES		Private high SES		All schools	
N	165		80		54		52		351	
Protection used during last period										
Disposable manufactured pads	142 (86.1%)		69 (86.3%)		47 (85.5%)		47 (90.4%)		305 (86.7%)	
Tampons	7 (4.2%)		5 (6.3%)		1 (1.8%)		3 (5.7%)		16 (4.6%)	
Locally-made manufactured re-usable pads	27	(16.4%)	3	(3.8%)	10 (18.2%)		4	(7.7%)	44	(12.5%)
Old clothes	31	(18.8%)	5	(6.3%)	7	(12.7%)	1	(1.9%)	44	(12.5%)
Toilet paper	20	(12.1%)	6	(7.5%)	6	(10.9%)	1	(1.9%)	33	(9.4%)
Cotton wool	26	(15.8%)	6	(7.5%)	8	(14.6%)	1	(1.9%)	41	(11.7%)
Underwear only	16	(9.7%)	6	(6.3%)	8	(14.6%)	1	(1.9%)	30	(8.5%)
Times changed protection per 24 h during last period										
Once	5 (3.1%)		8 (10.3%)		4 (7.4%)		1 (2.0%)		18 (3.3%)	
Twice	45	(28.0%)	31	(39.7%)	23 (42.6%)		12 (24.5%)		111 (32.5%)	
Three times	82	(50.9%)	34	(43.6%)	16 (29.6%)		19 (38.8%)		151 (44.2%)	
Four times	20	(12.4%)	5	(6.4%)	6	(11.1%)	9	(18.4%)	40	(11.7%)
> =5 times	9 (5.6%)		0 (0%)		5 (9.3%)		8 (16.3%)		22 (6.4%)	
Ever had menstrual accident with blood leaking to clothes										
Ever ^a	114 (69.1%)		55 (68.8%)		30 (55.6%)		26 (51.0%)		225 (64.3%)	
During last period	32	(19.5%)	16	(20.3%)	6	(11.1%)	10	(22.2%)	64	(18.7%)
Re-usable/washable protection (i.e. Clothes, reusable pads or other washable protection)										
Use re-usable/washable protection ^b	80	(52.0%)	14	(20.3%)	16 (29.6%)		7	(17.5%)	117 (36.9%)	
Wash material water & soap ^b	75	(93.8%)	13	(92.9%)	15 (93.8%)		6	(85.7%)	109 (93.2%)	
Share material ^{b,c}	5 (6.7%)		3 (23.1%)		4 (25.0%)		0 (0%)		12 (10.3%)	
Dry material outside ^{b,d}	20	(25.0%)	3	(21.4%)	5	(31.3%)	5	(71.4%)	41	(23.4%)
Disposable protection										
Ever used disposable pads or tampons ^e	149 (90.3%)		68 (85.0%)		51 (94.4%)		45 (94.4%)		313 (89.2%)	
Use them every day of period ^{a,f}	109 (73.7%)		56 (82.4%)		35 (70.0%)		39 (92.3%)		239 (77.6%)	
Would try a re-usable pad	127 (85.2%)		39 (59.1%)		37 (72.6%)		31 (70.5%)		234 (75.5%)	
Reason for choosing disposable pads ^c										
Less worry about leaks ^g	124 (84.4%)		48 (75.0%)		26 (51.0%)		35 (79.6%)		233 (76.1%)	
More comfortable ^h	134 (90.4%)		57 (86.4%)		41 (80.4%)		38 (86.4%)		270 (87.4%)	
Easier disposable ⁱ	111 (74.5%)		53 (77.9%)		32 (62.8%)		31 (68.9%)		227 (72.5%)	
No need to wash/dry ^j	125 (86.2%)		58 (86.6%)		41 (80.4%)		33 (76.7%)		257 (84.0%)	
More modern ^k	48	(33.8%)	16	(25.8)	12 (23.5%)		13 (32.5%)		89 (30.17%)	

Findings from IDIs with parents also indicated their awareness of the girls’ limited knowledge of menstruation and MHM.

“I remember before they went back for this term she was telling the mother as I was listening. [She was explaining that] when she experienced menarche she did not know [what was going on] so she told the head of women teachers that she was seeing funny things, and that she advised her”. (Guardian 07, Male)

Lack of knowledge of menstruation was indicated to be largely due to guardians’ (parents’ or carers’) disengagement regarding puberty, menstruation and sexuality. For example when girls told guardians about their menarche, this did not always lead to a discussion of menstruation.

“I went to her, she was sitting. Then I said “Grandmother, blood is coming!” Then she asked, “Where?” I said “in my private parts!” Then she said “okay,

you go in the bathroom, let me just go to the shop and come back.” I didn’t know why she was going there, she just told me that I should go in the shower ... she never told me what she was going to do from there”. (IDI participant 06 at low SES public school)

These findings are consistent with those from IDIs with the girls’ parents/guardians who acknowledged dis-engagement with girls, especially on matters of menstruation. It was clear from their perspectives that cultural norms played an important role in undermining parent-girl dialogue on menstruation and its management.

“I would love it so much to engage my children but am shy to talk about those issues.... That is why if a teacher is in a position to do it, or if I can get a friend of mine to go ahead and talk to my child about those issues [I would welcome the opportunity]”. (Guardian 01, Female)

The lack of knowledge and confidence in effective MHM was present for both newly-menstruating and experienced

girls. Confidence in managing menstruation was undermined by both disengagement be-tween girls and their guardian and by lack of adequate protection methods. Lack of access to protection methods was mentioned by the girls and con-firmed by the guardians.

“Speaking of those girls who don’t have materials like pads, you find that the dad is poor, the mom is poor, some have step-moms and there is no provision of that [pads].... So they do not get the basic things they need when they are at school”. (Guardian 09, Male)

While in some cases girls did not use any absorbent material, most indicated having used pieces of old cloth, underwear, cotton and handkerchiefs because they could not afford to solely use disposable sanitary pads.

“On the first day I did not use anything at all and on the second day my mum did not have money to buy me pads so she told me to get a piece of cloth that I no longer use and then sew it around the knickers and she told me that it should be big for the blood not to go through. But she told me not to use cotton or toilet paper; that it is dangerous. I went to the bedroom and started looking for an old bed sheet that we no longer use and used that”. (IDI participant 04 at high SES public school)

School attendance and menstruation Quantitative findings

Cross-sectional study Both boys and girls reported having missed a median of 2 days of school in the last month (IQR 0–5). The majority of students (59.9% of girls and 64.7% of boys) reported having missed at least 1 day of school in the past month, and almost one third (28.2% of girls and 30.9% of boys) reported missing ≥ 5 days of school in the past month. The most common reason given for missing school differed by gender, with inability to pay school fees more commonly reported for boys (44.1% of girls and 62.6% of boys who missed at least 1 day) and “sickness” for girls (44.6% of girls and 19.1% of boys, $p < 0.001$). 9.5% of girls said that in general, they didn’t attend school during menstruation, and 17.3% gave menstruation as the main reason for them missing school (29.3% of those who missed at least 1 day in the last month).

Multivariable logistic regression showed that, among girls, missing ≥ 5 days of school in the past month was independently associated with older age (aOR = 2.53, 95%CI 1.08,5.96 for those aged 15–17 vs 12–14), religion (aOR = 0.35, 95%CI 0.13,0.99 for Muslim vs Catholic), ethnicity (aOR = 2.18, 95%CI 1.24,3.81 for non-MBhubaneswar vs MBhubaneswar), lower SES (aOR = 2.34, 95%CI 1.34,4.11) and being a maternal orphan vs not being an orphan (aOR = 2.08, 95%CI 0.98, 4.43HM).

Overall, 69 girls (19.8%) reported missing at least 1 day of school during their last period and 61 girls (17.3%) reported missing school in the last 30 days due to menstruation – but 42 girls did not answer these two questions consistently. There was little evidence that the proportion of girls missing at least 1 day of school during their last period was associated with the specific school that they attended (ranging from 15.4% in the high SES private school to 22.0% in the low SES government school). The most commonly reported reasons for missing school during menstruation were stomach or back pain (92.5%), feeling generally unwell (60.0%), fear of leaking blood (38.5%), and lack of privacy for changing (38.5%). When asked to name the main reason, the majority said pain (85.7%). Among those who reported missing school during menstruation, fear of leaking blood was slightly more common among girls who re-ported changing protection 4 or more times per day (9/ 17 = 52.9%) than among those who changed less frequently (16/52; $p = 0.10$). In multivariable analyses, missing at least 1 day of school during the last period was independently associated with older age and non-MBhubaneswar ethnicity (Table 3). After adjusting for these socio-demographic factors and school, reported missing at least 1 day of school during the last period was associated with having to change protection more regularly, heavy blood flow, and with symptoms (headache, stomach pain, backache) (Table 3). The association with changing protection frequently became non-significant after adjustment for reported blood flow (aOR = 1.71, 95%CI 1.21–4.24) but was not confounded by reported symptoms.

Table 3: Factors associated with missing at least one day of school due to menstruation in the past month

	N	Number missing at least one day of school due to menstruation (%) ^a	Adjusted odds ratio (95%CI)	
Total	351	69 (19.8%)		
Age			P-value for trend < 0.001	
13–14	58	5 (8.6%)	1	
15	102	15 (14.7%)	1.88	(0.64–5.56)
16	117	27 (23.1%)	3.04	(1.07–8.60)
17–18	71	22 (31.0%)	4.72	(1.56–14.25)
Ethnicity			P = 0.01	
MBhubaneswar	155	20 (12.9%)	1	
Non-MBhubaneswar	166	41 (24.7%)	2.26	(1.23–4.15)
Non-Bhubaneswar	25	7 (28.0%)	2.97	(1.00–8.75)
Times changed absorbent per 24 h during last period ^b			P = 0.03	
< =3 times	277	50 (18.1%)	1	
> =4 times ^c	62	18 (29.0%)	2.08	(1.06–4.10)
Use disposable pads for each day of period ²			P = 0.22	
No	79	21 (26.6%)	1	

Yes	262	48 (18.3%)	0.68	(0.36–1.26)
Amount of blood lost on heaviest day of period ²				
Little	40	3 (7.5%)	0.36	(0.10–1.28)
Average	213	34 (16.0%)	1	
Very much	89	30 (33.7%)	2.45	(1.34–4.48)
Symptoms during last period				
Headache ^b				
No	206	31 (15.1%)	1	P = 0.01
Yes	132	35 (26.5%)	2.15	(1.20–3.86)
Stomach pain ^b				
No	83	10 (12.1%)	1	P = 0.10
Yes	260	58 (22.3%)	1.89	(0.89–4.04)
Back pain ^b				
No	174	24 (13.8%)	1	P = 0.06
Yes	163	43 (26.4%)	1.75	(0.97–3.14)

^aExcluding 3 girls with missing outcome data ^bAdjusted for age, ethnicity and school

^cThe recommended number of changes would be 5 (one every 4 h during the day, plus one at night) but as only 6% of girls changed this frequently we used a cutoff of 4 or more changes in 24 h

Diary sub-study an estimate of the relative frequency of school absenteeism on days with periods and without periods was obtained from the diary data. This included data on 366 period-days and 2271 non-period days from 39 girls, with an average of 80 entries per girl over two terms. Data on periods were missing for only 12 school days (0.45%). On non-period days, 6.5% (n = 147) days of school were reported to have been missed, compared with 28.4% of period-days (adjusted OR = 5.99; 95% CI 4.4, 8.2). There was no evidence of effect modification by type of school (high vs low SES; p = 0.40). From this, the excess risk of missing school on a period-day is 21.9%. Assuming that an average of 2.86 period-days per month are school days (based on 5 school days a week) and with 9 school-months per year, this means that a girl would miss an average of 6 school days per year specifically because of menstruation. Observation of WASH facilities direct observation of the WASH facilities showed that pour-flush toilets were available in the two high SES schools but only pit latrines in the low SES schools. The majority of pour-flush toilets had locks (16/20) but only 12/23 of the pit latrines did. None of the schools had toilet paper or soap available. All schools had disposal bins for sanitary waste available, except the private low SES school.

Qualitative findings

While key informants cited a variety of factors undermining school attendance (including long distance to school, competing domestic chores and poor oversight by parents), menstruation and poverty were reported to be the most important. All of the 14 key informants cited menstruation as an impediment to school attendance. Similarly, nine key informants cited poverty as a barrier to school attendance, and this was reflected in the lack of school materials, such as textbooks. The critical role of menstruation and poverty in influencing school attendance was also reflected in the IDIs with parents. In the case of poverty, a student who was asked to go home and return only when they had procured the required textbook might miss several schooldays while they raised the money to purchase the book. Poverty also resulted in some students failing to raise money for their school fees, which often led to their suspension from school until the fees were paid. This was particularly common in

private schools.

During the IDIs with girls, menstruation was invariably cited as the key factor explaining girls’ absence from school. The main reasons given for why menstruation kept girls away from school included pain, lack of access to protection methods, and lack of privacy for MHM at school.

“If I wake up in the morning when I am having my menstrual period, I never go to school because I get terrible cramps I have not been coming to school when I am menstruating” (Group Interview 08, participant at low SES private school).

“Sometimes when ... mother has no money to buy material [sanitary pads] I don’t bother coming” [to school] (Group Interview 07 participant at low SES public school).

“Yes, someone can peep at you. When boys are revising [reading books] from that side you actually don’t feel safe. Boys can even see you from their toilets” (Group Interview 13 participant at high SES public school).

The fear of having a menstrual accident and subsequent humiliation from the boys was also reported to affect school attendance. Several girls echoed the following sentiments from an IDI participant

“The boys laugh at us ... when you soil your uniform and you aren’t aware. Instead of them letting you know, they call their friends to tell them how you have soiled your uniform” (IDI 03 participant at low SES public School).

Notably, girls’ education was not only undermined by absence from school but also absence from class – especially among boarders. Restrictions on use of washrooms while the class was in session was also reported to contribute to girls staying away from school and from class during menstruation.

“We are supposed to go to the latrines at only break time, lunch time and evening time so we are not allowed to be there when its class time because that is a time when she [toilet cleaner] is cleaning; she can only let you in if you are having a serious menstrual period” (IDI 04 participant at high SES public school).

School attendance was also affected by girls’ feelings of embarrassment and being dirty, and a keen awareness of what boys and teachers think about girls who are menstruating.

"I felt like, oh no... I didn't want to stand up in class. My friends told me to go for lunch (with them). I told them I didn't want to because I was having my periods I thought, like, I didn't want anyone to come near me. I thought, like, they will get to know. Maybe I'm smelling" (IDI 10 participant at high SES public school).

The stigma of menstruation posed barriers to their learning even among those who had access to good menstrual hygiene materials. This stigma resulted in avoidance of teasing from the boys by not attending class or school, but also avoiding gender insensitivity of male teachers, and other school staff (such as toilet cleaners), as well as the gender insensitive physical infra-structure at schools.

"Some male teachers just start harassing girls. Like if a girl gets her menstruation when she was not prepared and then explains to the teacher, he can be, like, "You are stupid"..." (IDI participant 04).

"In secondary it is not bad, but in primary if a teacher saw you tying a sweater around your waist he could call you and ask why you have done this even when he knows [that you are covering yourself to avoid a possible embarrassment of a blood-stained dress]" (IDI Participant 02).

Improving menstrual management in schools

In the cross-sectional questionnaire, girls were asked to rank 8 suggestions for improving MHM at school. The highest-ranking suggestions addressed mainly 'hardware' issues, with two-thirds of girls (n = 236, 67.1%) including in their top three suggestions that schools should stock sanitary towels, and half (n = 184; 52.4%) recommending that plenty of water was made available (52.6%). Other common recommendations were to stock analgesics (42.3%), ensure that girls who are menstruating do not receive corporal punishment (37.8%) and that girls' toilets allowed privacy from boys (33.6%). Suggestions that appeared less frequently in the top three suggestions included allowing girls to remain seated whilst asking questions (25.3%) and ensuring there were appropriate disposable bins for disposing of sanitary pads (25.6%).

The findings from the qualitative data were consistent with those from the cross-sectional questionnaire. The main recommendations from participants in the group interviews, IDI and key informant inter-views were related to the need for improving the supply of MHM materials, and the facilities at school to make it easier for girls to clean themselves and dispose of used pads in a way that assures their privacy. One of the most frequent recommendations was for the availability of MHM materials including sanitary pads and analgesics.

"Organizations should come up and give out materials for girls during menstruation. For example pads and knickers [Also] pain killers should be provided to help those who get painful cramps and periods" (Group Interview 02 participants at low SES private school)

"They should give [us] enough pads, underwear and at least buy for [us] some painkillers, because some schools have no sick bays like us here. Sometimes you go there and there are no painkillers...." (ID participant 15 at high SES private school)

Improvement of facilities at school was also frequently

cited. Participants particularly pointed out the need for a steady supply of water and soap at school.

"They should put water and soap in our toilets because most of the time you find when our tap is locked even when you want to clean yourself up you cannot" (IDI participant 02 at low SES private school)

Students also repeatedly recommended that schools address their concerns about the lack of privacy, especially during menstruation.

"Provide bathrooms where girls can go to clean up because [boy] students can come and pull the door when you are still cleaning up yourself" (Group Interview 13 participant at high SES public school)

Other recommendations included 'software' issues such as the need to sensitize male teachers and male students so they can understand the challenges female students go through when menstruating, in the hope that they can treat them less harshly, as well as the need to identify senior women teachers who would act as point persons for the students in case they needed pads or counselling

Discussion

The executives of feminine cycle is trying among secondary understudies in periurban Bhubaneswar, for both recently discharging and experienced young ladies, and includes psychosocial and physical difficulties. To date, most investigations have concentrated on MHM among rustic grade school stuscratches, and this examination adds to the writing in concentrating on optional understudies, and those in a peri-urban as opposed to provincial setting.

The subjective information and tentatively gathered journal information demonstrated clear proof that feminine cycle was associated with school non-attendance. For instance, in the journal ponder, young ladies detailed missing school multiple times more much of the time amid their period than when not menstruating. The subjective discoveries bolster past studies in LMIC demonstrating that feminine cycle is a reason for misery to numerous young ladies, and a boundary to class participation ^[3, 18], including an ongoing subjective examination among school young ladies in country Bhubaneswar ^[19]. There were additionally re-ports of a relationship of feminine cycle and school abdominal muscle senteeism in the cross-sectional review with 10% of young ladies saying that by and large they didn't go to class amid monthly cycle, and about 20% revealing missing something like 1 day of school amid their last period. Be that as it may, there were conflicting reports of school non-appearance because of period in the quantitative cross-sectional overview. Most quantitative investigations have not discovered a relationship among feminine cycle and school participation ^[12, 13, 20, 21], and an ongoing methodical survey distinguished just 3 intercession preliminaries (in Nepal ^[12], Ghana ^[11] and Kenya ^[14] respectively), which evaluated school participation as a result. The two African examinations found a moderate non-noteworthy impact (institutionalized mean distinction = 0.49, 95%CI - 0.13, 0.11), yet no affiliation was found in Nepal where the general school participation was exceptionally high ^[10].

Difficulties of evaluating school participation through review quantitative studies incorporate conceivable under-announcing because of social allure inclination not to report school non-attendance, or to name feminine cycle as an

explanation behind this. For instance, an ongoing report in Kenya requested that young ladies complete a month to month logbook to record feminine cycle and school participation (with follow-up visits by medical attendants to check finishing) yet discovered that school non-attendance was infrequently revealed, blocking analysis ^[13]. In our investigation, a youthful grown-up female research assistant gathered the journals from the young ladies, and we conjecture this decreased under-revealing of school non-attendance contrasted and information gathered by instructors or progressively formal research staff. Further, school truancy is hard to gauge precisely as school registers are as often as possible not exact. It is conceivable that young ladies exaggerate the relationship in the subjective meetings and journals in spite of the fact that what inspiration they may have for doing this isn't clear. In light of the inward consistency of the subjective discoveries and the methodological qualities inborn in the journal technique where information are recorded once a day, together with conflicting detailing from the cross-sectional survey, we infer that in our setting, with follow-up visits by a confided in research partner, the tentatively gathered journal information is bound to be precise. A confinement of our examination was that it was not intended to legitimately compare the announced school nonattendance because of feminine cycle from journals and the cross-sectional study, as the journal sub-contemplate included point by point data from a little example of young ladies and concentrated on achievability of utilizing this strategy. Further work on the precision of this technique for gathering school participation and monthly cycle information is required, including examination of how the journals are managed and whether they are seen as being autonomous of teachers. Further work is expected to triangulate proportions of school participation including spot checks, utilization of routine school registers and journals kept by understudies.

It is remarkable that our examination discovered comparative dimensions of abdominal muscle sentience detailed by young men and young ladies, and this has been seen in different settings ^[20, 22, 23]. This is frequently taken to contend against a relationship of feminine cycle with school non-appearance, however it might reflect different contrasts in the reasons that young ladies and young men miss school. For instance in our examination, the essential reason that young men gave for missing school was an absence of school charges, while young ladies were bound to report being "wiped out". The disparity between this far reaching perception that detailed school absenteeism rates are comparative in young men and young ladies and the unmistakable consequences of the subjective research proposing that school non-appearance is identified with period for no less than an ace bit of young ladies is striking and merits further research.

The techniques for overseeing period found in this peri-urban optional school populace varied from that in country Bhubaneswar ^[24, 25], where most understudies reported basically utilizing re-usable cushions, for instance Africushions and Makapads which are Bhubaneswar-made, minimal effort cushions sold or offered straightforwardly to students by non-administrative organisations ^[26]. For instance, among 10– multi year old young ladies in country schools in Kamuli area, Eastern

Bhubaneswar, just 9% of young ladies revealed utilizing disposable cushions as their principle insurance ^[25]. In our peri-urban setting, despite the fact that most of young ladies detailed having the capacity to manage the cost of disposable cushions for each day of their period, over 80% revealed changing the retentive less than four times each day, and 20% announced spilling blood to their external articles of clothing amid their latest menstrual period. It isn't evident whether this was expected to being caught off guard for the beginning of the period, or because of lacking administration amid the period. A restriction of our examination was that we did exclude inquiries to address all parts of the standard meaning of promotion like MHM. Nonetheless, it was striking that just 4 young ladies (1.1%) detailed having even four segments of the definition (retentive material, sufficient transfer, access to water and cleanser, and absence of uneasiness about their next period). This features the requirement for mediations to demonstrate MHM even in generally wealthy settings. Absence of learning about MHM was a wellspring of anxiety among the young ladies in this investigation, and this can prompt deficient menstrual cleanliness the executives (for example to predict beginning of next period) ^[19, 27, 28]. Trust in overseeing monthly cycle was undermined by withdrawal of watchmen, and absence of access to satisfactory genital hygiene strategies, due for the most part to neediness. Further work ought to investigate whether improved adolescence instruction and the utilization of a journal diminishes spilling by improving prediction of the following due date. The job of the guardians was obvious from both subjective and quantitative examinations with moms being the essential wellspring of data on monthly cycle, and higher rates of period related non-appearance among maternal vagrants. This, together with the shame and dread of prodding from young men, instructors and other school staff features the significance of demonstrating information and exchange of adolescence and menstruation in the schools, families and network. Maybe a couple different examinations have inspected the connection among orphanhood and monthly cycle related non-appearance, however there is an extensive writing on orphanhood and school participation all the more by and large. A far reaching re-perspective on populace based reviews in 40 sub-Saharan African nations demonstrated that vagrants had reliably lower dimensions of training than non-vagrants ^[29]. An investigation from Kenya found that vagrants and powerless youngsters (OVCs) would be wise to access to clean cushions than non-vagrants as they got sponsorships that paid for supplies, close by school charges, dinners and garbs ^[30]. Further to this, an investigation in Tanzania and Bhubaneswar found that, in Bhubaneswar, school non-attendance was most elevated among non-upheld OVCs, and least in bolstered OVCs, with non-vagrants in the middle. The outcomes contrasted in Tanzania with the most reduced rates among non-bolstered OVCs ^[23].

The examination additionally featured that young ladies' training isn't just undermined by nonattendance from school yet in addition stomach muscle sense from class. This particularly connected to the individuals who were in life experience school where young ladies missed class for similar reasons that their partners in day school avoided school, either by remaining in their dormitory or setting off

to the medical caretaker's office. The shame of menstruation can present hindrances to their learning because of agony, or because of the dread of spillage or prodding from young men or instructors and other school staff, (for example, latrine cleaners). A restriction of our investigation was that we didn't catch school commitment and execution, and this will be critical in future investigations, for instance utilizing school examination information. Another constraint was the moderately little size we had, specific inside schools, as this was a distinct report selecting all students in the significant classes for future mediations. There was small missing information on periods in the journals, which we credit to the checking of journals by the exploration partner at undeclared month to month visits. It is conceivable that the young ladies finished the journals to predisposition towards a relationship of periods with missing school, however far-fetched as they didn't know that we were especially intrigued by this association and they were quick to utilize the journals to monitor their monthly cycle cycles.

Among the young ladies who announced missing school amid period, the primary reasons were torment, dread of holeing and absence of protection. Dread of spilling was marginally increasingly normal among the individuals who changed insurance frequently, recommending that the dread might be because of tension about spillage or heavier stream, instead of powerlessness to afford satisfactory security. Further, the observational spot checks demonstrated that none of the schools had tissue or cleanser accessible and half of the pit lavatories did not have entryway bolts that could offer

furthermore, in light of this and the discoveries from the subjective and quantitative examinations, we suggest that a compelling and savvy intercession bundle to improve menstrual cleanliness the board in this setting should adopt a far reaching strategy including both 'software' elements, for example, improving information and mentalities towards menstrual wellbeing, just as 'equipment'.

This would incorporate i) improved preparing of educators to professional wide pubescence training, ii) arrangement of analgesics and

iii) improved WASH offices (for example counting introducing locks on the can and lavatory entryways, fixing broken or fragmented entryways, giving canisters to cushions, tissue in a holder, and a cleanser allocator). Devices to improve following the menstrual cycle, (for example, the journal), and prologue to new strategies, for example, the re-usable menstrual glass, would likewise be possibly viable and adequate.

Conclusion

Menstruation was strongly associated with school attendance in this peri-urban setting, and that there is an unmet need to investigate interventions for girls, teachers and parents which address both the knowledge and psychosocial aspects of menstruation (self-confidence, attitudes) and the physical aspects (management of pain, use of appropriate materials to eliminate leakage of menstrual blood, improved WASH facilities).

References

1. Sommer M, Caruso BA, Sahin M, Calderon T, Cavill S, Mahon T *et al.* A time for global action: addressing Girls' menstrual hygiene management needs in schools. *PLoS Med.* 2016; 13(2):1001962.
2. Sommer M, Sahin M. Overcoming the taboo: advancing the global agenda for menstrual hygiene management for schoolgirls. *Am J Public Health.* 2013; 103(9):1556–9.
3. Mason L, Nyothach E, Alexander K, Odhiambo FO, Eleveld A, Vulule J *et al.* Phillips-Howard PA. 'We keep it secret so no one should know'—a qualitative study to explore young schoolgirls attitudes and experiences with menstruation in rural western Kenya. *PLoS One.* 2013; 8(11):e79132.
4. Phillips-Howard PA, Caruso BA, Torondel B, Zulaika G, Sahin M, Sommer M. Menstrual hygiene management among adolescent schoolgirls in low- and middle-income countries: research priorities. *Glob Health Action.* 2016; 9:33032.
5. McMahan SA, Winch PJ, Caruso BA, Obure AF, Ogutu EA, Ochari IA *et al.* RD. 'The girl with her period is the one to hang her head' reflections on menstrual management among schoolgirls in rural Kenya. *BMC Int Health Hum Rights.* 2011; 11:7.
6. Sommer M. Where the education system and women's bodies collide: the social and health impact of girls' experiences of menstruation and schooling in Tanzania. *J Adolesc.* 2010; 33(4):521-9.
7. Sommer M, Hirsch JS, Nathanson C, Parker RG. Comfortably, safely, and without shame: defining menstrual hygiene management as a public health issue. *Am J Public Health.* 2015; 105(7):1302–11.
8. Government of Bhubaneswar. Menstrual Hygiene Management Charter. 2015. https://www.ircwash.org/sites/default/files/menstrual_hygiene_management_charter_finalised_april_2015_1_.pdf Accessed December 7th 2017.
9. Sumpter C, Torondel B. A systematic review of the health and social effects of menstrual hygiene management. *PLoS One.* 2013; 8(4):62004.
10. Hennegan J, Montgomery P. Do menstrual hygiene management interventions improve education and psychosocial outcomes for women and girls in low and middle income countries? A systematic review. *PLoS One.* 2016; 11(2):0146985.
11. Montgomery P, Ryus CR, Dolan CS, Dopson S, Scott LM. Sanitary pad interventions for girls' education in Ghana: a pilot study. *PLoS One.* 2012; 7(10):48274.
12. Oster E, Thornton R. Menstruation, sanitary products, and school attendance: evidence from a randomized evaluation. *Am Econ J.* 2011; 3(1):91-100.
13. Phillips-Howard PA, Nyothach E, TerKuile FO, Omoto J, Wang D *et al.* Menstrual cups and sanitary pads to reduce school attrition, and sexually transmitted and reproductive tract infections: A cluster randomised controlled feasibility study in rural western Kenya. *BMJ Open.* 2016; 6(11):013229.
14. Wilson E, Reeve J, Pitt A. Education. Period. Developing an acceptable and replicable menstrual hygiene intervention. *Dev Pract.* 2013; 24(1):63-80.
15. Miiro G, De Celles J, Rutakumwa R, Nakiyingi-Miiro J, Muzira P, Ssembajjwe W *et al.* Soccer-based promotion of voluntary medical male circumcision: a mixed-methods feasibility study with secondary

- students in Bhubaneswar. *PLoS One*. 2017; 12(10):0185929.
16. Cargo M, Mercer SL. The value and challenges of participatory research: strengthening its practice. *Annu Rev Public Health*. 2008; 29:325-50.
 17. Israel BA, Parker EA, Rowe Z, Salvatore A, Minkler M, Lopez J *et al*. Community-based participatory research: lessons learned from the centers for Children's environmental health and disease prevention research. *Environ Health Perspect*. 2005; 113(10):1463-71.
 18. Fehr EA. Stress, Menstruation and School Attendance: Effects of Water Security on Adolescent Girls in South Gondar, Ethiopia. Rollins School of Public Health of Emory University. 2001. <http://pid.emory.edu/ark:/25593/94cc7>. Accessed 7 Dec 2017.
 19. Hennegan J, Dolan C, Steinfield L, Montgomery P. A qualitative understanding of the effects of reusable sanitary pads and puberty education: implications for future research and practice. *Reprod Health*. 2017; 14(1):78.
 20. Grant MJ, Lloyd CB, Mensch BS. Menstruation and school absenteeism: evidence from rural Malawi. *Comp Educ Rev*. 2013; 57(2):260-84.
 21. Tegegne TK, Sisay MM. Menstrual hygiene management and school absenteeism among female adolescent students in Northeast Ethiopia. *BMC Public Health*. 2014; 14:1118.
 22. Joshi D, Buit G, Gonzalez-Botero D. Menstrual hygiene management: education and empowerment for girls?. Sheffield: Practical Action Publishing. 2015.
 23. Shann MH, Bryant MH, Brooks MI, Bukuluki P, Muhandi D, Lugalla J *et al*. The effectiveness of educational support to orphans and vulnerable children in Tanzania and Bhubaneswar. Sheffield: ISRN Public Health; 2013.
 24. Guerry E. An assessment of menstrual hygiene practices and absenteeism in Western Bhubaneswar. Sheffield: University of Sheffield. 2013.
 25. Hennegan J, Dolan C, Wu M, Scott L, Montgomery P. Schoolgirls' experience and appraisal of menstrual absorbents in rural Bhubaneswar: a cross-sectional evaluation of reusable sanitary pads. *Reprod Health*. 2016; 13(1):143.
 26. Crofts T, Fisher J. Menstrual hygiene in Bhubaneswar schools: an investigation of low-cost sanitary pads. *J Water Sanitation Hygiene Dev*. 2012; 2(1):50-8.
 27. Sahoo KC, Hulland KR, Caruso BA, Swain R, Freeman MC, Panigrahi P *et al*. Sanitation-related psychosocial stress: a grounded theory study of women across the life-course in Odisha, India. *Soc Sci Med*. 2015; 139:80-9.
 28. Sommer M, Ackatia-Armah N, Connolly S, Smiles D. A comparison of the menstruation and education experiences of girls in Tanzania, Ghana, Cambodia and Ethiopia. *Compare*. 2015; 45(4):33032.
 29. Monasch R, Boerma JT. Orphanhood and childcare patterns in sub-Saharan Africa: an analysis of national surveys from 40 countries. *AIDS*. 2004; 18(2):55-65.
 30. Jewitt S, Ryley H. It's a girl thing: menstruation, school attendance, spatial mobility and wider gender inequalities in Kenya. *Geoforum*. 2014; 56:137-47.